17.0 Surface water and flooding

This chapter provides an overview of the potential impacts of the construction and operation of the project on watercourses, water related infrastructure, waterfront land and other water users. It also assesses the potential for flooding impacts as a result of temporary construction activities and permanent project infrastructure, and outlines management and mitigation measures to mitigate these impacts, as detailed in the Surface water and flooding technical report in **Appendix L**.

17.1 Assessment methodology

A qualitative assessment has been undertaken to address the potential impacts to surface water quality and flooding as a result of the project. Due to the linear nature of the project and relatively minor excavations required along the transmission cable route, a quantitative assessment was not deemed necessary to identify or manage any potential impacts.

However, for the Cooks River crossing, flooding impacts associated with a potential cable bridge were assessed using a TUFLOW model of the crossing. A TUFLOW model simulates flooding and tidal flow in water systems. To undertake this assessment, the existing TUFLOW model from the Cooks River Flood Study (PB MWH Joint Venture, 2009) prepared for Sydney Water was used. This should be considered as a high level assessment only, as the concept design of the proposed cable bridge has not been confirmed.

17.1.1 Desktop assessment to determine existing conditions

A desktop review and analysis of existing information was undertaken to determine potential receptors and to characterise the existing environment. A review of geospatial data of stormwater assets for relevant local government areas was also undertaken to identify existing stormwater assets within the study area. Additional geospatial data information (mapping, NSW Office of Environment and Heritage (OEH) data and aerial photographs) was obtained to support the assessment. A full list of existing information reviewed for the surface water and flooding assessment is provided in **Appendix L**.

17.1.2 Assessment of potential impacts

The assessment of surface water quality impacts arising from the project involved an assessment of potential construction or operational activities that could mobilise sediments and other pollutants into the surface water environment.

For flooding, the 100 year Average Recurrence Interval (ARI) flood standard was adopted in the assessment to identify measures which are required to mitigate any adverse flooding impacts attributable to the project. Changes in flood behaviour under Probable Maximum Flood (PMF) conditions were also considered in order to identify impacts on critical infrastructure or emergency response, and significant changes in flood hazard resulting from the project.

The assessment of flood impacts was undertaken by identifying where the project would require significant changes at the surface level or above ground infrastructure. Potential changes that may have drainage/flooding impacts include:

- the finished surface following installation of the conduits; and
- construction and operation of the cable bridge required to cross the Cooks River.

Flooding impacts at substations were not considered in this assessment as the project would not change the flood flow paths in the existing substations. Of the three substations, Beaconsfield West substation is documented to be within the 100 ARI flood extent.

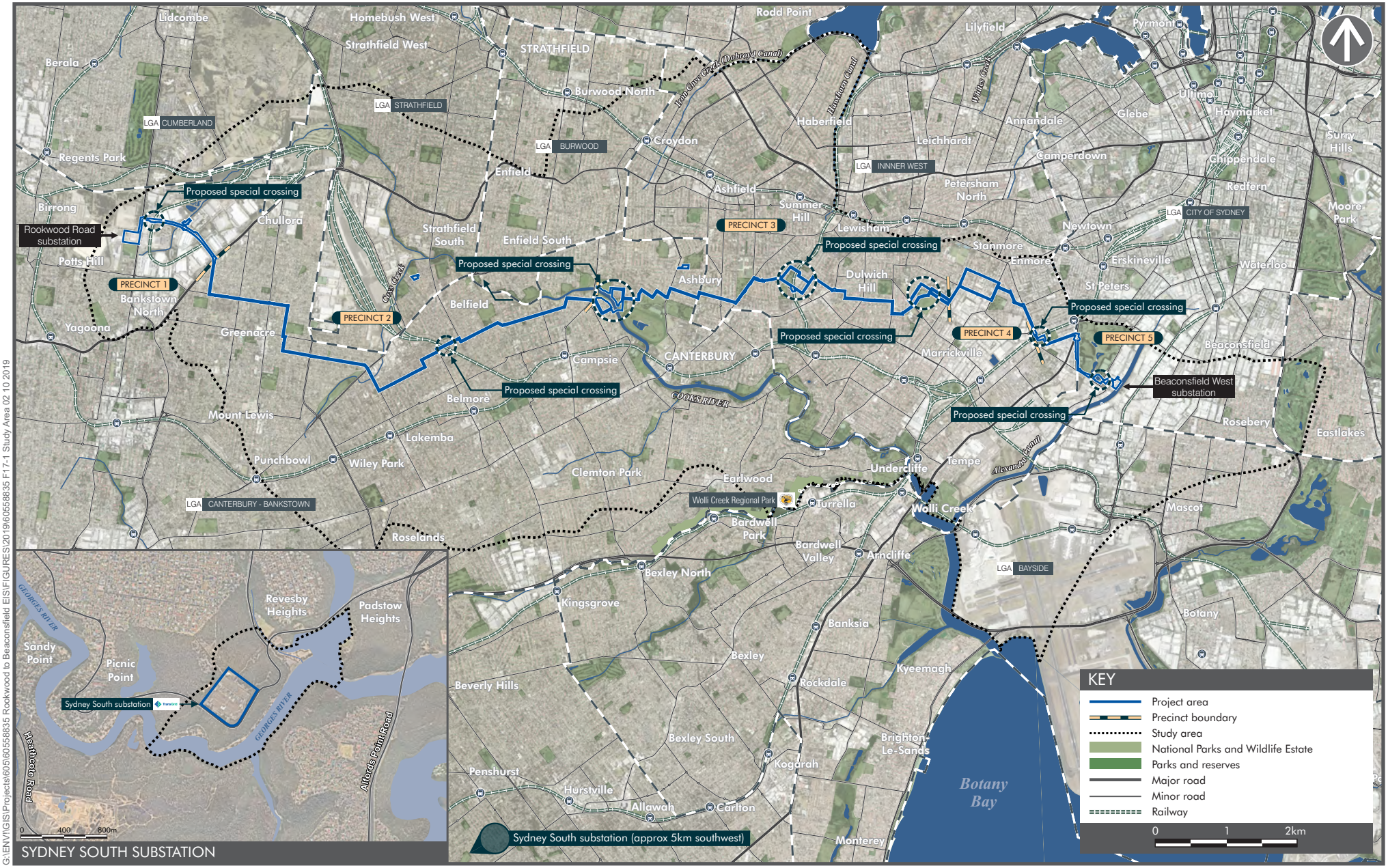
17.1.3 Study area

The surface water and flooding assessment has considered the surface water catchments where the project would occur, including Rookwood Road, Beaconsfield West and Sydney South substations, as well as waterways and drainage lines that cross the transmission cable route and the construction laydown areas. The connected waterways such as the Cooks River, Botany Bay and Iron Cove have also been considered.

The study area comprises portions of the following catchments as shown in **Figure 17-1**:

- Cooks River catchment;
- Parramatta River (Iron Cove) catchment; and
- Georges River catchment.

While these broader catchments have been considered in the assessment, the potential impacts are focused at a more localised level surrounding the project area.



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SURFACE WATER AND FLOODING STUDY AREA

Powering Sydneys Future
Potts Hill to Alexandria Transmission Cable Project

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

FIGURE 17-1

17.2 Existing environment

This section provides an overview of the existing watercourses (including hydrology and water quality), water related infrastructure, waterfront land, water users and flood potential within the study area. An overview of the existing soil environment and potential and known contamination within the study area is provided in **Chapter 16 Soils and contamination**.

17.2.1 Catchments and waterways

The transmission cable route (including Rookwood Road and Beaconsfield West substations) is located within the Cooks River catchment (which includes Coxs Creek) and the Sydney Harbour and Parramatta River catchment (SHPR catchment). The Sydney South substation is located within the Georges River catchment.

Waterways within each catchment consist of a mix of concrete lined and modified watercourses that convey stormwater to the Cooks River or in the case of Hawthorne Canal, to Rozelle Bay, which is part of the Parramatta River estuary. The transmission cable route would cross the Cooks River, the main waterbody within the study area. Coxs Creek, a primary tributary of the Cooks River, would also be crossed by the transmission cable route in the western portion of the study area. At the point of crossing, Coxs Creek is a concrete channel. The Beaconsfield West substation is located adjacent to the Alexandra Canal, a highly modified waterway (formerly Shea's Creek) which also flows into the Cooks River. The Sydney South substation is located approximately 150 metres north of the Georges River estuary, which flows into Botany Bay. The Georges River estuary at the Sydney South substation is a tide dominated drowned valley estuary (OEH, 2018). Although much of the catchment is urbanised, the estuary has retained many of its natural characteristics.

The Cooks River, Iron Cove, Alexandra Canal and downstream portions of Hawthorne Canal have been mapped as 'key fish habitat', as defined in the Fisheries Policy and Guidelines for Fish Habitat Conservation and Management (Fairfull, 2013). Key fish habitat is mapped within the project area at two locations: the Cooks River in Precinct 3, where the project crosses the river and at Alexandra Canal in Precinct 5 (which is a tributary of the Cooks River), where the project (i.e. the Beaconsfield West substation) is adjacent. Key fish habitat within the project area is discussed further in **Chapter 13 Biodiversity**.

The project's receiving waters are marine environments which include the intertidal and subtidal ecosystem of Sydney Harbour and its estuarine tributaries.

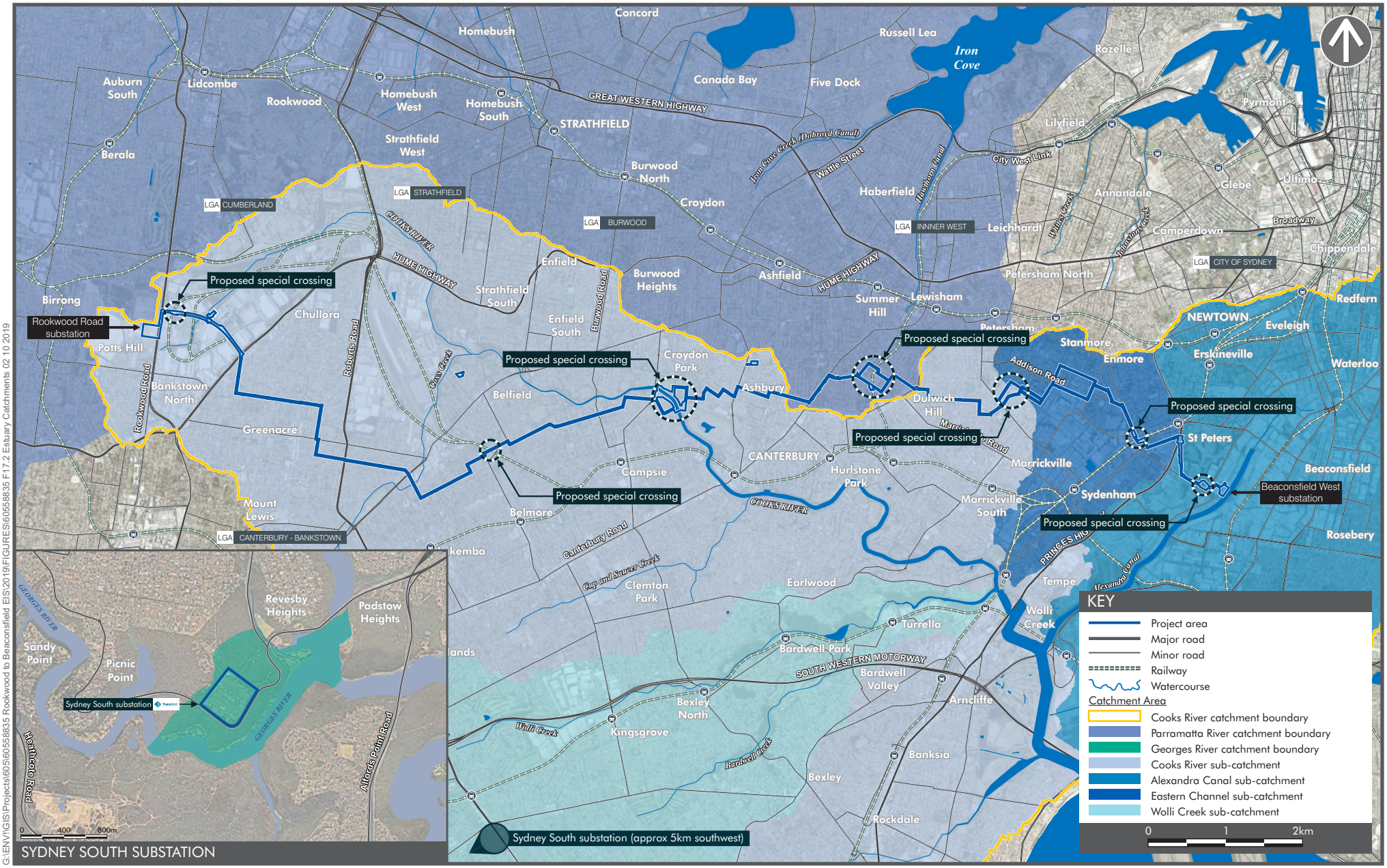
Alexandra Canal is one of the main waterways downstream of the project area within the Cooks River catchment. Alexandra Canal is one of only two navigable canals built in NSW and is characterised by its controlled route, defined edges and sandstone embankment walls. The canal is considered to be of high historic, aesthetic and technical/research significance (Sydney Water, 2014). Historically the Alexandra Canal catchment has been the site of a number of industries, which has resulted in contaminated runoff flowing into the waterway. The NSW Environment Protection Authority (NSW EPA) declared the bed sediments of Alexandra Canal between Huntley Street, Alexandria and the junction of Alexandra Canal with the Cooks River at Mascot as a remediation site in August 2000 under Section 23 of the *Contaminated Land Management Act 1997*.

A summary of the surface water features within the study area are summarised in **Table 17-1** and shown graphically on **Figure 17-2**, Surface water features are discussed further in the surface water and flooding assessment in **Appendix L**.

Table 17-1 Catchment descriptions and water features which intersect the transmission cable route

Precinct	Catchment description	Intersected water features	Form of water feature at intersection location	Form of proposed crossing
Precinct 1	**Catchment:** Cooks River The Cooks River within this precinct flows past the Yana Badu Wetland approximately 200 metres downstream of Muir Road, which is a naturalised watercourse (artificial wetland) built for flood events.	Cooks River along Muir Road, Chullora	Culvert under the road	Trenching
		Urban drainage network	Stormwater pits and pipes	Measures to temporarily support or relocate the stormwater network would be required
Precinct 2	**Catchment:** Cooks River (Coxs Creek sub-catchment) Coxs Creek has been channelised with a concrete lined channel in this precinct.	Coxs Creek at Wangee Road, Lakemba	Culvert under the road	Trenching under the base slab of the channel. The removal/reinstatement of a small section of the culvert would be required
		Tributary of Cooks River at Rawson Road	Culvert under the road	Trenching through the existing culvert
		Tributary of Cooks River at Omaha Street	Culvert under the road	Trenching through the existing culvert
		Urban drainage network	Stormwater pits and pipes	Measures to temporarily support or relocate the stormwater network would be required.
Precinct 3	**Catchment:** Cooks River (Eastern Channel sub-catchment), Parramatta River The majority of the precinct is within the Cooks River catchment and drains either via drainage channels, or by being discharged to the Sydenham Flood Detention Basin, and then pumped back to the Cooks River. A small portion of this precinct in Dulwich Hill drains to the Hawthorne Canal.	Cooks River at Lindsay Street, Campsie	The Cooks River at this location is a wide, concrete lined channel	The crossing of the Cooks River would require a cable bridge at Lindsay Street or underboring between Mildura Reserve and Croyden Avenue or Lees Park.
		Major urban drainage network	Stormwater pits and pipes	Measures to temporarily support or relocate the stormwater network would be required

Precinct	Catchment description	Intersected water features	Form of water feature at intersection location	Form of proposed crossing
Precinct 4	**Catchment:** Cooks River (Eastern Channel sub-catchment) The precinct drains to the Cooks River, either via the Eastern Channel, or by being discharged to the Sydenham Flood Detention Basin, and then pumped back in to the Eastern Channel.	Major urban drainage network	Stormwater pits and pipes	Measures to temporarily support or relocate the stormwater network would be required
Precinct 5	**Catchment:** Cooks River (Alexandra Canal sub-catchment) West of the Princes Highway, St Peters drains to the Cooks River via the Eastern Channel. There is a detention basin in Camdenville Park which is pumped out into the Eastern Channel. East of the Princes Highway (Alexandria), Precinct 5 drains to the Alexandra Canal. Currently stormwater is harvested from the stormwater culvert in the northeastern corner of Sydney Park.	Urban drainage network	Stormwater pits and pipes	Measures to temporarily support or relocate the stormwater network would be required
		Sydney Park Wetland	Artificial wetland	Options include routing around wetland or underboring.



G:\ENVIGIS\Projects\605\60558835 Rookwood to Beaconsfield EIS\2019\FIGURES\60558835 F17.2 Estuary Catchments 02 10 2019

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ESTUARY CATCHMENTS

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Potts Hill to Alexandria Transmission Cable Project

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations

Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018), SMCMA (2011), AECOM (2018)

FIGURE 17-2

17.2.2 Drainage and topography

The majority of land traversed by the transmission cable route drains into catchments and waterways via local piped urban stormwater networks. Localised flooding is known to occur in some areas as a result of overflow of these networks. The transmission cable route is predominantly in elevated topographical areas.

Topography and drainage across the study area is summarised in **Table 17-2**.

Table 17-2 Drainage and topography summary

Precinct	Elevation range	Drainage
1	36-53 metres Australian Height Datum (AHD)	Area drains into a tributary of the Cooks River which drains to the northwest into the Cooks River.
2	Generally 9-50 metres AHD with low point around Cooks River (6 metres AHD)	Western portion drains into a tributary of the Cooks River which drains to the northwest into the Cooks River. Centre portion drains into Coxs Creek which drains to the northwest into the Cooks River. Eastern portion drains into the Cooks River.
3	Generally 9-46 metres AHD with low point around Cooks River (3 metres AHD) and relative low point around Hawthorn Canal (20 metres AHD).	The eastern and western portions drain into the Cooks River to the south. The centre portion drains to Hawthorn Canal in the north.
4	4-16 metres AHD, lowest in the east	Drains into the Cooks River to the south.
5	6-18 metres AHD, lowest in the eastern most and western most extent of the construction precinct, high point at King Street.	Drains into the Cooks River and Alexandra Canal. A flood detention basin is present in Camdenville Park and man-made wetlands are present within Sydney Park, and local stormwater is harvested from the urban drainage network near Sydney Park Road.

17.2.3 Water quality

Water quality of the catchments and waterways within the study area are generally highly influenced by their urban context. The following features influence the water quality of the receiving waters in the study area:

- the urbanisation of the catchments and subsequent reduction in pervious areas reduces the likelihood of the settling or depositing out of pollutants and sediments being transported in stormwater runoff before entry into the estuary or contributing waterways;
- the artificial channelisation and hard (typically concrete) lining of waterways reduces the potential for erosion in the channels, minimising the sediment load transfer from upstream catchments to the discharge location;
- elevated levels of heavy metals, pH, turbidity and nutrients. This is representative of waterways within a highly urbanised catchment; and
- to assist with managing the water quality in the receiving waters, pollution control devices including gross pollutant traps and litter booms have been installed at a number of locations on waterways downstream of the project. These devices are typically maintained by the local council.

Specific water quality results and detail regarding pollutant pathways into each of the three catchment areas (Cooks River, Parramatta River and Georges River) can be found in the surface water and flooding assessment in **Appendix L**.

17.2.4 Waterfront land

The transmission cable route would be required to cross waterfront land and the associated riparian corridor as defined by the *Water Management Act 2000*. Waterfront land serves the following functions:

- providing bed and bank stability and reducing bank and channel erosion;
- water quality management by trapping sediment, nutrients and other contaminants;
- habitat diversity for terrestrial, riparian and aquatic flora and fauna;
- connectivity between wildlife habitats;
- flood conveyance and controlling the direction of flood flows;
- interface or buffer between developments and waterways; and
- recreational uses.

Locations where the riparian corridor would be traversed or may be temporarily occupied during construction include:

- un-named tributary at Rawson Road (Precinct 2);
- un-named tributary at Omaha Street (Precinct 2);
- Coxs Creek at Wangee Road (Precinct 2); and
- Cooks River at Mildura Reserve/Lindsay Street (Precinct 3).

At these locations the watercourse has been channelised, limiting the need for the riparian corridor to provide bank stability. Hydrologic connectivity to these watercourses is through the urban drainage network, so the water quality management functions, which might otherwise be provided by the riparian corridors, are currently provided through the urban drainage network. The riparian corridors that are connected to the project have been disturbed, limiting their habitat diversity and connectivity. However, the presence of mangroves at the Cooks River within the study area indicates that this is an area of moderately sensitive key fish habitat (refer to **Chapter 13 Biodiversity**). The riparian corridors have also been urbanised, with roads or pedestrian bridges crossing the corridors at the considered locations. As such, the buffer between development and these watercourses is already limited.

For all locations other than the Cooks River, the flood conveyance is controlled by other hydraulic structures.

The Sydney South substation is more than 40 metres from the edge of a watercourse and does not occupy waterfront land.

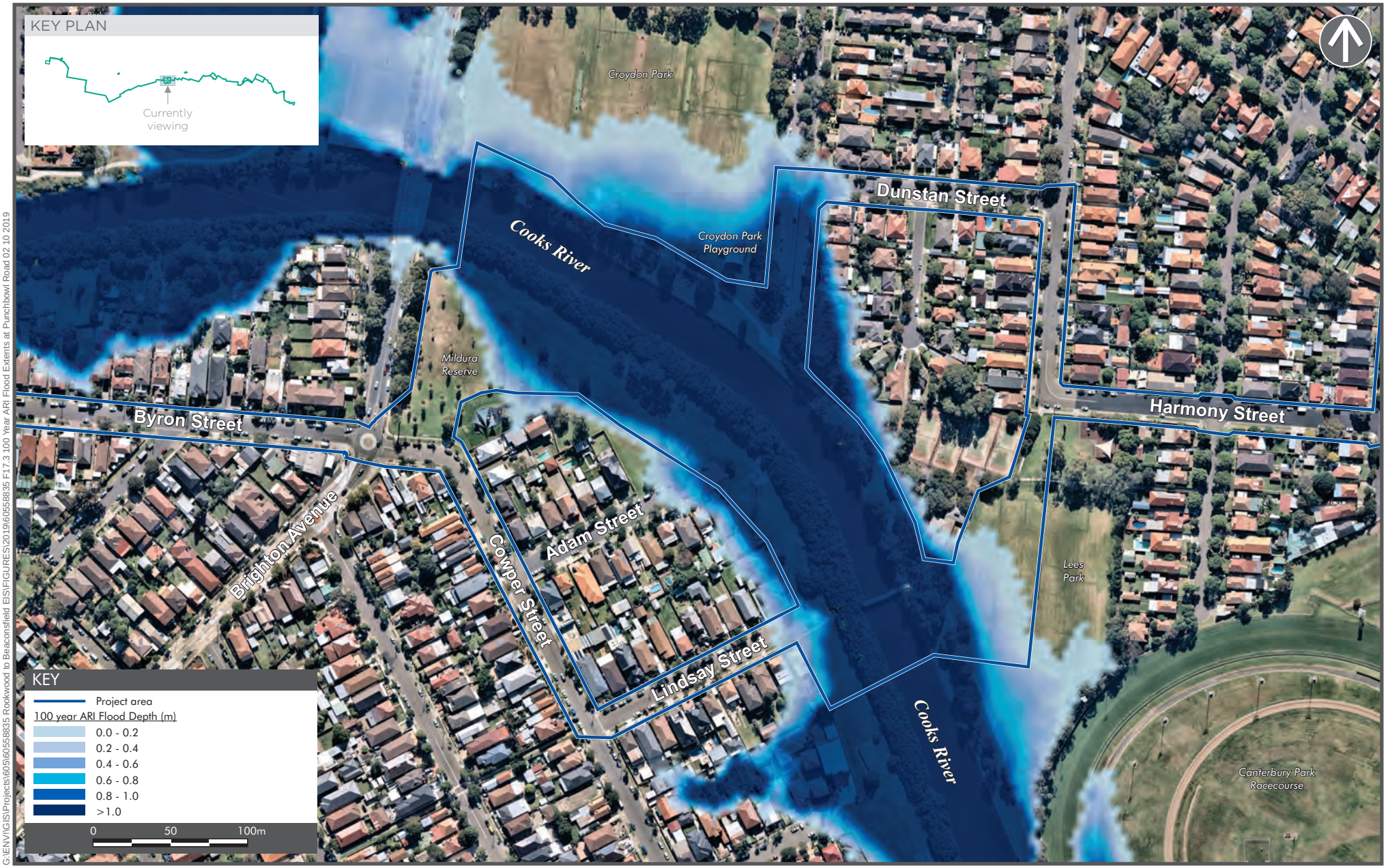
17.2.5 Flooding

The transmission cable route is generally only subject to local overland (surface runoff) flows. However, there are a select number of locations where the transmission cable route is proposed to cross a watercourse and is therefore subject to mainstream flooding. These locations are:

- Cooks River at Muir Road (Precinct 1);
- un-named tributary of the Cooks River at Rawson Road (Precinct 2);
- Coxs Creek at Wangee Road (Precinct 2);
- un-named tributary of the Cooks River at Omaha Street (Precinct 2); and
- Cooks River at Mildura Reserve/Lindsay Street (Precinct 3).

The Cooks River Flood Study (PB MWH Joint Venture, 2009) shows areas of key inundation during the 100 year ARI flood. Due to the nature of the proposed cable bridge structure and the extent of flooding in the 100 year ARI event, the Cooks River at Lindsay Street in Campsie (Precinct 3) has been identified as the location, across the project area, with the greatest potential for flood impacts (refer to **Figure 17-3**). Discussion of these potential impacts is provided in **Section 17.4.2**.

The Sydney South substation is sufficiently far from the Georges River estuary, and is elevated above the anticipated water surface, such that mainstream flooding is not likely to affect the substation.



G:\ENV\GIS\Projects\605\60558835 Rookwood to Beaconsfield EIS\FIGURES\2019\60558835 F17.3 100 Year ARI Flood Extents at Punchbowl Road 02 10 2019

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Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018), Cooks River Flood Study (MWH+PB, 2009)

100 YEAR ARI FLOOD EXTENTS AND DEPTHS AT THE PROPOSED CABLE BRIDGE CROSSING OVER COOKS RIVER

Powering Sydney's Future
Potts Hill to Alexandria Transmission Cable Project

FIGURE 17-3

17.3 Assessment of potential construction impacts

17.3.1 Erosion and sedimentation

17.3.1.1 Impacts to water quality

Water quality impacts could potentially arise from:

- earthworks activities and exposed soil subjected to wind or rain which may cause sediment to enter surface water or the stormwater network;
- during underboring, drilling fluid being released either during frac-out or through spills at the surface may enter surface water or infiltrate to groundwater;
- construction activities adjacent to or within waterways could introduce foreign contaminants such as oil or greases, and disturb contaminated sediments;
- contaminated or acid sulfate soils sediments that may be mobilised by works;
- pollutants from work sites may be carried downstream by stormwater, potentially impacting the water quality in the Cooks River, Alexandra Canal, Iron Cove Creek or Georges River; and
- drainage works, such as installation of drainage diversions during construction have the potential to concentrate flows, which may exacerbate erosion and result in scour or the mobilisation of pollutants.

Soils transported into surface water or stormwater networks can impact water quality through increased turbidity, lowered dissolved oxygen levels, and increased nutrients (nitrogen and phosphorus). Suspended sediments within surface water flows may settle and smother aquatic ecosystems. Increases in nutrients carried by these flows may also contribute to eutrophication[1]. Temporary drainage works implemented during construction also have the potential to concentrate flows, which may exacerbate erosion. These construction activities pose the greatest risk where they occur near waterways, on steep slopes or on land subject to surface water flows or flooding and would place increased pressure on sensitive receiving environments such as the Cooks River and Parramatta River estuary.

The key objective during construction would be to separate clean water from sediment laden water, to minimise erosion of disturbed areas and to contain sediments on-site. Land that is considered at high risk of erosion during construction includes:

- slopes with greater than ten percent grade; and
- areas where rainfall erosivity presents as a risk.

Within the project area, the banks of the Cooks River near the cable crossing may meet these criteria.

Erosion and sediment loads would gradually diminish with completion of construction activities as the disturbed areas are progressively stabilised.

Beaconsfield West substation, which would be a stockpiling location, is exposed to flooding from both overland flows along Burrows Road, and flooding of the Alexandra Canal. There is the potential for material that is stockpiled below the PMF level to be inundated and released into the environment by the flood velocity. Any contaminated material, if present within the stockpile, could therefore be released into the environment.

Spills and leaks from construction vehicles and plant have the potential to impact surface water quality where the materials enter a local watercourse. Spills and leaks would be managed by maintaining equipment and conducting activities with the potential to cause a spill in a safe manner. Refuelling and fuel storage would not be carried out within 100 metres of a waterway and appropriate spill containment measures would be implemented to reduce the potential for spills and leaks to impact off-site receivers. Accidental spills or leaks would be managed by protocols outlined in the Construction Soil and Water Management Plan (CSWMP) which could include quick spill response times and the

[1] Eutrophication is when a body of water becomes overly enriched with minerals or nutrients which induces an excessive growth of plants and algae.

use of spill kits to contain and capture contaminated water. Industry standard measures are proposed to manage the potential water quality impacts that may arise as a result of runoff and spills associated with the project. Many of the measures are documented in *Managing Urban Stormwater* (the Blue Book).

During underboring, there is the risk of frac-out i.e. where drilling fluid leaks from the bore and may reach the surface in some instances. Suitable containment measures are typically sufficient in mitigating a release of drilling fluid, fuels, oils, chemicals or other construction materials at the surface. The management of leaks and spills will be addressed in the CSWMP. Impacts from underboring resulting in contamination are discussed further in **Chapter 16 Soils and contamination**.

One option for the transmission cable route at the Cooks River is to install the conduits via underboring. The transmission cable route would therefore pass under or over the Viva Energy high pressure oil pipeline running along the northern side of the Cooks River. If the construction is not managed appropriately, there is a risk of accidental damage to the pipeline which could result in a release of oil which would impact the water quality of the Cooks River.

Water that collects in the open sections of trenches would require discharge or disposal in accordance with the *Protection of the Environment Operations Act 1997* which may trigger the need for a licence. If a licence or permit is required from the relevant authority this would need to be obtained prior to the commencement of construction activities. Water that does not meet water quality requirements for discharge would be captured and sent off-site for disposal at a suitably licenced facility. Where possible, the transmission cable route would be designed to avoid intercepting groundwater. This would minimise the need for dewatering the trench.

Potential impacts on surface water quality during construction of the project would be similar to those experienced for other urban construction projects and are considered manageable with the application of standard mitigation measures (refer to **Section 17.5**). These measures would be in accordance with applicable guidelines such as the Blue Book.

17.3.1.2 Impacts to geomorphology

Construction activities within or adjacent to watercourses and/or riparian zones, such as the installation of cable bridge abutments, are likely to involve the clearing of vegetation and may result in disturbance to the channel bed and bank areas. The latter could disturb the existing floodplain and/or in-channel form, exposing it to scour erosion or altering the trajectory of the channel geometry.

Water from the work sites, derived mainly from groundwater and some surface water runoff could be discharged to the stormwater system if it is of suitable quality and this would ultimately discharge into Botany Bay via Alexandra Canal or the Cooks River. It is unlikely that increased erosion or channel deepening (bed incision) would be caused by discharge of this water and increased flows, since the stormwater discharge points are concrete lined.

Project areas where soil has been exposed and/or weakened by construction activities (including excavations) can be eroded/mobilised by wind or runoff and have the potential to deposit sediments in receiving waterways. Sediments can fill and smother in-stream geomorphic units and habitat features such as pools and riffles. Furthermore, sediments can accumulate at in-stream barriers and constrictions, which may result in localised flooding and/or channel avulsion (i.e. a new altered flow path around an in-stream barrier). However, many of the waterways that intersect the project including the Cooks River and Coxs River are concrete lined channels, so the potential for geomorphic changes are restricted.

Erosion and sediment loads would gradually diminish after construction as the disturbed areas are stabilised. The key objective is to minimise erosion of disturbed earthworks areas and to contain sediments on-site before they enter the riparian zone and watercourse/drainage system. This could be achieved by stabilising areas as soon as possible, minimising the amount of time areas are exposed for and avoiding working in wet weather, where feasible.

Other potential construction impacts on the geomorphology include increased impermeable areas associated with work sites and construction laydown areas (e.g. site offices and sheds) and/or altered flow paths that may result in increased over bank flows entering the waterway and causing erosion.

17.3.2 Changes to surface water flows

Construction flooding and drainage impacts could potentially arise as a result of:

- work sites may increase runoff volumes and peak flows (e.g. maximum flow rates) following rainfall events due to an increase in impermeable surfaces;
- drainage infrastructure may become blocked (e.g. by soil, vegetation, waste) or temporarily diverted due to construction activities. Disruption to local drainage lines may result in localised flooding upstream of the project area; and
- removal of existing pavement could divert flow away from designed drainage structures and into new receiving areas. Diverting drainage lines may also create localised areas of flooding and scour.

Construction of the transmission cable circuit would require excavating a trench in which to lay the conduits. Trenching and conduit installation would only require the opening of short sections of trench at a time (typically up to around 20 metres at any one location per day), with backfilling occurring as soon as each section of the conduits has been installed, leaving typically no more than 20 metres open at one time. During this period, there is a possibility that overland flow would enter the trench or joint bay, either as sheet flow from surrounding areas or as channelised flow in the kerb and gutter system. Trenches would be temporarily covered when works are not occurring; however, there is a potential that temporary covers are not sealed, and flow may enter the trench. There may also be disruption of existing drainage networks during decommissioning, upgrade or replacement of drainage pits and pipes during trenching activities.

Water may be diverted from the existing flow path into the excavated trenches, requiring it to be pumped out of the trench to a tank/basin. If large volumes of water accumulate during heavy rain, the water may spill from the trench or joint bay in an uncontrolled manner.

Where cable bridges are planned to be installed, the construction of the bridges may have some localised impact on overland stormwater flows.

Coxs Creek at Wangee Road and the un-named tributaries of the Cooks River at both Rawson Road and Omaha Street are comprised of stormwater culverts passing under the roadways. The level of cover present above these culverts would be insufficient to construct the new transmission cable circuit above the culverts. As such, the construction process at these locations would likely involve trenching through the existing culverts, laying the transmission cable conduits and then reconstructing the culverts to match the pre-existing conditions. Depending on local site conditions, alternative construction methods, such as underboring, may also be considered by the construction contractor to minimise surface impacts.

Where underboring is carried out, launch and receive pits would be required to be excavated and in operation for up to around ten weeks at each location. These pits would have diversions in place to prevent surface water flow from entering the pits. Backfilling of the pits would occur as soon as the conduits are installed.

At the Cooks River, sediment barriers or site bunds would be used to prevent sediment from entering the watercourse. Works within watercourses would not be undertaken during or immediately following rainfall events when higher flows in the watercourse (e.g. Cooks River or Coxs Creek) are expected.

As substation upgrades and construction laydown area works at the Beaconsfield West substation would be contained within the existing boundary of the site and would be managed by existing site stormwater infrastructure, it is unlikely that surface water flows would be impacted in this location.

17.3.3 Impacts to the existing stormwater network

Where the transmission cable route crosses existing stormwater assets, these assets may require relocation or protection during construction. There would also be a need to divert stormwater as part of construction management activities to help manage flow. Where diversion would result in additional stormwater flow being diverted into the existing stormwater network, appropriate sediment management would be required and consultation with relevant authorities undertaken. Where a water stream generated by the project is identified as being contaminated, it is not permitted to be

discharged to the stormwater network. The contaminated water would be either discharged to the sewer under a trade waste licence or trucked off-site for disposal.

Impacts to the urban stormwater network are not anticipated if the transmission cable circuit passes below the stormwater pipes, which would be supported during construction. However, there is a risk that stormwater could enter the trench if the stormwater pipes are temporarily cut and replaced during asset relocation. If pipes are required to be cut and replaced, rainfall forecasts would be monitored and works rescheduled if required, to avoid disrupting the flow of stormwater so as to minimise the risk of uncontrolled stormwater discharge.

At Camdenville Park, there is an existing flood detention basin. Depending on the final project design including choice of backfill materials and cable alignment, the construction of the transmission cable circuit could compromise the integrity of the embankment wall of the flood detention basin unless suitable measures are implemented. That is, the integrity of the flood detention basin would need to be considered during detailed design to prevent potential damage.

17.3.4 Impacts to waterfront land

The existing riparian corridors within the project area have undergone significant urbanisation (**Section 17.2.4**), therefore the potential for additional impacts to the riparian corridors are limited. However, construction works and construction laydown areas would occupy land that would otherwise be used for recreation such as Mildura Reserve and the Cooks River cycleway in Croydon Park and Lees Park reserves. Therefore, there would be a temporary impact to the recreational functions provided by waterfront land.

17.3.5 Water use

There would be a temporary increase in potable water demand as a result of the project during the construction stage. However, construction of the project does not require any on-site processes that consume large quantities of water (e.g. concrete batching is expected to be done off-site at locations with sufficient water supply). A number of other activities may require minor quantities of water. These activities include:

- on-site washrooms and amenities;
- wheel wash-down for vehicles leaving the site;
- dust suppression;
- concrete cutting; and
- equipment cleaning.

Potable water would be obtained from the Sydney Water potable supply network subject to agreement with Sydney Water.

17.4 Assessment of potential operational impacts

Operation of the project is anticipated to have limited impacts on the surface water environment, given the majority of infrastructure would be located underground. However, above ground infrastructure such as cable bridges have the potential to change the existing flow paths and flood storage at key locations.

Once the transmission cable circuit has been installed, generally only visual inspections would be required during regular monitoring and inspection. Ongoing physical access to the transmission cable circuit is not required however ongoing monitoring of the cable, for damage (missing/worn cable markers) and outages would occur through access to the link boxes and sensor boxes located near the joint bays.

17.4.1 Impacts to waterfront land

As the existing riparian corridor has undergone significant urbanisation (**Section 17.2.4**), the potential for additional impacts to the riparian corridor during project operations are limited. However, one of the

options for the crossing of the Cooks River is via cable bridge. This may affect the following functions of the riparian corridor:

- conveying flood flows (refer **Section 17.4.2**)
- providing an interface between developments and waterways; and
- providing passive recreational uses.

The cable bridge would be adjacent to an existing footbridge and is expected to have a relatively small footprint. This would not impact on the function of the Cooks River cycleway, Croydon Park playground or the Lees Park sports field. The recreational function of the land along the transmission cable route would be restored following completion of the project construction, and as such, the impacts to the functions provided by waterfront land would be minimal.

17.4.2 Changes to surface water flows

The project may result in minor potential obstruction to flood flows as a result of new infrastructure and reductions in the floodplain area, which could have an impact on downstream flooding behaviour or on nearby existing developments.

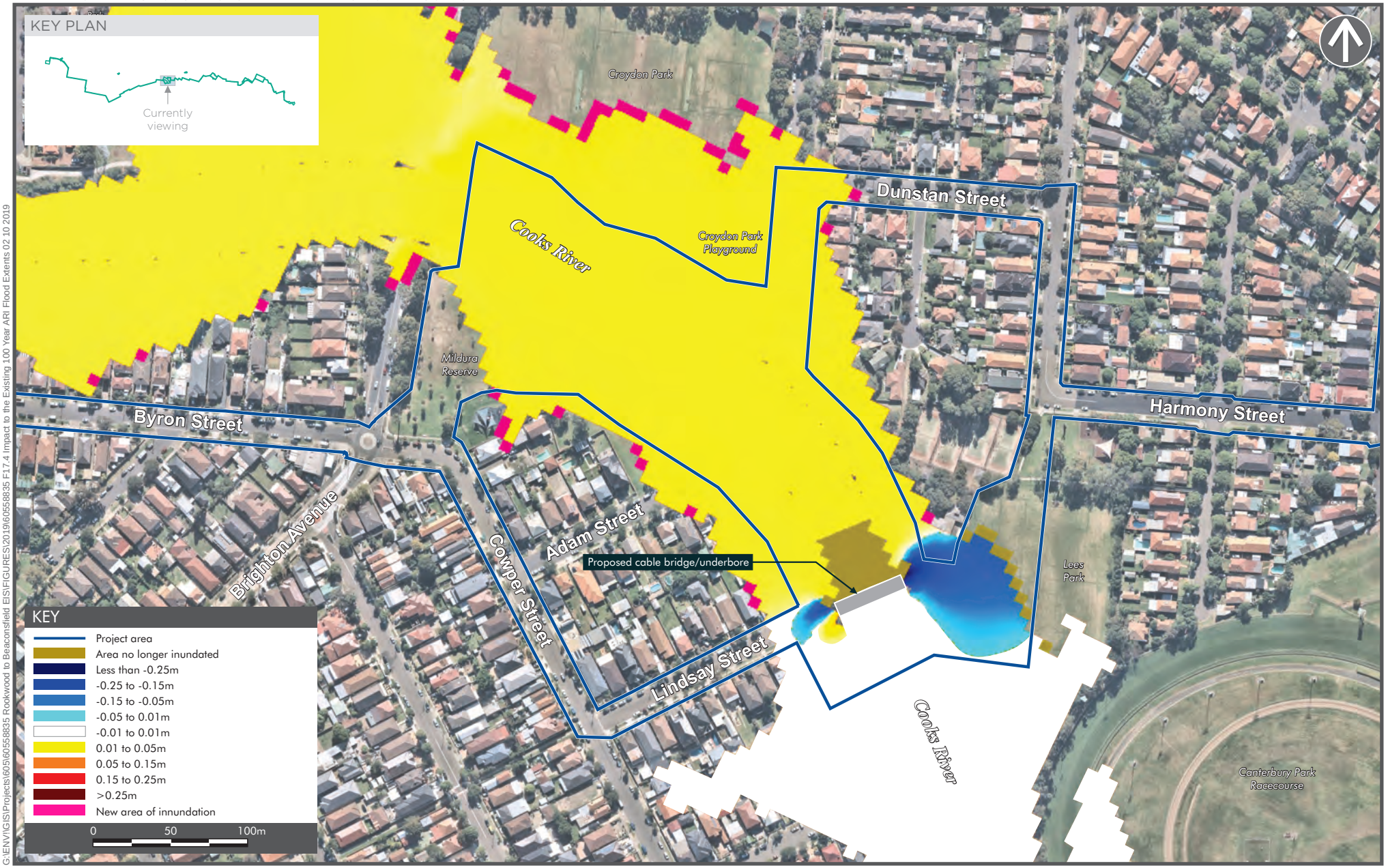
For the majority of the transmission cable route, the surface would be restored to be similar to the existing condition, and as a result no major alterations to overland flow are anticipated. Minor alterations to overland flow routes may occur around bridge piers where cable bridges are required. However, with the appropriate design of cable bridges, bridge piers are expected to be negligible as flowpaths would be maintained and the loss of flood storage is expected to be minor.

Coxs Creek at Wangee Road and the un-named tributaries of the Cooks River at Rawson Road and Omaha Street (in Precinct 2) are comprised of stormwater culverts passing under the roadways. These culverts would be restored following completion of project construction therefore there would be no lasting impacts on water flows.

A cable bridge crossing of the Cooks River is proposed adjacent to the existing Lindsay Street footbridge (in Precinct 3). The existing footbridge does not sit above the current 100 year ARI floodplain and therefore would provide some obstruction to flows. The new cable bridge would be aligned immediately upstream of the existing footbridge but would sit above the 100 year ARI event water level to minimise the potential for increase in flood impacts. In order to raise the cable bridge above the 100 year ARI event water level, the cable bridge would be built such that the lowest structural element of the bridge clears 5.1 metres AHD, assuming 500 millimetres of freeboard. Although the deck of the cable bridge would clear the 100 year ARI water level, the bridge abutments would potentially cause upstream flooding impacts at adjacent properties of approximately 40 millimetres with localised impacts up to 50 millimetres (refer to **Figure 17-4**).

This assessment has shown that there would be no new properties inundated as a result of the potential flood level increases of up to 50 millimetres. At properties which already experience inundation, floor level survey would be required to determine if any floor levels would be affected and to what extent. A Flood Mitigation Strategy (FMS) would be prepared to outline specific measures and requirements for the design and construction of the proposed cable bridge over the Cooks River to minimise impacts associated with impeding surface water flows (as detailed in **Section 17.5.1**). If refinement of the cable bridge design cannot avoid flooding impacts on additional properties, then an alternative crossing method and/or alternative crossing location of the Cooks River would need to be investigated.

During extreme events such as the PMF, roads and road crossings of the Cooks River are blocked by flooding under present conditions (Sydney Water, 2009). As such, the PMF does affect the emergency response under present conditions. The potential impacts of the construction of the cable bridge would need to be investigated further to determine if emergency response would be adversely affected.



G:\ENVIGIS\Projects\605\60558835 Rookwood to Beaconsfield EIS\FIGURES\2019\60558835 F17.4 Impact to the Existing 100 Year ARI Flood Extents 02 10 2019

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100 YEAR FLOOD IMPACTS AT LINDSAY STREET (PRECINCT 3)

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Potts Hill to Alexandria Transmission Cable Project

FIGURE 17-4

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018), Cooks River Flood Study (MWH+PB, 2009)

17.5 Environmental management and mitigation measures

17.5.1 Environmental management objectives and outcomes

The objectives of the management approach for surface water and flooding are:

- minimise the disturbance to the movement of water in the stormwater network as well as in the Cooks River and Coxs Creek;
- preserve the downstream receiving water quality; and
- limit the potential for increases in flood levels and manage flood risk.

The environmental management and mitigation measures to be undertaken during the project to manage potential surface water and flooding issues and achieve the management objectives are presented in **Table 17-3**.

Table 17-3 Environmental management measures – surface water and flooding

No.	Impact/Issue	Environmental management and mitigation measures	Timing
WQ1	Water quality, soil erosion and sediment control (CSWMP)	A CSWMP will be prepared as part of the overall CEMP to document the measures required to mitigate and manage potential impacts on soils and surface water during construction. The CSWMP will include the following sub-plans and measures: • Erosion and Sediment Control Plans (ESCPs) (see WQ2); • where wheel washing is required, wheel wash wastewater will be collected (e.g. through temporary containment and directing to sediment basins or tanks) and disposed of appropriately; • water collected during construction (e.g. during dewatering or surface water inflows to the trench or pits) would be discharged or disposed of in accordance with the *Protection of the Environment Operations Act, 1997 and the ANZECC Water Quality Guidelines (2000) for 95% protection level for marine ecosystems.* Contaminated water captured during construction would be disposed of at an appropriately licensed facility; and • where works are within the riparian zone (40 metres from the top of the watercourse bank) the *Controlled Activities on Waterfront Land Guidelines* (DPI, 2012) would be reviewed and relevant measure included into the CSWMP where appropriate. Procedures and protocols to manage potentially contaminated fill, soil, bedrock, acid sulfate soils and extracted groundwater will be detailed in the CEMP in accordance with conditions outlined in the Preliminary Site Investigation report (refer to **Appendix K**) and the *NSW Acid Sulfate Soils Manual* (Stone *et al,* 1998).	Construction
WQ2	Water quality, soil erosion and sedimentation control (ESCP)	ESCPs will be prepared as part of the CEMP for transmission cable route work sites, substations and construction laydown areas, in accordance with the Blue Book (Landcom, 2004). ESCPs will be implemented in advance of site disturbance and updated as required as the construction progresses and the work site locations change. Measures in the ESCPs will include:	Construction

No.	Impact/Issue	Environmental management and mitigation measures	Timing
		• construction traffic to be restricted to access tracks, where existing roads cannot be utilised (e.g. through Sydney Park). These access tracks will be clearly delineated and maintained until construction is complete; • where possible, clean water will be prevented from entering excavations by diverting runoff away from earthworks activities; • the extent of ground disturbance and exposed soil will be minimised to the greatest extent practicable to minimise the potential for erosion; • disturbed ground and exposed soils, such as inside trenches or at construction laydown areas, will be temporarily stabilised (e.g. with geotextile) prior to extended periods of site inactivity and permanently stabilised as soon as possible to minimise the potential for erosion; • stormwater flows will be managed to avoid flow over exposed soils which may result in erosion and impacts to water quality. Inside the excavation this may require the use of trench stops; and • rainfall forecasts will be monitored daily during construction and works rescheduled if necessary and as determined by the contractor, to reduce risk of erosion and sedimentation and to minimise the impact of heavy rainfall and flood events.	
WQ3	Water quality – spills and leaks	The following measures will be documented in the CSWMP and implemented to mitigate and manage spills and leaks: • areas will be allocated for the storage of fuels, chemicals and other hazardous materials. These areas will be as far away as feasible and reasonable from watercourses, located where flooding during a 20 year ARI event is unlikely, and on an impervious, bunded area; • the storage and handling of dangerous goods will be in accordance with relevant guidelines and standards such as the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005); • fuel and liquid storage at construction laydown areas will be secured and stored in accordance with the NSW EPA guidelines (Department of Environment and Climate Change NSW, 2007b); • appropriate spill containment and prevention measures will be applied to fuel and liquid storage, where feasible and reasonable; • accidental spills or leaks will be managed through the use of spill containment measures including spill kits. Any contaminated material will be disposed of to an appropriately licenced facility; • re-fuelling of construction plant and equipment will be undertaken using appropriate spill containment measures to mitigate pollution risks from accidental spills or leaks; • refuelling activities will be undertaken at least 100 metres from the nearest watercourse;	Construction

No.	Impact/Issue	Environmental management and mitigation measures	Timing
		• a spill response kit will be available on-site at all work sites at all times; • where bulk fuel or other liquid substances are to be brought to a work site, a container specifically designed for that purpose will be used; • underboring sites will have appropriate stormwater diversions, as well as downstream pollution and sediment control measures to both prevent stormwater entering the excavation as well as to assist with containing any loss of drilling fluid; and • flows of drilling fluid will be visually monitored in accordance with the CSWMP.	
FF1	Flooding and water flows (FMS)	A Flood Mitigation Strategy (FMS) will be prepared in accordance with the *Floodplain Development Manual* (DIPNR, 2005) for work within flood prone or flood affected land within the project area to demonstrate that the existing flooding characteristics will not be exacerbated. The FMS will be prepared by a suitably qualified and experienced person in consultation with directly affected landowners, Department of Industry (DI) - Water, Department of Planning, Industry and Environment, Sydney Water and relevant councils. The FMS will be prepared during detailed design and prior to construction. The FMS will identify design and mitigation measures that will: • be considered by the contractor in the development of site-specific flood management plans, including the need protect plant, staff, materials and earthworks activities from flooding (refer to FF3); • avoid or reduce impacts at adjacent properties; and • not significantly alter surface water flows during construction and operation. The FMS will limit flooding characteristics to the following levels, or else provide alternative flood mitigation solutions consistent with the intent of these limits: • a maximum increase in inundation time of one hour in a 100 year ARI rainfall event; • a maximum increase of 10 millimetres in inundation at properties where floor levels are currently exceeded in a 100 year ARI rainfall event; • a maximum increase of 50 millimetres in inundation at properties where floor levels would not be exceeded in a 100 year ARI rainfall event; and • no inundation of floor levels which are currently not inundated in a 100 year ARI rainfall event.	Detailed design
FF2	Flooding and water flows at Cooks River	The FMS will outline specific measures for the construction of the proposed cable bridge over the Cooks River to minimise impacts associated with impeding surface water flows. This will include: • where possible, construction will take place outside of the floodplain; • construction will not be undertaken during flooding events;	Detailed design and construction

No.	Impact/Issue	Environmental management and mitigation measures	Timing
		• temporary mobile plant will be used during construction that be quickly removed in the event a flood; • the crossing will be designed to be elevated above the 100 year ARI floodplain extent (as identified in the FMS), subject to consultation with Sydney Water and the relevant road authority; and • if abutments or piers are required within the floodplain and within an area with significant depth or velocity during flood events, or are likely to affect an overland flow path, then a quantitative flood impact assessment will be prepared for the crossing to meet the requirements of mitigation measure FF1. If these requirements cannot be met, design changes for this crossing may be required. These changes will be discussed with the relevant authorities, where necessary.	
FF3	Flooding and water flows during construction	Flood Management Plans (FMPs) will be developed as part of the CSWMP for works within flood prone or flood affected land within the project area. Measures to be detailed in the FMPs to manage potential flood and water flow impacts will include: • the construction of the project will be staged to limit the extent and duration of temporary works in a floodplain; • work inside ephemeral watercourses including, but not limited to the Coxs Creek and other urban drainage network assets, will not be undertaken during or immediately following runoff generating rainfall events when stormwater flows in these watercourses are expected; and • flood emergency response procedures will be documented within the FMPs to make sure construction equipment and materials are removed from floodplain areas at the completion of each work activity or in the event a weather warning is issued for impending flood producing rain.	Construction
FF4	Camdenville Park flood detention basin	Design of the transmission cable route through Camdenville Park will consider the integrity and functionality of the existing flood detention basin.	Detailed design

18.0 Groundwater

This chapter provides an overview of the potential impacts on groundwater resources as a result of the construction and operation of the project. It also outlines the proposed management and mitigation measures to mitigate impacts, as detailed in the Groundwater Technical Report in **Appendix N**.

18.1 Assessment methodology

A qualitative assessment has been undertaken to address the potential impacts on groundwater systems that may result from the project. Required water use during construction, as well as the discharge of water from the project, has also been considered.

18.1.1 Desktop assessment to determine existing conditions

A desktop review and analysis of existing information was undertaken to determine potential receptors and to characterise the existing environment.

The following existing groundwater and geological data were considered:

- Geological Survey of NSW Sydney 1:100,000 Geological Sheet 9130 (Herbert, 1983);
- previous geotechnical and groundwater investigations for Rookwood Road substation (Douglas Partners, 2010/2017) and Beaconsfield West substation (Parsons Brinckerhoff, 2009);
- Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources (NSW Office of Water, 2011);
- National Atlas of Groundwater Dependent Ecosystems (Bureau of Meteorology, 2018); and
- review of bores registered with Department of Industry-Water accessed through the Bureau of Meteorology.

18.1.2 Assessment of potential impacts

Potential impacts on groundwater resources including minimal impact considerations under the Aquifer Interference Policy (AIP) (NSW Office of Water, 2012) were assessed by considering the location of registered bores and Groundwater Dependent Ecosystems (GDEs) (refer to **Section 18.2.3**), the regional geology and hydrogeology, and by identifying areas where there could be impacts on these resources.

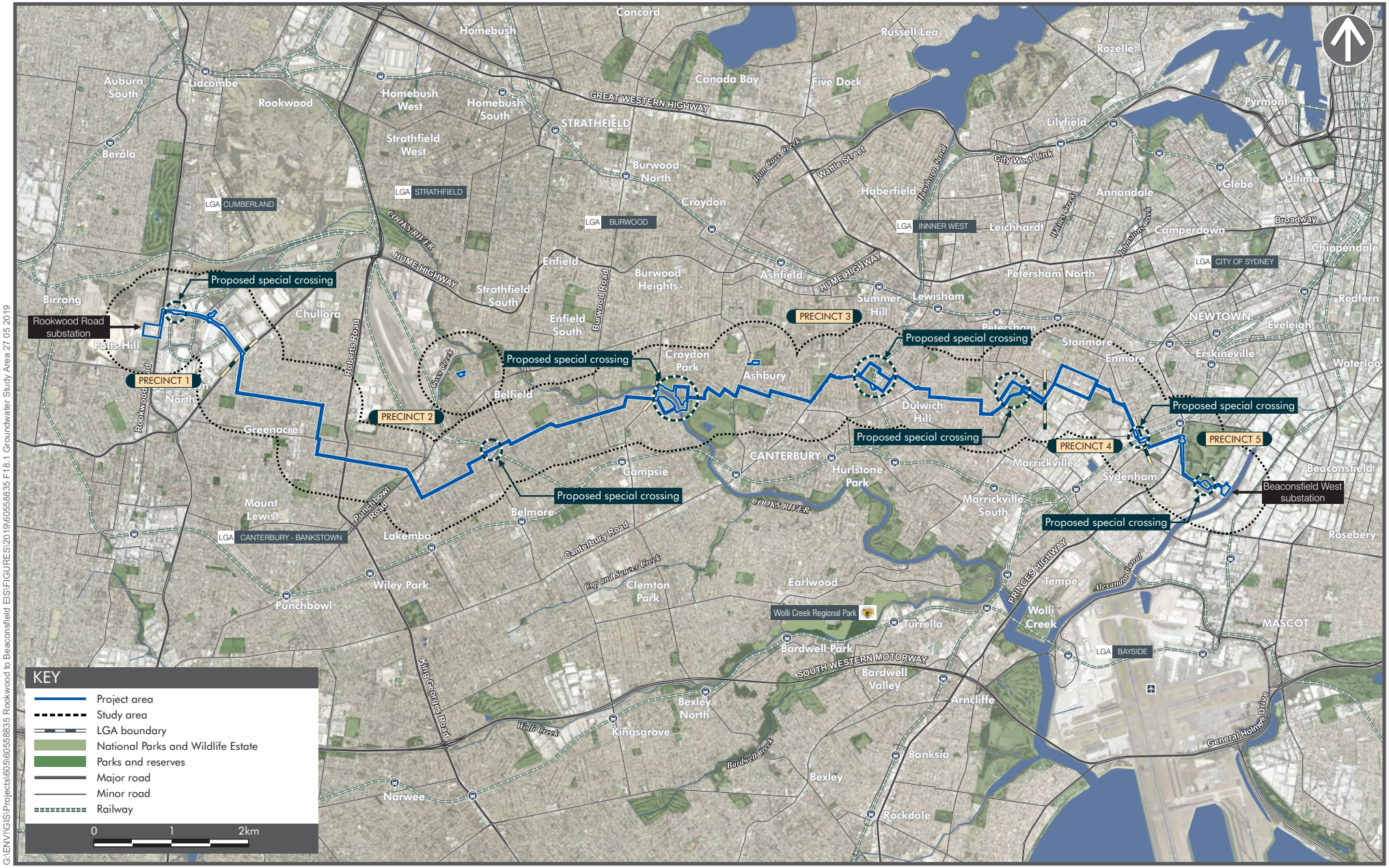
Groundwater impacts have the potential to occur where the excavation intersects the watertable in areas such as joint bay excavations, trench excavations in excess of two metres and at underbore locations, especially at the Cooks River. Creation of impermeable surfaces, such as at construction laydown areas, can also affect groundwater recharge.

Where available, data from previous investigations has been compiled to identify areas of concern for groundwater impacts.

18.1.3 Study area

For the groundwater assessment, the study area comprises the groundwater systems and resources[1] within a 500 metre radius of the project area. The groundwater study area is shown in **Figure 18-1**.

[1] Groundwater systems refer to aquifers whereas groundwater resources refer to the groundwater users such as bores.



G:\ENVIGIS\Projects\605\60558835 Rookwood to Beaconsfield EIS\FIGURES\2019\60558835 F18.1 Groundwater Study Area 27 05 2019

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GROUNDWATER STUDY AREA

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Potts Hill to Alexandria Transmission Cable Project

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

FIGURE 18-1

18.2 Existing environment

A description of the existing waterways, soil profiles and contamination within the project area is provided in **Chapter 16 Soils and contamination**, **Chapter 17 Surface water and flooding** and the Groundwater Technical Report in **Appendix N**.

Groundwater across the project area is present in:

- fill, imported and local, used for the construction of infrastructure and waste infilling such as at Sydney Park and Camdenville Park;
- alluvium around the edges of major waterways including the Cooks River and Alexandra Canal; and
- bedrock aquifer of the Ashfield Shale and Hawkesbury Sandstone.

Groundwater within the project area is recharged by infiltration of rainfall and runoff. Perched groundwater may be encountered within fill and natural clayey soils. In lower lying areas tidal influences are typically experienced within close proximity to the foreshore. Groundwater levels fluctuate in response to diurnal variation, tidal influences, variable rainfall, dewatering, seasonal variation and longer term in response to natural climatic variation.

The project area is located in an urbanised part of Sydney where rainfall recharge has been reduced by hard stand and roof runoff being captured and directed to stormwater. The majority of groundwater recharge occurs in parks, gardens and bushland. Alluvium flanking the Cooks River and Alexandra Canal is recharged daily by tidal fluctuations.

Groundwater flow typically follows the surface topography but is also influenced by a number of factors such as geological boundaries, palaeochannels, building foundations and groundwater extraction.

18.2.1 Groundwater levels

Groundwater levels are variable across the project area ranging from between 0.3 and three metres below ground level. Elevated groundwater levels may be present where the watertable is perched, which is generally encountered within areas of fill and natural clayey soils. In areas where the watertable is less than 2 metres below ground level, the trench excavation depth may intercept groundwater and require temporary dewatering during construction.

18.2.2 Groundwater quality

Groundwater quality across the project area is variable and dependent upon the lithology of the aquifer, tidal influences and current and previous land uses. Groundwater quality within the alluvium is naturally variable being typically of low salinity in upper reaches of creeks and rivers and increasing in salinity downstream due to increased tidal influences. Similarly, natural groundwater quality within the shale and weathered shale is variable and is often saline. Groundwater quality within fill is dependent upon the quality and origin of the fill material (i.e. if the fill comprises contamination, groundwater quality could potentially be contaminated).

At Sydney Park, for example, the groundwater is known to be contaminated and leachate and landfill gas has been generated due to waste infilling of the former quarries/brick pits. Other known areas of contamination are outlined in **Chapter 16 Soils and contamination** and **Appendix K**. Elsewhere along the transmission cable route, the unconfined alluvial aquifers are susceptible to contamination from former and current land use practices such as leakage from industrial sites, leaky sewage systems or the application of fertilizers. The shales are generally less susceptible to contamination due to the presence of an overlying clayey soil profile restricting groundwater infiltration. Existing groundwater contamination along the transmission cable route is discussed in more detail in **Chapter 16 Soils and contamination** and **Appendix K**.

Groundwater quality within the Botany Sands aquifer in Precinct 5, under natural conditions, is generally of low salinity. However, due to the shallow unconfined nature of the aquifer, it is susceptible to groundwater contamination from a variety of historic and current land uses such as tanneries, metal platers, service stations, light industry, landfills, dry cleaners, petrol stations and leaky sewage pipes.

18.2.3 Groundwater dependent ecosystems

GDEs are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater, such as wetlands and vegetation on coastal sand dunes. Most wetland communities and many river systems have some degree of dependence on groundwater.

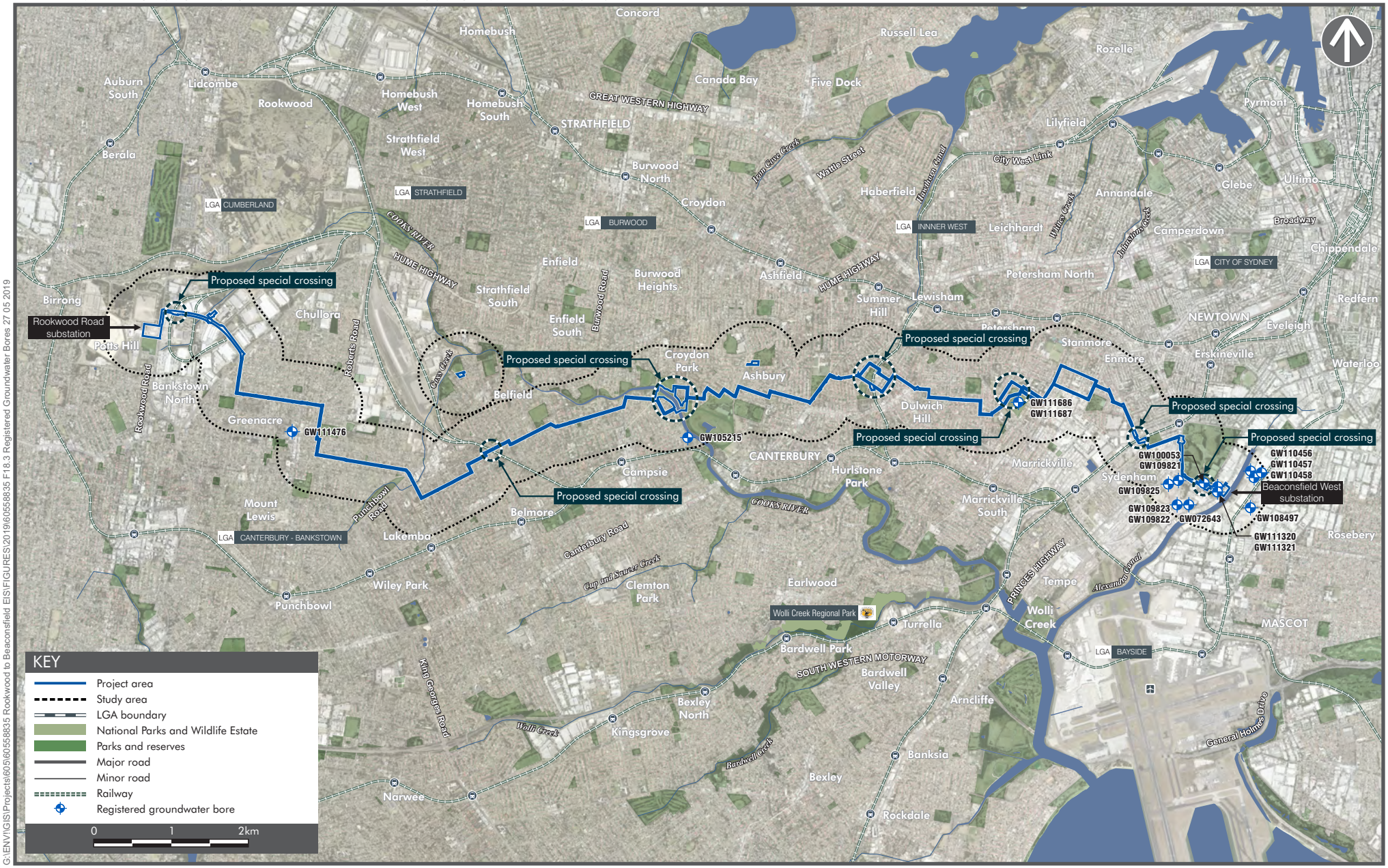
The closest high priority GDEs identified are the Botany Wetlands or Lachlan Swamps located in Centennial Park. These wetlands are areas where groundwater surfaces in the Botany Sands aquifer, supporting ecosystems. Since the wetlands are located approximately 4 kilometres northeast of the eastern most extent of the project area and east of Alexandra Canal, it is considered unlikely that the GDEs would be impacted by any temporary dewatering due to the project.

A search of the GDE Atlas (BoM, accessed 28 May 2019) for high priority GDEs indicated that there are no ecosystems within the study area that are likely to be dependent on groundwater. The project is not expected to change availability of water for plants due to the low permeability of the clayey soils, frequent rainfall events and nearby GDEs are located at points of recharge.

18.2.4 Groundwater extraction

Existing groundwater use within the study area is limited as the area is serviced by a reticulated water supply provided by Sydney Water. Groundwater usage to the east of St Peters within the Botany Sands aquifer is higher because groundwater can be extracted for domestic purposes for little cost other than borehole establishment and pumping costs. The extracted water is typically used to water lawns and gardens or wash cars.

A review of bores registered within the study area identified 16 registered bores. It is possible there are other private bores present within the 500 metre radius that have not been registered. Review of these boreholes indicates that 14 are registered as monitoring bores, one is for domestic use, one is for recreation and culture and the remainder had no purpose recorded. The dominant purpose of the wells for groundwater monitoring is consistent with low groundwater use in the project area. The wells are typically shallow, being less than 10 metres deep. Exceptions are domestic bore GW105215 located in Bellombi Street, Canterbury, that is drilled to a depth of 15 metres and monitoring wells GW109821 (35 metres) and GW109825 (22 metres) located at Alexandria Landfill, south of Sydney Park. The distribution of registered boreholes is shown on **Figure 18-2**.



G:\ENV\GIS\Projects\605\60558835 Rookwood to Beaconsfield EIS\FIGURES\2019\60558835 F18.3 Registered Groundwater Bores 27 05 2019

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REGISTERED GROUNDWATER BORES

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Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

FIGURE 18-2

18.3 Assessment of potential construction impacts

Construction of the project would involve a variety of activities with potential to impact on quality and flow of groundwater. These are discussed below. Measures to manage these impacts are presented in **Section 18.5**.

18.3.1 Impacts on groundwater

Groundwater impacts could potentially arise from:

- spills of fuels, oils, chemicals or construction materials or drilling muds may infiltrate groundwater through underboring activities or open excavations;
- construction activities could introduce foreign contaminants such as oil or greases, and disturb contaminated sediments, potentially having an adverse impact on groundwater quality;
- contaminated or acid sulfate soil sediments that may be mobilised by construction activities; and
- intersecting existing contaminated groundwater during excavation or creating a more permeable pathway for contamination to reach groundwater.

Since the majority of the transmission cable route is predominately located in topographically elevated areas and is to be excavated from shale, it is anticipated that groundwater would not be intersected along the majority of the transmission cable route. Areas with the potential to intersect groundwater are immediately adjacent to the Cooks River and locations that require underboring.

Underboring using thrust boring would typically require a pit 4 metres below ground surface and underboring using horizontal direction drilling (HDD) would typically be between 4 and 10 metres below ground surface. Potential impacts during underboring include accidental spills or leaks such as frac-outs. These potential impacts would be managed by:

- protocols outlined in the Construction Soil and Water Management Plan (CSWMP) which would include spill response times and the use of spill kits to contain and capture contaminated water; and
- HDD by suitably qualified and experienced drilling contractors and adherence to the guidelines set out in the Minimum Requirements for Water Bores in Australia (National Uniform Drillers Licensing Committee, 2011).

Potential contamination impacts from HDD are discussed further in **Chapter 16 Soils and contamination**.

18.3.2 Temporary dewatering

At locations within the project area where perched groundwater or the watertable are intersected, temporary dewatering may be required to maintain dry conditions in the excavation during construction. There are many options to remove water from the excavation, some of which are pump and sump techniques, installation of temporary barriers and pumping from temporary bores. Licensing of groundwater extraction in accordance with the AIP would be required if the extracted groundwater exceeds 3 megalitres per year. As a condition of this licence, groundwater treatment prior to discharge would also be required.

Dewatering discharge options are dependent on water quality or degree of treatment undertaken prior to discharge. Should groundwater be discharged to sewer, a licence through Sydney Water would be required and the groundwater discharge criteria would be in accordance with the Sydney Water acceptance standards (Sydney Water, 2019). Should groundwater be discharged to stormwater, the groundwater quality discharge criteria would be in accordance with the ANZECC Water Quality Guidelines (2000). Potential impacts due to groundwater extraction include loss of water from existing registered bores, damage to nearby infrastructure caused by ground settlement or degradation of water in local waterways due to unmonitored discharge.

18.3.2.1 Groundwater levels

During dewatering, local groundwater levels are expected to be temporarily lowered but are expected to return to their former levels following the cessation of dewatering. Groundwater levels fluctuate naturally over different time periods due to a number of natural factors including diurnal, tidal, seasonal

and climate change influences. Seasonal and climate change oscillations are related to the variability of rainfall conditions and recharge. Groundwater levels are influenced by topography, proximity to creeks, rainfall and evapotranspiration. Groundwater levels can also be influenced by artificial means. For example, groundwater levels can be lowered by pumping or increased by deep foundations altering groundwater flows and causing groundwater mounding. Under natural conditions, groundwater levels would be expected to naturally fluctuate over an amplitude of approximately 1 metre.

Predicted groundwater level drawdown is not expected to be substantial and less than 2 metres. This is due to the watertable in the study area being typically deeper than 1 or 2 metres below ground level and the base of the excavation (for the transmission cable conduits and joint bays) being approximately 2 metres deep and up to 10 metres deep for localised underboring (four metres for launch and receive pits and up to 10 metres for the underbore itself). The actual drawdown in the surrounding area would be limited over most of the transmission cable route because:

- the deeper excavations for underboring pits would occur in the shale bedrock, which has a low hydraulic conductivity;
- the trench excavations would not be open for a significant amount of time (only a matter of a few days before being backfilled); and
- joint bay excavations are unlikely to intersect groundwater, being typically no deeper than 2 metres but will potentially be left open and dewatered for up to three weeks.

Since the predicted groundwater level drawdown is less than 2 metres, the impacts are considered to be a Level 1 minimal impact (as defined in the AIP) and thus these impacts are considered acceptable in accordance with the AIP. Consequently, Level 2 impacts are not triggered and therefore no groundwater modelling is required to assess dewatering impacts to satisfy the AIP. Similarly, since the predicted impacts on groundwater levels are considered minimal (i.e. less than 1 metre) and temporary, potential impacts on nearby registered bores, GDEs or wetlands are considered acceptable in accordance with the AIP.

Where excavations intersect the watertable, a Groundwater Management Strategy to manage temporary dewatering would be required. The strategy would include measures to manage localised temporary dewatering to minimise groundwater extraction and to ensure groundwater discharge works minimise potential impacts on the environment. The installation of gravel drainage blankets may be required beneath parts of the transmission cable conduits where bedrock is shallow and groundwater mounding could be caused by the blocking of groundwater flow paths. The strategy would be developed during the detailed design stage.

The potential increase of impermeable areas, such as construction laydown areas and joint bays, could temporarily alter or reduce groundwater recharge, by directing captured water to stormwater. The increase of impervious surfaces during construction is expected to be minor in comparison to the area from which the groundwater is recharged. As such, potential impacts related to an increase of impervious surfaces are considered minor and would not significantly reduce groundwater recharge.

18.4 Assessment of potential operational impacts

Operation of the project is anticipated to have limited impacts on groundwater, given the majority of infrastructure would be located above the expected groundwater elevation. Although project infrastructure would be in contact with groundwater at a number of special crossings, there would be no dewatering or significant alteration of the groundwater flow regime. Therefore, operational impacts would be minimal as discussed below.

Measures identified to minimise and manage any impacts are presented in **Section 18.5**.

18.4.1 Changes to groundwater flow and levels

Below ground infrastructure such as the installation of the transmission cable circuit has the ability to create physical barriers resulting in temporary or permanent interruptions to groundwater flow. Temporary impacts may occur after heavy rainfall, with infiltration to the watertable and lateral flow being slowed due to the barrier, creating a groundwater mound behind the barrier.

Permanent impacts may be caused by the compartmentalisation of an aquifer caused by the construction of a hydraulic boundary impacting groundwater flow patterns. In the case of the installation of the transmission cable circuit, a hydraulic barrier can be created if the conduits fully penetrate the aquifer. The transmission cable circuit is unlikely to create hydraulic barriers because the excavations are shallow and where the watertable is intersected it is likely to only be partially intersected, allowing groundwater to flow beneath the infrastructure. In areas where it is suspected that groundwater flows may be altered, groundwater mounding could be avoided by the inclusion of drainage blankets beneath the transmission cable circuit.

Project infrastructure may be in contact with groundwater at a number of special crossings, however there would be no dewatering or significant alteration of the groundwater flow regime because:

- the majority of the transmission cable route is in the low hydraulic conductivity Bringelly and Ashfield Shales and a significant barrier to flow would not be created due to the relatively small footprint of the project including the special crossings; and
- the special crossings at Sydney Park in the Botany Sands aquifer also have a small footprint in the higher hydraulic conductivity saturated zone and excess groundwater, if present, would flow around the infrastructure with the elevated head conditions dissipating rapidly across the aquifer because of the higher hydraulic conductivity.

Long term groundwater levels are unlikely to be impacted by the project other than the potential for some localised groundwater mounding. Consequently, groundwater levels in registered bores and in the wetlands in Sydney Park are not expected to be impacted by the project.

18.5 Environmental management and mitigation measures

18.5.1 Environmental management objectives and outcomes

The groundwater management and mitigation measures for the project seek to minimise disturbance and maintain the existing quality of groundwater.

The measures presented in **Table 18-1** are proposed to manage and monitor potential groundwater impacts during construction and operation of the project. These measures include the development and implementation of a range of management strategies which would inform the detailed design and the construction management plans that would be implemented during construction.

Table 18-1 Environmental management measures – groundwater

No.	Impact/Issue	Environmental management and mitigation measures	Timing
GW1	Groundwater interception	A Groundwater Management Strategy will be prepared that will outline the requirement for drilling and installation of monitoring wells for baseline groundwater level and quality monitoring. This additional information will be collected prior to or during detailed design in locations where it is likely that the watertable may be intersected (refer **Section 18.3**). This data will be used to confirm whether groundwater control measures or dewatering will be required. Where it is likely that groundwater will be intersected, estimates of groundwater inflows will be predicted to assess if a groundwater extraction license would be required (that is if 3 ML/year of groundwater discharge was to be exceeded). Outcomes from the GMS will inform the Construction Environmental Management Plan (CEMP). The CEMP, where necessary: • measures to stabilise the excavation, such as installation of temporary shoring in trenches (e.g. sheet piling); • localised temporary dewatering measures to maintain dry working conditions;	Detailed design

No.	Impact/Issue	Environmental management and mitigation measures	Timing
		• measures to maintain groundwater flow conditions to minimise disruption to down-gradient receptors; and • measures to minimise groundwater drawdown to reduce any ground settlement impacts.	
GW2	Aquifer interference	Detailed hydrogeological information (e.g. bore data) will be used to inform the most suitable underboring construction method at select special crossings that will minimise the need for dewatering. Where an aquifer is to be completely penetrated at the underboring special crossings, appropriate controls (such as drainage blankets) will be installed beneath the infrastructure to ensure groundwater flow is maintained to minimise disruption to groundwater flow paths.	Detailed design
GW3	Intersection of contaminated groundwater	If existing contaminated groundwater is identified, measures will be implemented to ensure that the backfill within the excavation does not create a more permeable pathway for migration of contamination.	Detailed design and construction
GW4	Dewatering	A Construction Soil and Water Management Plan (CSWMP) will be prepared as part of the CEMP to document the measures required to mitigate and manage potential impacts on groundwater during construction. The CSWMP will include the following measures: • water collected during dewatering of excavations would be discharged or disposed of in accordance with the *Protection of the Environment Operations Act 1997* and the ANZECC Water Quality Guidelines (2000) for 95% protection level for marine ecosystems; and • contaminated groundwater captured during construction will be disposed of at an appropriately licensed facility.	Construction

19.0 Waste management

This chapter provides an overview of typical waste streams likely to be generated by the project, the potential impacts from the handling, storage and transport of waste materials; and proposed waste management strategies, including consideration of reuse options.

19.1 Assessment methodology

The approach for assessing potential waste related impacts included:

- reviewing the regulatory framework for waste management;
- identifying potential waste generating activities;
- preliminary classification of waste likely to be generated by the project in accordance with relevant legislation; and
- identifying available waste management options.

The types of waste presented within this assessment are indicative, based on the concept design for the project and knowledge of similar previous projects. The types of waste have been identified for the purposes of determining potential impacts and waste management options for the project. While the actual waste amounts generated by the project would be refined and subject to detailed design, the management and mitigation measures proposed in this chapter would still be implemented.

19.1.1 Legislative and policy context

19.1.1.1 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is the primary mechanism for waste management and recycling in NSW.

Waste generated by the project would be classified, reused or disposed of in accordance with the POEO Act.

19.1.1.2 Protection of the Environment Operations (Waste) Regulation 2014

The Protection of the Environment Operations (Waste) Regulation 2014 (POEO Waste Regulation) sets out provisions that cover the way waste is managed, in relation to classification and transportation as well as reporting and record keeping requirements for waste management facilities.

It is an offence under the POEO Waste Regulation to transport waste generated in NSW (other than restricted solid waste) more than 150 kilometres from the place of generation for disposal, unless the waste is transported to one of the two lawful disposal facilities nearest to the place of generation.

The project would not transport waste to a facility further than 150 kilometres from the project area. Sufficient facilities are available within the Sydney metropolitan region for the disposal of waste with specific facilities being identified during detailed design and construction planning based on waste type, availability, timing and capacity.

19.1.1.3 Waste Avoidance and Resource Recovery Act 2001

The *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) aims to ensure that waste management options are considered against the following waste management hierarchy:

1. avoidance of unnecessary resource consumption;
2. resource recovery (including reuse, reprocessing, recycling and energy recovery); and
3. disposal.

The project has considered the waste management hierarchy throughout development of the concept design. While not specifically intended, by reducing the proposed trench cross-section through design refinements, the amount of spoil required during excavation has been reduced. Most of the construction materials (such as concrete and excess cables) would be recycled. Surplus spoil would be disposed of at a local licensed waste facility.

19.1.2 Waste classification

The POEO Waste Regulation and NSW Environment Protection Authority (NSW EPA) *Waste Classification Guidelines* (NSW EPA, 2014) determine the classifications for waste in NSW. Many waste types are pre-classified under the POEO Act and do not require testing. However, if a waste is not pre-classified, it may need to be tested to determine its classification.

19.1.2.1 Waste types

Activities during the construction of the project that would generate waste include earthworks, removal of existing road pavements, vegetation clearing, underboring, conduit installation, joint bay construction, cable pulling and jointing, vehicle and plant washdown, maintenance of equipment, and on-site offices. Key waste streams generated during these activities would typically include:

- concrete, asphalt or bitumen from the excavation of road base and road sub-base;
- excess spoil from excavations;
- waste slurry from horizontal directional drilling;
- potential asbestos containing materials from excavation of unknown fill (refer **Chapter 16 Soils and contamination** for further information on asbestos);
- green waste from the clearance of vegetation, roots, tree stumps and debris;
- excess conduit piping from conduit installation;
- cable off-cuts from cable pulling;
- domestic waste (i.e. food scraps, plastic or paper items, metal) from construction material packaging and on-site personnel at work sites and site offices;
- liquid wastes including oils, lubricants and fuel from equipment maintenance;
- potentially contaminated material from excavation in industrial/commercial areas; and
- wastewater runoff including water utilised in dust suppression activities and vehicle/plant washdown.

19.2 Assessment of potential construction impacts

Potential impacts associated with construction waste likely to be generated by the project include:

- inadequate collection and classification of waste, resulting in unnecessary waste disposal to landfill. This may reduce local or regional landfill capacity;
- contamination of soil, surface water and/or groundwater could occur due to spills, uncontrolled sedimentation or erosion;
- dust impacts could result from inappropriate storage (both in trucks and at stockpile sites);
- transport and disposal of liquid and solid wastes could lead to potential environmental pollution and indirect impacts on public health;
- incorrect storage, handling and disposal of putrescible waste from work sites or site offices, which could lead to an increase in vermin and nuisance effects on surrounding properties; and
- incorrect classification, handling and/or disposal of contaminated waste, including contaminated spoil and asbestos containing materials, could lead to potential environmental pollution and/or increased public health risks.

These potential waste management impacts would be managed through the implementation of the waste management measures identified in **Section 19.4**.

19.2.1 Spoil generation

Spoil consists of soil, rock or dirt excavated as part of the proposed works and removed from its original location. It is estimated that around 115,000 cubic metres of spoil would be generated during construction.

Opportunities to reuse spoil generated by the project (if it can be achieved safely) elsewhere within the project area would be investigated further during detailed design and construction planning.

TransGrid would explore opportunities to dispose of clean material on council controlled parklands within the project area, in consultation with the relevant councils

Table 19-1 details the spoil management approach proposed for the project, which is in accordance with the waste minimisation hierarchy.

Table 19-1 Spoil management approach

Priority	Reuse option	Approach
1	Avoidance	The detailed design would be optimised further to reduce spoil generation.
2	Resource recovery/reuse	Spoil generated during construction would be reused for the project (where suitable), for fill and embankments within a short haulage distance of the source location and/or stockpile location.
3	Disposal	Excess spoil would be disposed of in accordance with the Waste Management Plan to be prepared as part of the Construction Environmental Management Plan (CEMP) for the project.

Excavated spoil would be classified in accordance with the *Waste Classification Guidelines: Part 1 Classifying Waste* prior to leaving site. This would serve to ensure that it is appropriately categorised and potentially reused (if an opportunity can be identified) or disposed of at an appropriately licensed facility. Spoil from the excavation works would be transported from site on trucks, primarily along haulage routes classified as truck routes by Roads and Maritime Services. The final identification of haulage routes would be determined during detailed design and construction planning. Potential impacts associated with haulage routes have been described in **Chapter 8 Traffic and transport**.

Excavated spoil would also be temporarily stockpiled at the five construction laydown areas, as identified in **Chapter 4 Project description**. Stockpiles would be relatively minor in volume. However, stockpiling may occur over the duration of the construction period. Stockpiles would be appropriately managed in accordance with good industry practice. Management of the stockpile sites would be detailed in a Waste Management Plan, to be prepared for the project as part of the CEMP. Potential air quality impacts associated with the storage and management of stockpiles have been described in **Chapter 9 Air quality**.

19.2.1.1 Contaminated spoil

An assessment of known and potential contamination has been undertaken with the details described in **Chapter 16 Soils and contamination**. The assessment identified a number of areas with potential for contamination, including asbestos within unclassified fill and various other contaminants along the transmission cable route.

Hazardous or special waste arising from the construction of the project (such as contaminated spoil or asbestos present within fill) would be removed and disposed of in accordance with the relevant legislation and guidelines, including the WARR Act, Work Health and Safety Regulation 2011 and NSW EPA *Waste Classification Guidelines: Part 1 Classifying Waste* (NSW EPA, 2014a).

Any excavated material that could potentially be contaminated would be sampled and analysed by a NATA Registered laboratory and managed in accordance with the *Waste Classification Guidelines: Part 1 Classifying Waste* (NSW EPA, 2014), the Guidelines on the Duty to Report Contamination (NSW EPA, 2015) and the *Contaminated Land Management Act 1997*. The contaminated material would then be disposed of at an appropriately licensed facility.

19.2.2 Wastewater

Wastewater generated as a result of the project could include grey water, pumped water from trenches and pits, and washdown water used for vehicles and equipment. As the project would utilise potable water as its primary water source, opportunities to reuse wastewater for on-site uses (i.e. dust suppression) would be investigated further during detailed design and construction planning. Where the generation of wastewater exceeds the potential for reuse, it would either be tested to confirm quality and discharged into the local stormwater system in accordance with the provisions of the POEO Act or pumped into a truck and disposed of at an off-site licensed facility. It is anticipated that the amount of wastewater generated would have a negligible impact on the existing stormwater system.

19.2.3 Drilling waste slurry

Should horizontal directional drilling (HDD) be adopted as an underbore construction method at the identified special crossing locations, the project would have to manage the waste slurry produced through the mixing of spoil and drill fluids. A number of options for storage and disposal of the waste slurry are common industry practice and would depend on the volume of waste to be generated. A common method is to have a vacuum truck located on-site at all times during drilling to collect the waste slurry and then transport and dispose of the slurry at an appropriately licensed facility.

Opportunities to reuse drilling waste slurry, through the use of a recycling unit to separate the solids from the liquid, would be investigated further during detailed design and construction planning. Following separation of solids from the liquid, solids would be managed as outlined in **Section 19.2.1** and liquids would be managed as outlined in **Section 19.2.2**.

19.2.4 Waste classification and estimated quantities

Waste classification for the project falls within four categories:

- general solid (non-putrescible) waste;
- general solid (putrescible) waste;
- liquid waste; and
- special waste, restricted or hazardous waste depending on the contaminant.

Table 19-2 provides waste types for these four different waste classifications. As construction staging and scheduling can influence the amount of waste generated, quantities of waste would be refined and estimated during detailed design and construction planning.

Table 19-2 Waste classification and types

Waste classification	Waste type
General solid (non-putrescible) waste	Spoil, metal, timber, paper and cardboard, glass, plastic, sediment and litter collected from stormwater treatment plants, asphalt, cured concrete
General solid (putrescible) waste	Food waste, other organic matter
Liquid waste	Sewage effluent, construction wastewater, drilling waste slurry
Hazardous and/or special waste	Contaminated spoil and drilling waste slurry (solids), asbestos containing fill

19.2.4.1 Recyclables

As noted above, a number of construction activities would result in the generation of recyclable waste (refer to **Table 19-2**). Recycling bins would be established at construction laydown areas and substations as needed to allow for recyclables to be segregated and sent to an appropriate waste facility.

19.3 Assessment of potential operational impacts

Once operational, the transmission cable circuit is not expected to generate waste except for ongoing maintenance and repair which would generate relatively small waste streams including:

- concrete for repair works to joint bays, link/sensor boxes or other concrete structures; and
- small sections of cable or conduit off-cuts if required for repairs.

Operational waste generated at the substations would be managed in accordance with existing waste management procedures. The project would not lead to any significant increase in waste volumes generated at the substations.

Overall, waste volumes generated during operation would be considerably lower than those generated during construction and could safely and appropriately be managed through standard waste management strategies, as detailed in **Section 19.4**.

19.4 Environmental management and mitigation measures

19.4.1 Management objectives

The waste management objectives for the project are too:

- manage wastes in accordance with relevant legislation and policy requirements; and
- design, construct and operate the project so that waste is managed in accordance with the waste hierarchy.

19.4.2 Environmental management and mitigation measures

Project-specific waste management and mitigation measures are detailed in **Table 19-3**.

Table 19-3 Environmental management and mitigation measures

No.	Impact/issue	Environmental management and mitigation measures	Timing
WM1	Waste minimisation	The following waste minimisation strategies will be implemented: • use of recycled materials (i.e. recycled content for asphalt and concrete including the use of fly ash) wherever feasible; • use of wastewater or recycled water to reduce potable water demand for construction activities; and • use of modular, precast/prefabricated structures, where feasible.	Detailed design and construction
WM2	General	Waste will be managed in accordance with the waste hierarchy established in the WARR Act. This will include the: • classification of waste during construction in accordance with the current guidelines; • segregation of waste at construction laydown areas and substations (within appropriate bins) for ease of recycling/reuse; • procurement of materials on an as needed basis to avoid waste due to over-ordering; and • investigating opportunities to reuse materials where feasible.	Construction and operation
WM3	Construction waste	Waste will be managed (classified, handled and stored) in accordance with relevant state legislation and government policies (including the NSW EPA *Waste Classification Guidelines*). All waste to be disposed off-site will be directed to a waste management facility that is lawfully permitted to accept that type of waste. Records of waste tracking and disposal will be	Construction and operation

No.	Impact/issue	Environmental management and mitigation measures	Timing
		maintained.	
WM4	Spoil management	The Waste Management Plan developed for the project as part of the CEMP will outline the requirements for spoil management. The plan will identify: • spoil generation activities; • spoil generation location; • spoil management hierarchy; • on-site management, including stockpile sites; • spoil reuse options; • spoil disposal locations; • spoil transport modes and routes; and • material tracking requirements.	Detailed design and construction
WM5	Asbestos waste	The disturbance, movement and disposal of asbestos containing materials will be carried out in accordance with the Work Health and Safety Regulation 2011 and other relevant guidelines. The handling and disposal of asbestos waste will be tracked in accordance with the Asbestos Management Plan (refer to CT6).	Construction
WM6	Construction wastewater	Wastewater not used on-site will be disposed off-site or discharged into the local stormwater system in accordance with the requirements of the POEO Act.	Construction
WM7	Spoil reuse	Reasonable and feasible options will be investigated to reuse spoil (where it can be achieved safely) in accordance with the POEO Act and WARR Act.	Detailed design and construction
WM8	Concrete recycling	Opportunities to recycle concrete (e.g. from excavation of concrete roads) will be investigated.	Detailed design and construction

20.0 Land use and property

This chapter presents an assessment of potential impacts to land use and property resulting from the construction and operation of the project.

20.1 Assessment methodology

20.1.1 Legislative and policy context

Relevant legislation and policy relating to land use and property are discussed in **Chapter 5 Strategic planning and approval process**.

20.1.2 Methodology

The assessment has involved:

- providing an overview of the existing environment with respect to land use and planning controls in the study area, based on a review of existing land use zoning provisions, objectives of the relevant local environment plans (LEPs) and aerial imagery;
- assessing the potential for impacts or changes to existing land uses and properties within and around the project area as a result of construction and operation of the project; and
- identifying appropriate management and mitigation measures to avoid or minimise impacts on land use and property.

20.1.3 Study area

For the purpose of the land use and property assessment, the study area comprises the project area and the immediately adjacent allotments. To provide broader context for the assessment the land use zones in the wider local government area were also considered. The study area is shown in **Figure 20-1** to **Figure 20-4**.

20.2 Existing environment

The following sections summarise the property details, land use and land use zoning within and adjacent to the project area for areas around the transmission cable route (per precinct), substations and construction laydown areas.

20.2.1 Transmission cable route

The transmission cable route is primarily located within road reserves within land zoned for residential (R1 General Residential, R2 Low Density Residential, R3 Medium Density Residential and R4 High Density Residential) under the relevant LEPs. However, some sections of the road reserve along the transmission cable route have other land use zones including:

- business park, infrastructure and industrial (Precinct 1);
- infrastructure and public recreation (Precinct 2);
- public recreation, infrastructure and local centre (Precinct 3);
- neighbourhood centre, industrial, mixed use and infrastructure (Precinct 4); and
- public recreation, business development, infrastructure, mixed use and industrial (Precinct 5).

Land zoning of locations along the transmission cable route are presented in **Table 20-1**.

There are also several locations where the transmission cable route extends outside the road reserve. This mainly occurs in land zoned as industrial, recreation or infrastructure. **Table 20-2** presents the land use zones where the transmission cable route extends outside the road reserve and/or is located within private allotments.

Land uses adjacent to the transmission cable route are largely comprised of residential areas; however, there are also sections of recreational and mixed use development.

The main land uses within the study area for the transmission cable route, in each precinct include:

- Precinct 1: industrial (IN1);
- Precinct 2: residential (R2, R3, R4);
- Precinct 3: residential and public recreation (R2, R3, RE1);
- Precinct 4: residential (R2); and
- Precinct 5: recreational, commercial, and industrial (RE1, B5, IN1).

The land use zoning within and adjacent to the transmission cable route in each precinct is shown on **Figure 20-1** to **Figure 20-4**.

20.2.2 Substations

Rookwood Road substation is in an area zoned as business park (B7) and adjacent land uses predominately consist of industrial infrastructure (SP2) and public recreation (Potts Park) (RE1). Beaconsfield West substation is zoned as industrial and adjacent land uses primarily consist of industrial land (IN1). Sydney South substation is zoned as infrastructure (SP2) and is surrounded by Georges River National Park (E1). The land use zones surrounding each substation are presented in **Table 20-3**.

20.2.3 Construction laydown areas

The proposed construction laydown areas have various existing land uses. Property details, land use and land use zoning for the construction laydown areas and land use zones of adjacent land is provided in **Table 20-4**.

Table 20-1 Land use zones along the transmission cable route

Precinct	Transmission cable route land use zone	Study area (adjacent) land use zones	Relevant LEP
1	• B7 – Business park • SP2 – Infrastructure • IN1 – General industrial	• IN2 – Light industrial • RE1 – Public recreation	• Bankstown LEP 2015
2	• R2 – Low density residential • SP2 – Infrastructure (road infrastructure facility, classified road and railway) • R4 – High density residential • R3 – Medium density residential • RE1 – Public recreation	• B1 – Neighbourhood centre • IN2 – Light industrial • R4 – High density residential • RE1 – Public recreation • SP2 – Infrastructure (classified road, railway and educational establishment)	• Bankstown LEP 2015 • Canterbury LEP 2012
3	• R3 – Medium density residential • RE1 – Public recreation • SP2 – Infrastructure (drainage, classified road) • R2 – Low density residential • B2 – Local centre	• B1 – Neighbourhood centre • B4 – Mixed use • B6 – Enterprise corridor • R1 – General residential • R2 – Low density residential • R3 – Medium density residential • R4 – High density residential • RE1 – Public recreation • RE2 – Private recreation • SP2 – Infrastructure (educational establishment, classified road, rail infrastructure facilities)	• Ashfield LEP 2013 • Canterbury LEP 2012 • Marrickville LEP 2011
4	• R2 – Low density residential • B1 – Neighbourhood centre • IN2 – Light industrial • B4 – Mixed use • RE1 – Public recreation • SP2 – Infrastructure (rail infrastructure facilities, railways)	• B1 – Neighbourhood centre • B4 – Mixed use • B5 – Business development • B7 – Business park • R1 – General Residential • R2 – Low density residential • R3 – Medium density residential • R4 – High density residential • RE1 – Public recreation • RE2 – Private recreation • SP2 – Infrastructure (Educational establishment)	• Marrickville LEP 2011

Precinct	Transmission cable route land use zone	Study area (adjacent) land use zones	Relevant LEP
5	• RE1 – Public recreation • SP2 – Infrastructure (classified road) • R1 – General residential • B4 – Mixed use • B5 – Business development • IN2 – Light industrial	• B4 – Mixed use • B5 – Business development • R1 – General residential • R2 – Low density residential • RE1 – Public recreation • SP2 – Infrastructure (classified road)	• Marrickville LEP 2011 • Sydney LEP 2012

Table 20-2 Property details and land use zones for sections of the transmission cable route extending outside the road reserve and/or located in private allotments

Precinct	Location	Property details	Existing land use[1]	Transmission cable route land use zone	Study area (adjacent) land use zone
1	Transmission cable route through William Holmes Street	• Part Lot 102 DP 1149790	• Road for Potts Hill Business Park	• B7 – Business Park (Bankstown LEP 2015)	• IN1, IN2 – Infrastructure (Bankstown LEP 2015) • RE1 – Public Recreation (Bankstown LEP 2015)
1	Cable bridge over a rail line on Muir Road, Chullora	• Part Lot 101 DP 1067379 • Part Lot 102 DP 1067379 • Part Lot 2 DP 1227526	• Railway line • Vacant, vegetated industrial land	• IN1 – General industrial (Bankstown LEP 2015) • IN1 – General industrial (Bankstown LEP 2015)	• SP2 – Infrastructure (Bankstown LEP 2015) • B7 Business Park (Bankstown LEP 2015) • IN1, IN2 – Infrastructure (Bankstown LEP 2015)
2	Underbore under freight rail line at Enfield Intermodal, Belfield	• Part Lot 16 DP 1220197	• Railway line • Vacant, vegetated land	• SP2 – Infrastructure: Railways (Canterbury LEP 2012)	• SP2 – Infrastructure: Railways (Canterbury LEP 2012) • R3 – Medium Density Residential (Canterbury LEP 2012)

Precinct	Location	Property details	Existing land use[1]	Transmission cable route land use zone	Study area (adjacent) land use zone
3	Option 1: Proposed cable bridge over Cooks River and cycle way on Lindsay Street, Campsie	• Part Lot 1 DP 1161873 • Part Lot 2 DP 1159674 • Part Lot 7005 DP 93371 • Part Lot 15 DP 109776 • Part Lot 1 DP 1162030 • Part Lot 7049 DP 93378	• Cooks River • Vacant public recreation land • Passive / active recreation (part of Lees Park)	• SP2 – Infrastructure: Drainage (Canterbury LEP 2012) • RE1 – Public Recreation (Canterbury LEP 2012)	• R3 – Medium Density Residential (Canterbury LEP 2012) • RE1 – Public recreation (Canterbury LEP 2012) • SP2 – Infrastructure: Drainage (Canterbury LEP 2012)
3	Option 2: Proposed underbore under Cooks River within Mildura Reserve/Croydon Park	• Part Lot 7315 and 7316 DP 1166291 • Part Lot 1 DP 126704 • Unidentified Parcel (Cooks River) • Part Lot 7063 DP 93375	• Cooks River • Active recreation (part of Croydon Park) • Passive recreation (part of Mildura Reserve)	• SP2 – Infrastructure: Drainage (Canterbury LEP 2012) • RE1 – Public recreation (Canterbury LEP 2012)	• R3 – Medium density residential (Canterbury LEP 2012) • RE1 – Public recreation (Canterbury LEP 2012) • SP2 – Infrastructure: Drainage (Canterbury LEP 2012)
3	Option 1: Proposed underbore under light rail line at Terry Road, Dulwich Hill	• Part Lot 18 DP 1223949	• Railway line, vegetated on both sides	• SP2 – Infrastructure: Rail infrastructure (Marrickville LEP 2011)	• SP2 – Infrastructure: Rail infrastructure (Marrickville LEP 2011) • R1 – General Residential (Marrickville LEP 2011) • R2 – Low Density Residential (Marrickville LEP 2011) • R4 – High Density Residential (Marrickville LEP 2011)

Precinct	Location	Property details	Existing land use[1]	Transmission cable route land use zone	Study area (adjacent) land use zone
3	Option 2: Proposed underbore under light rail line at Arlington Light Rail Station	• Part Lot 18 DP 1223949	• Railway line and station (with landscaped and hardstand areas)	• SP2 – Infrastructure: Rail infrastructure (Marrickville LEP 2011) • R2 – Low Density Residential (Marrickville LEP 2011) • RE1 – Public recreation (Marrickville LEP 2011)	• R1 – General residential (Marrickville LEP 2011) • R2 – Low Density Residential (Marrickville LEP 2011) • RE2 – Public recreation (Marrickville LEP 2011) • B4 – Mixed use (Marrickville LEP 2011) • SP2 – Infrastructure: Rail infrastructure (Marrickville LEP 2011)
3	Option 5a: Transmission cable route through Henson Park and underbore at Amy Street playground, Marrickville	• Part Lot 423 DP 1035319	• Active recreation (Henson Park, sports field with hardstand areas)	• RE1 – Public Recreation (Marrickville LEP 2013)	• RE1 – Public Recreation (Marrickville LEP 2013) • R2 – Low density residential (Marrickville LEP 2011)
4	Transmission cable route through Camdenville Park, St Peters	• Part Lot 9 DP 879483 • Part Lot 1 DP 1056652	• Passive recreation (Camdenville Park) • Bridge	• RE1 – Public recreation (Marrickville LEP 2013) • SP2 – Infrastructure (Sydney LEP 2012)	• R1 – General residential (Marrickville LEP 2011) • R2 – Low density residential (Marrickville LEP 2011) • B5 – Business development (Marrickville LEP 2011) • IN1 – General industrial (Marrickville LEP 2011) • SP2 – Infrastructure: Railways (Sydney LEP 2012)

Precinct	Location	Property details	Existing land use[1]	Transmission cable route land use zone	Study area (adjacent) land use zone
5	Transmission cable route through Sydney Park car park, Princes Highway, Alexandria	• Part Lot 100 DP 747948 • Part Lot 1 DP 719002 • Part Lot 2 DP 719002 • Part Lot C DP 162399 • Part Lot 101 DP 747948	• Car park • Road corridor	• RE1 – Public recreation (Sydney LEP 2012) • SP2 – Infrastructure (Sydney LEP 2012)	• RE1 – Public recreation (Sydney LEP 2012) • SP2 – Infrastructure (Sydney LEP 2012) • B4 – Mixed use (Marrickville LEP 2011)
5	Transmission cable route through Sydney Park, Alexandria	• Part Lot 2 DP 627734 • Part Lot 6 DP 810522 • Part Lot 1 DP 995509 • Part Lot Y DP 418181 • Part Lot 1 DP 996048 • Part Lot D DP 357837	• Passive recreation	• RE1 – Public recreation (Sydney LEP 2012)	• RE1 – Public recreation (Sydney LEP 2012) • B4 – Mixed use (Sydney LEP 2012) • IN1 – General industrial (Sydney LEP 2012)
5	Transmission cable route through 54 Barwon Park Road	• Part Lot 101 DP543143	• City of Sydney - Sydney Park Nursery Depot	• RE1 – Public recreation (Sydney LEP 2012)	• RE1 – Public recreation (Sydney LEP 2012) • R1 – General residential (Sydney LEP 2012)
5	Transmission cable route through private property at: 182-190, 192-200 and 202-212 Euston Road, Alexandria and 53-57 Burrows Road, Alexandria	• Part Lot C DP162050 • Part SP45592 • Part SP45593	• Industrial properties	• IN1 – General industrial (Sydney LEP 2012)	• IN1 – General industrial (Sydney LEP 2012) • RE1 – Public recreation (Sydney LEP 2012)

Note:

1 Land uses based on aerial imagery sourced from Six Maps (http://maps.six.nsw.gov.au/), viewed 14 March, 31 May 23 November, 27 December 2018 and 13 May 2019.

Table 20-3 Land use zones surrounding the substations

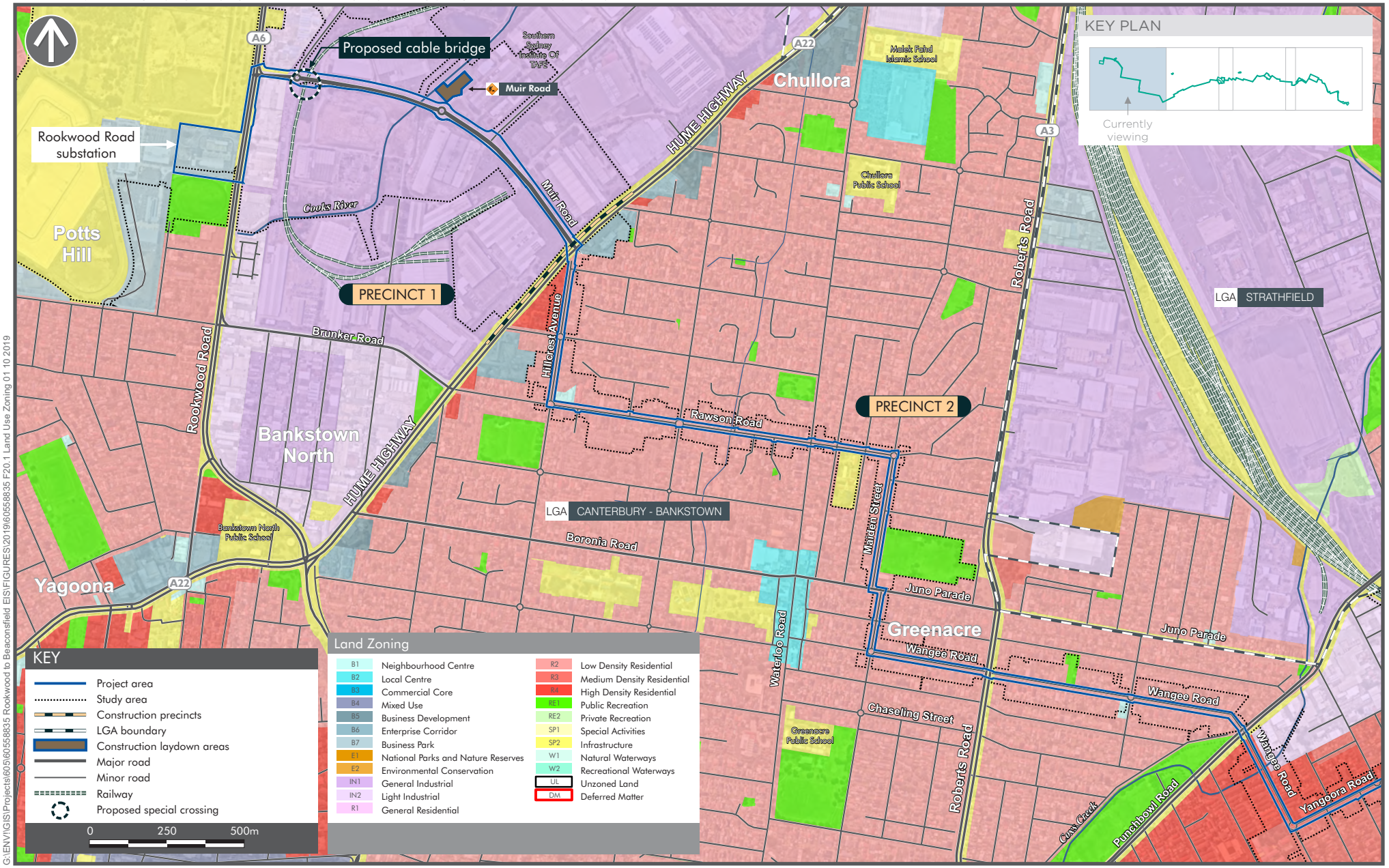
Substation	Property details	Land use zone	Adjacent land use zones	Relevant LEP
Rookwood Road substation	• 10 William Holmes Street, Potts Hill • Lot 101 DP1149790	• B7 – Business park	• B7 – Business park • RE1 – Public recreation • SP2 – Infrastructure (road infrastructure facility and water supply system)	• Bankstown LEP 2015
Beaconsfield West substation	• 48 Burrows Road, Alexandria • Lot 102 DP791667	• IN1 – General industrial	• IN1 – General industrial	• Sydney LEP 2012
Sydney South substation	• 925A Henry Lawson Drive, Picnic Point • Lot 1 DP440591	• SP2 – Infrastructure (Electricity transmission or distribution network)	• E1 – National Park and Nature Reserves • SP2 – Infrastructure (road infrastructure facility)	• Bankstown LEP 2015

Table 20-4 Construction laydown areas and adjacent land use zones

Laydown area	Property details	Existing land use[1]	Land use zone	Adjacent land use zones	Relevant LEP
12 Muir Road, Chullora	• Lot 27 DP1007364	• TAFE Chullora campus, grassed area	• IN1 – General industrial	• IN1 – General industrial	• Bankstown LEP 2015
Cooke Park, Belfield	• Chisholm Street, Belfield • Lot A DP357501 and Lots 9, 10, 11, 12, 13, 27 DP18185	• Sporting field (portion of Cooke Park)	• RE1 – Public recreation	• R2 – Low density residential	• Strathfield LEP 2012
Peace Park, Ashbury	• 30 Trevenar Street, Ashbury • Lot 1 and 3 DP566982	• Vacant land	• R2 – Low density residential	• R2 – Low density residential • RE1 – Public recreation	• Canterbury LEP 2012

Laydown area	Property details	Existing land use[1]	Land use zone	Adjacent land use zones	Relevant LEP
Camdenville Park, St Peters	• 63 May Street, St Peters, also King Street St Peters • Lot 9 DP879483 and Lot 1 DP1056652	• Vacant land (portion of Camdenville Park)	• RE1 – Public recreation • SP2 – Infrastructure (rail infrastructure facilities)	• IN1 – General industrial • R1 – General residential • R2 – Low density residential	• Marrickville LEP 2011
Beaconsfield West substation, Alexandria	• Burrows Road, Alexandria • Lot 102 DP791667	• Substation	• IN1 – General industrial	• IN1 – General industrial	• Sydney LEP 2012

Note:
1 Land use based on aerial imagery sourced from Six Maps (http://maps.six.nsw.gov.au/), viewed 10 May 2019.



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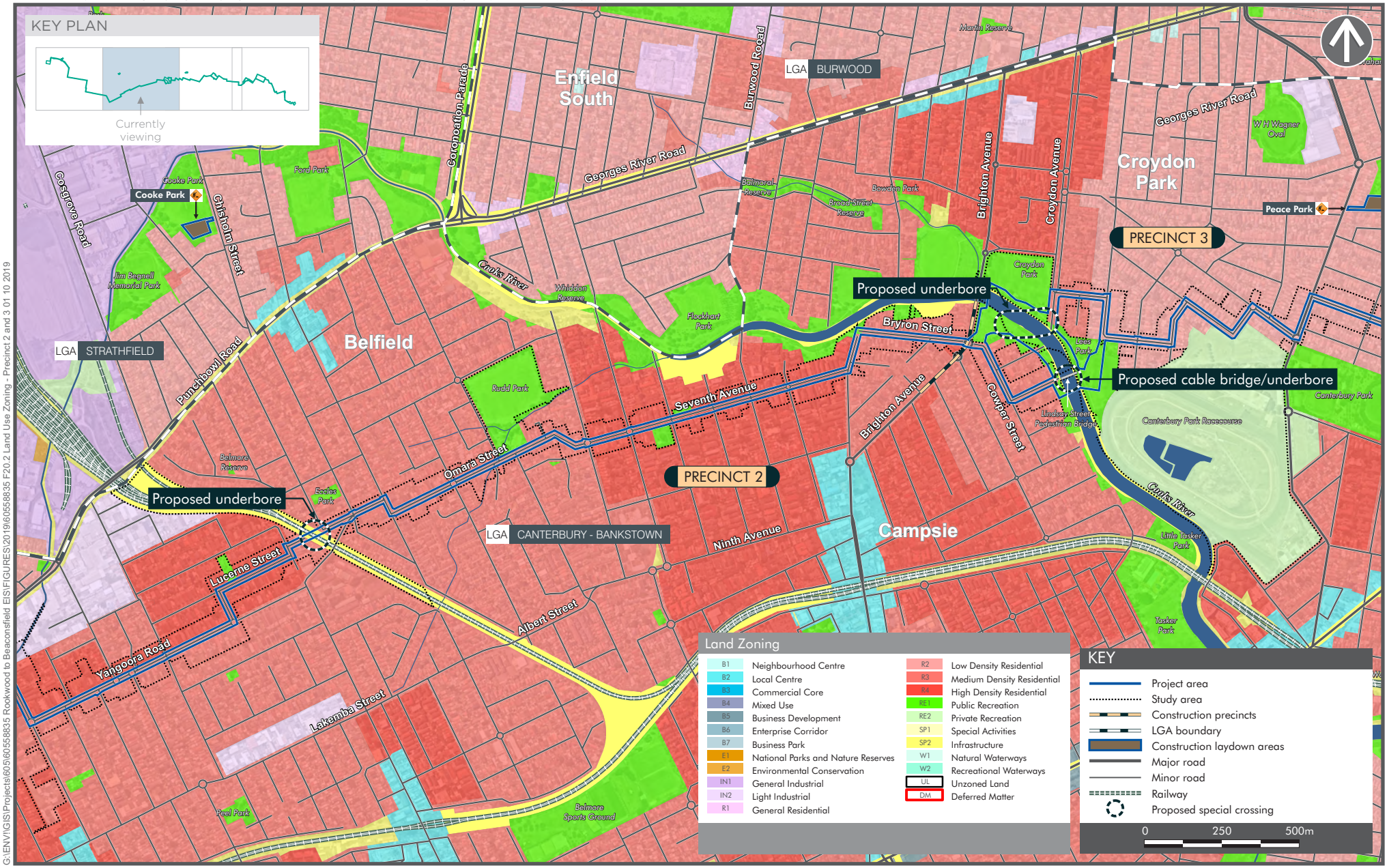
LAND USE ZONING - PRECINCT 1 AND 2

Powering Sydney's Future
Potts Hill to Alexandria Transmission Cable Project

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

FIGURE 20-1



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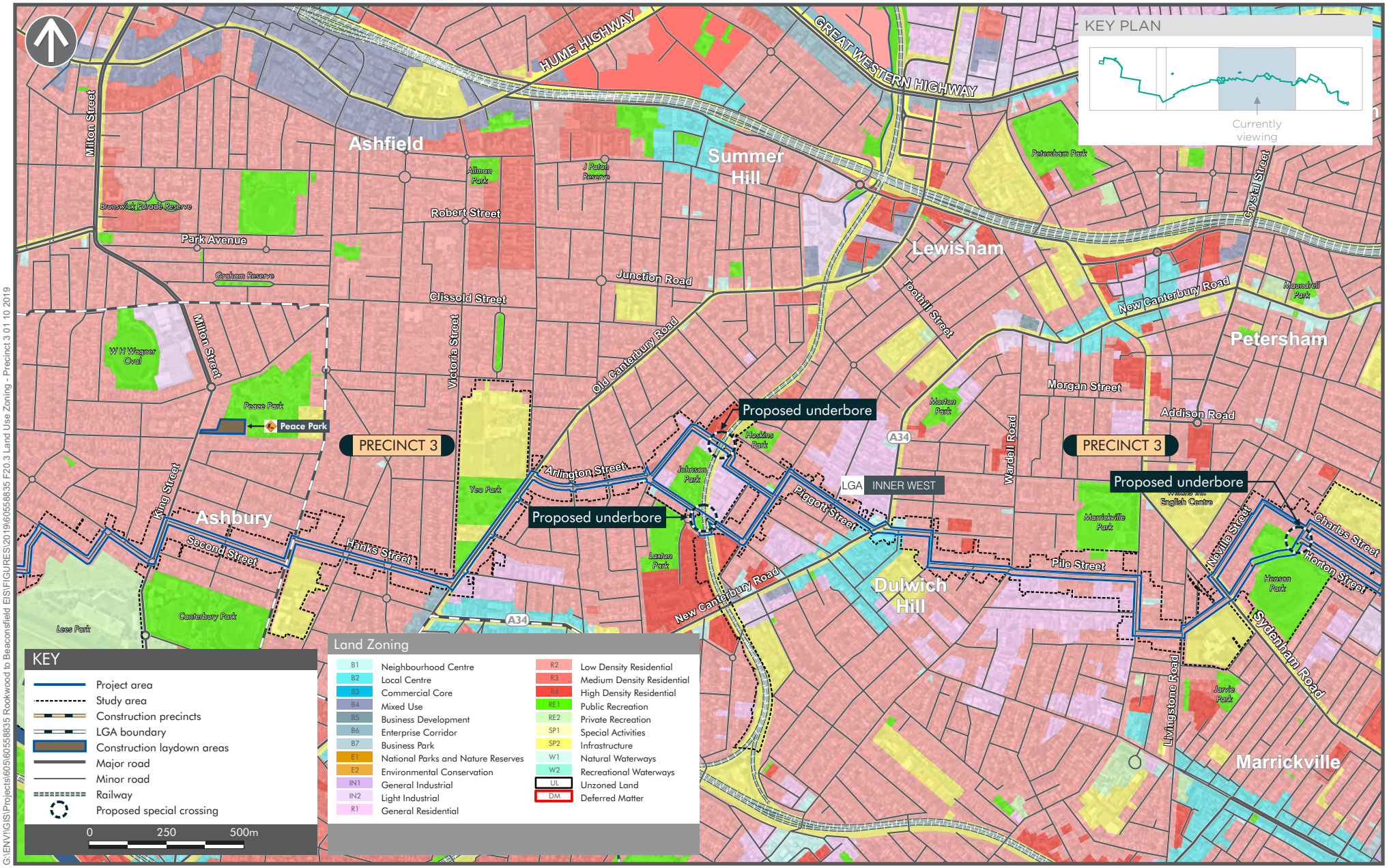
LAND USE ZONING - PRECINCT 2 AND 3

Powering Sydney's Future
Potts Hill to Alexandria Transmission Cable Project

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

FIGURE 20-2



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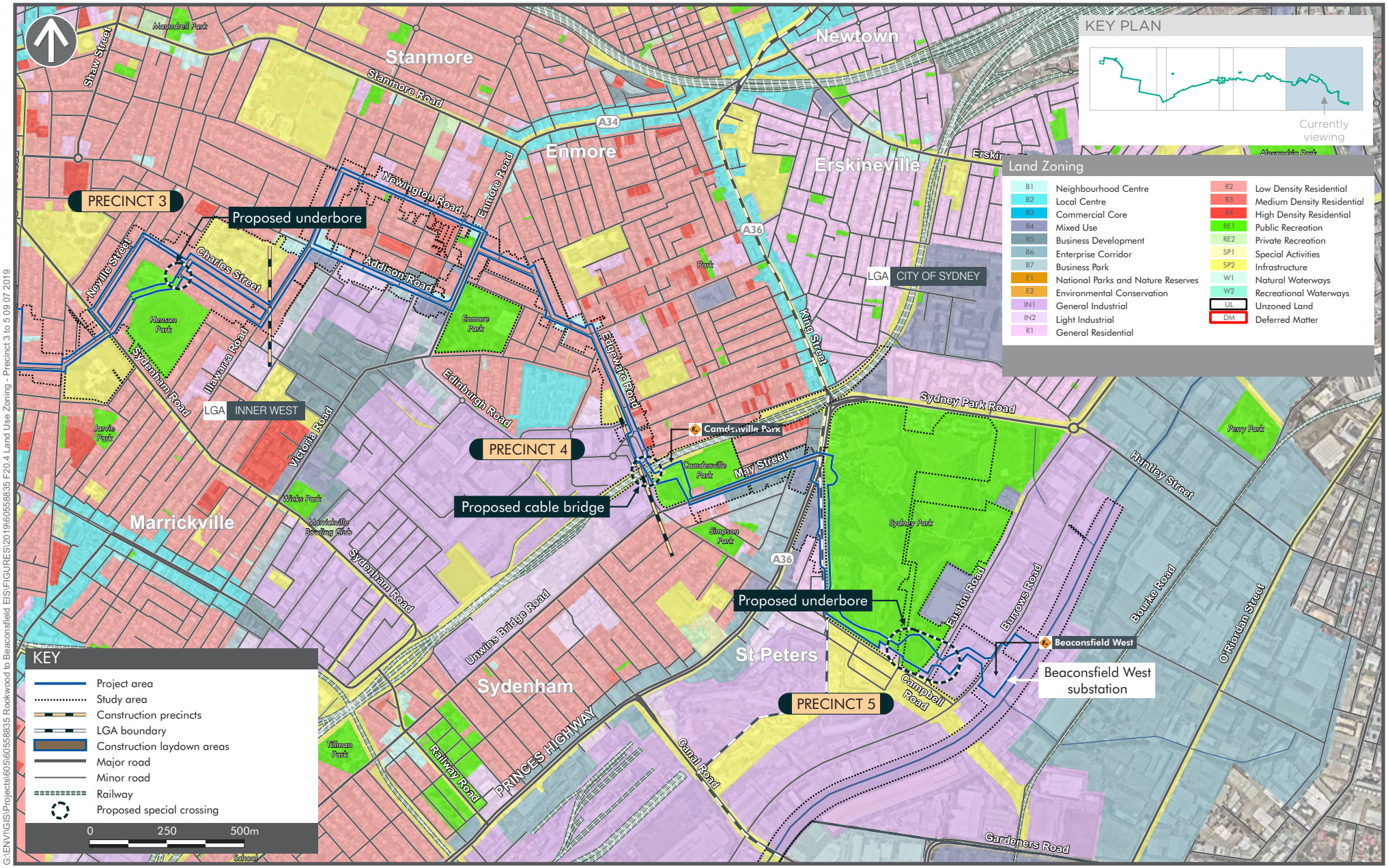
LAND USE ZONING - PRECINCT 3

Powering Sydney's Future
Potts Hill to Alexandria Transmission Cable Project

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

FIGURE 20-3



G:\ENV\GIS\Projects\605\60558835 Rookwood to Beaconsfield EIS\FIGURES\2019\60558835 F20.4 Land Use Zoning - Precinct 3 to 5 09 07 2019

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LAND USE ZONING - PRECINCT 3 TO 5

Powering Sydney's Future
Potts Hill to Alexandria Transmission Cable Project

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

FIGURE 20-4

20.2.4 Underground utilities

The existing major utilities located in the project area that have the potential to be impacted by the project include:

- communications (Telstra, Optus, NBN);
- gas (Jemena);
- power (Ausgrid, Sydney Trains, TransGrid);
- sewer (Sydney Water);
- stormwater (relevant local councils);
- fuel pipelines (Viva Energy Australia);
- water supply (Sydney Water); and
- traffic control cables and traffic lights (Roads and Maritime Services).

The depths of utilities within the project area would typically be about 0.5 to 2 metres below the ground surface. Above ground telecommunication and power services are also present and would be considered.

20.3 Assessment of potential impacts

As a result of previous investigations into potential route options and consideration of environmental and community constraints in the development of the concept design, the project has:

- avoided the need for total land acquisition through the use of trenching in road reserves where possible;
- avoided the temporary use of land where sterilisation or isolation would result post-construction;
- minimised impacts to privately owned land which could adversely affect the existing users of that property and future development; and
- avoided the need for freehold land acquisitions.

While the transmission cable route is located primarily within road reserves, in some instances it is required to extend into private property and open space such as recreational areas and parks.

While the project has minimised the impacts to property and land use where possible, some impacts would occur as a result of both construction and operation of the project. These are described in more detail below.

20.3.1 Construction

The construction works may result in temporary impacts on existing property and land uses due to:

- property access disruptions during certain construction activities such as excavation and cable jointing;
- temporary lane and road closures to allow for trenching and laying of conduits;
- temporary occupation of private and public land for construction works such as conduit installation and construction of special crossings (i.e. cable bridges or underboring); and
- temporary occupation of private and public land for the purpose of construction laydown areas.

Impacts to adjacent properties and land uses from works within the road reserve would be of relatively short duration as the works would progressively move along the transmission cable route.

20.3.1.1 Property access

During construction, vehicle access to properties will be retained and obstruction of driveways will be avoided where possible, however it is likely that there will be driveways impacted during different stages of construction, which may result in minor disruptions to access. For example, during cable

jointing near driveways, access to these properties would not be possible. Affected owners/occupants would be informed and feasible and reasonable solutions for access to their specific location discussed. This is explained further in **Chapter 7 Traffic and transport**.

20.3.1.2 Traffic disruptions

Construction works would be managed to ensure impacts to vehicular, public and active transport networks are minimised where feasible. This is discussed further in **Chapter 7 Traffic and transport**. Considering the works within the road reserve would be temporary and provided the traffic mitigation measures outlined in the Construction Traffic Management Plan for the project are implemented, impacts on property and land use along the transmission cable route are expected to be temporary and minor.

20.3.1.3 Land use changes

There are a number of locations where the transmission cable route extends outside the road reserve, as presented in **Table 20-2**. These areas are predominantly comprised of industrial or public recreation areas. The existing use of these areas may be impacted, particularly those used for public recreation such as parks and open spaces. While the construction works would not be consistent with the existing land uses of these areas, the works would be temporary in nature and land would be reinstated to its prior condition following construction.

Works at the substations would be confined to the existing substation boundaries and would therefore not require any property acquisition or land use changes.

The construction laydown areas would be located on both private and public land as presented in **Table 20-4**. The land required for the majority of these construction laydown areas makes up only a portion of a larger allotment. Properties selected for these construction laydown areas are currently vacant or are being used for public recreation or industrial purposes.

Depending on landowner requirements at construction laydown areas (irrespective of whether it is publicly or privately owned), it is anticipated that an agreement for the temporary use of the land would be required. This could be in the form of a lease/licence or Deed of Agreement. The relevant landowners will be consulted with throughout the project planning process. The use of recreational properties as construction laydown areas would be required for the duration of the construction period. However, the impacts on these areas would be temporary (up to 24 months) and the land would be returned to its original condition following construction. Additionally, construction laydown areas would not occupy the entire recreation area, allowing users access to some of the recreational space. Alternative parks and reserves are also located within close proximity to the locations selected for construction laydown areas. In the case of recreational properties, as there are alternative recreational spaces nearby and the works are temporary, impacts on land use from construction laydown areas are considered minor.

20.3.1.4 Public access and amenity

There would be no direct impact to property and land uses surrounding the project area during construction works, as the use of these areas would remain unchanged. However, the construction works would likely result in indirect (however temporary) impacts on access to adjacent land uses and amenity (e.g. users of Sydney Park), resulting from impacts on traffic and access, noise and vibration, reduced air quality (dust), and visual amenity impacts. These impacts would be temporary and would be managed through the implementation of measures outlined in this EIS and in the Construction Environmental Management Plan (CEMP).

20.3.1.5 Utilities

Potential impacts to utilities during construction include planned disruption and restoration, relocation of utilities and the potential for utilities to be damaged during excavation works. These events could result in service interruption to residences and businesses and associated economic impacts and, in the event a utility is damaged, risks to public and worker safety. No major utility relocations are anticipated. Where relocations are required, these would be within the project area, mainly within the road reserve. **Chapter 11 Hazards and risks** further discusses impacts on utilities.

20.3.2 Operation

20.3.2.1 Restrictions on future development

Land along the transmission cable route would be reinstated to its prior condition following construction allowing the majority of existing land uses to continue during operation. However, there would be restrictions on future development and activities along and in proximity to the transmission cable route. TransGrid's primary responsibility is to protect the transmission cable circuit from damage, and to protect the public from electrical risks.

The full length of the transmission cable route would be registered within Dial Before You Dig. Searches of the Dial Before You Dig database that trigger the transmission cable circuit location, would be automatically notified to TransGrid. Any activities that have the potential to interfere or disturb the ongoing safe operation and maintenance of assets would require consultation with TransGrid.

Clauses 44 and 45 of the State Environmental Planning Policy (Infrastructure) also require that a planning consent authority notifies TransGrid of any development application within specified distances of the underground cables. TransGrid would advise whether the project meets TransGrid electrical safety standards.

Further, where the transmission cable circuit is proposed to be located over two private properties, as presented in **Table 20-2**, TransGrid intends to acquire a partial land interest or easement. The easement would be registered in-perpetuity on the title of the property, and would set-out the negotiated rights, obligations, and restrictions for both TransGrid and the property owner within the defined easement area. Where future use and development is restricted, TransGrid would make a monetary payment to compensate for the loss in land value, in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*.

In accordance with TransGrid's electrical safety standards, certain activities are prohibited from occurring directly above or adjacent to the transmission cable route, including:

- boring or excavating within two metres of the cable (e.g. the installation of fencing);
- raising or lowering of existing ground surface levels;
- installation of structures such as houses, buildings or fixed plant;
- storage of flammable liquids or explosives; and
- planting or cultivation of trees or shrubs with extensive root systems.

Other activities that have the potential to result in electrical safety hazards if not managed appropriately, may be approved with conditions, with TransGrid's prior written consent and when the risks associated with the activity have been satisfactorily mitigated, including:

- concrete pavement and car parking;
- erection of structures spanning the transmission cable circuit;
- excavations in proximity to the transmission cable circuit (but greater than two metres distance);
- installation of metallic pipes, fences, underground or overhead cables and services, if safe distances are maintained; and
- road-boring within approved distances of a high voltage cable.

Each proposed development and activity would be assessed individually, taking into consideration specific electrical safety conditions at the proposed transmission cable circuit location, and the mitigation and management measures proposed to be implemented.

Once planning approval for any future development has been granted by the relevant development authority, all development works must comply with WorkCover NSW *Work Near Underground Assets Guide 2007* and TransGrid guidelines *Requirements for Working in the Vicinity of TransGrid Underground Cables*.

Therefore, while it is unlikely that the proposed transmission cable circuit would limit the type of development permitted in each land use zone, development on or adjacent to the transmission cable route would be restricted in accordance with TransGrid's safety standards.

In the event that an unsafe development or activity occurs along the route, TransGrid has powers under section 49 of the *Electricity Supply Act 1995* to serve notice for the obstruction to be removed.

The presence of the transmission cable circuit within the road reserve may restrict the planting of street trees due to the potential for tree roots to grow into the trench space and potentially interfere with the operation of the transmission cable. Planting of trees and use of space for car parking may also be restricted within open space and recreation areas such as Camdenville Park or Sydney Park. The tree species to be planted would need to have a root system that is unlikely to interfere with the transmission cable in future.

20.3.2.2 Impacts on land use

Cable bridges are proposed to be located primarily in land zoned as SP2 (Infrastructure) or RE1 (Public recreation). The proposed cable bridge at Muir Road in Precinct 1 encroaches onto private property, therefore an easement would be required over a part of this land. This impact on land use would be minor due to the relatively small footprint of the cable bridge.

At the substations, the project would be consistent with the existing land use. Works would be confined to the boundaries of the existing substations. As such, impacts on land use associated with the substation upgrades are not anticipated.

Re-zoning of any part of the project area is not proposed as the project is permissible and compatible with current zoning. The project would also not change the land use of the project area following completion. Therefore, as operation of the project would not re-zone or change the land use of the project area, no significant impacts to current land uses would result from the operation of the project.

20.4 Environmental management and mitigation measures

Environmental management and mitigation measures relating to land use and property are outlined in **Table 20-5**.

Table 20-5 Environmental management and mitigation measures

No.	Impact/issue	Environmental management and mitigation measures	Timing
LP1	Property use	Agreements will be negotiated with relevant landowners for the temporary use of property during construction and for permanent easements over private property during operation.	Detailed design and construction
LP2	Traffic and access disruptions	Affected landowners/occupants will be provided with advance notification of project construction schedules and changes to access arrangements or traffic disruptions.	Construction
LP3	Vehicle access	Vehicle access to residential and business properties will be maintained at all times, where possible. Where restricting access to properties is required to enable construction works, vehicle access will be restored as soon as possible. Where access to a property cannot be maintained, affected owners/occupants will be informed and feasible and reasonable solutions for access to their specific location discussed.	Construction
LP4	Temporary land use change	Construction laydown areas will be reinstated to their pre-existing condition as soon as practicable following the completion of construction, in consultation with the relevant landowner.	Construction and operation
LP5	Identification of utilities	Further surveys (including potholing) will be undertaken to confirm the locations of major utilities	Detailed design

No.	Impact/issue	Environmental management and mitigation measures	Timing
		identified in DBYD. Thermal resistivity assessments will be undertaken to determine the potential for reduced trench widths in order to minimise the need for utility relocation or support/protection measures.	
LP6	Disruption of services or relocation of utilities	Where services need to be disrupted or utilities relocated, relevant stakeholders will be consulted and affected communities notified.	Detailed design and construction
LP7	Utility damage	Where works are to be carried out in close proximity to utilities, consultation will be undertaken with the relevant utility provider to determine safety and network integrity requirements.	Construction

21.0 Social and economic

This chapter provides a summary of the potential socio-economic impacts of the project and the proposed management and mitigation measures to address impacts, as detailed in the Socio-economic Impact Assessment (SEIA) in **Appendix M**.

21.1 Assessment methodology

21.1.1 Study area

The study area for the SEIA was defined based on the need to consider local, community and regional impacts. The study area includes:

- the local study area - considers impacts within the direct vicinity (within 400 metres) of the project; and
- the regional study area – considers impacts that may occur on a broader regional or community scale. The regional study area comprises the four Local Government Areas (LGAs) and the 17 suburbs that the project would be located within.

The local study area and regional study area are shown in **Figure 21-1**.

21.1.1.1 Local study area

The local study area has been divided into five construction precincts (as discussed in **Chapter 4 Project description**) for the purposes of assessment, with construction precinct boundaries based on existing LGA boundaries, noise catchment areas and land use zoning, where applicable.

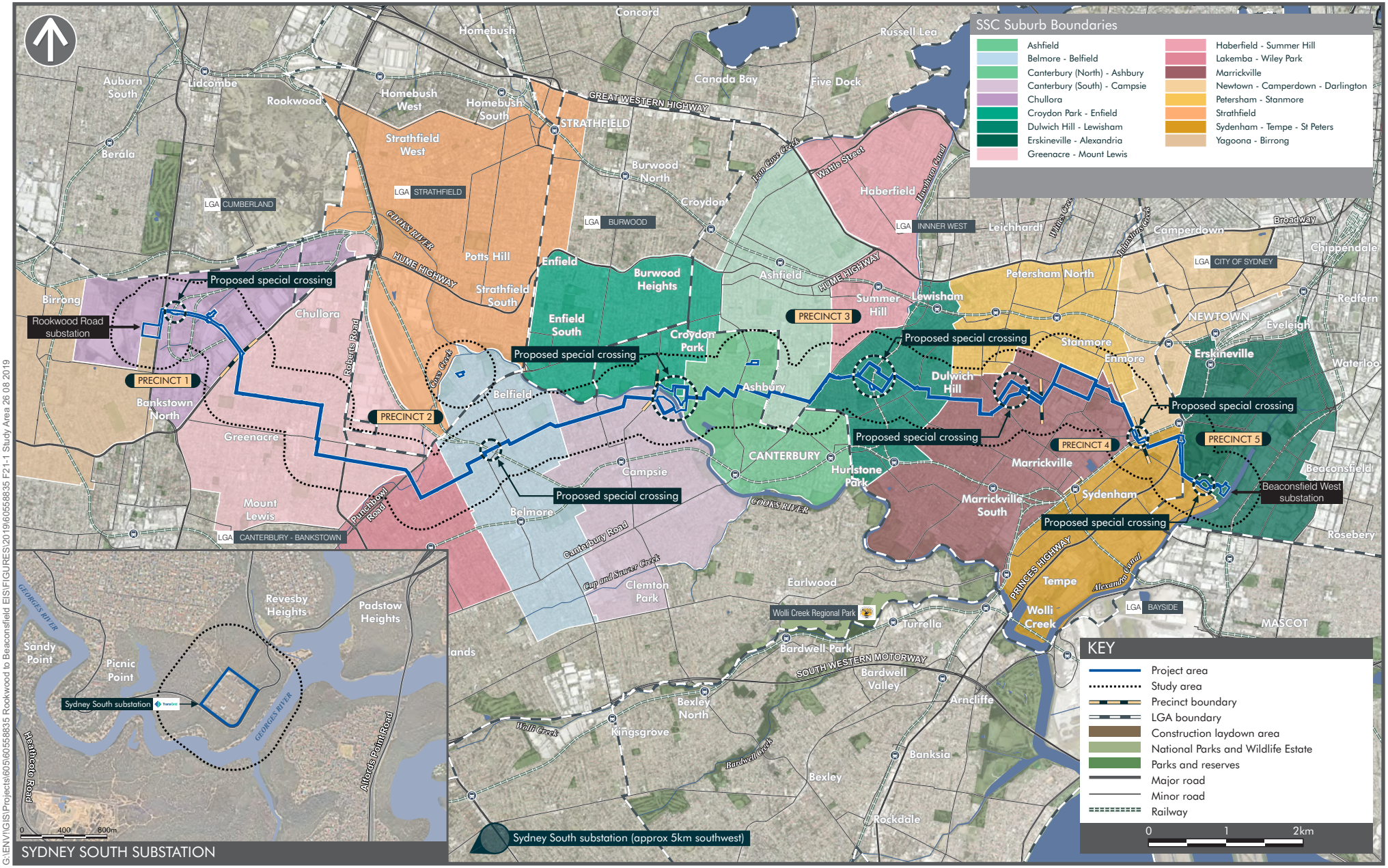
Site specific impacts were also assessed for the different construction methodologies being considered at the special crossing locations (underbore or cable bridge). The transmission cable route and special crossing options for the project are outlined in **Chapter 4 Project description**. A summary of the five construction precincts (including substation upgrade areas and construction laydown areas) that comprise the local study area and the corresponding land uses that characterise each construction precinct is provided in **Table 21-4**.

21.1.1.2 Regional study area

The regional study area is comprised of 17 suburbs that the project would be located within. These 17 suburbs are covered by four LGAs (Canterbury-Bankstown, Strathfield, Inner West, and City of Sydney). These suburbs are:

- Potts Hill;
- Yagoona;
- Chullora;
- Greenacre;
- Lakemba;
- Belmore;
- Belfield;
- Campsie;
- Croydon Park;
- Ashbury;
- Ashfield;
- Dulwich Hill;
- Marrickville;
- Newtown;
- St Peters;
- Alexandria; and
- Picnic Point.

Statistical data for the 17 suburbs the project would be located in has been used to identify local community characteristics and to identify key demographic trends, where applicable.



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STUDY AREA

Powering Sydneys Future
Potts Hill to Alexandria Transmission Cable Project

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

FIGURE 21-1

21.1.2 Statutory context, policies and social impact guidelines

The assessment of socio-economic impacts is essential to the assessment of environmental impacts under both Commonwealth and NSW State environmental planning legislation, whereby 'environment' is defined to include the socio-economic environment in the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the NSW *Environmental Planning and Assessment Act 1979 (*EP&A Act).

There are several contemporary guidelines for the assessment of socio-economic impacts. The following guidelines were considered during the preparation of the socio-economic assessment:

- *Techniques for Effective Social Impact Assessment: A Practical Guide* (Office of Social Policy, NSW Government Social Policy Directorate, 1995);
- *International Principles for Social Impact Assessment* (International Association for Impact Assessment, 2003) (discussed in **Appendix M**);
- *Social impact assessment guideline for State significant mining, petroleum production and extractive industry development* (Social Impact Assessment Guideline for resource projects) (DPE, 2017); and
- *Marrickville Development Control Plan – Generic Provisions Social Impact Assessment* (Marrickville Council, 2011).

21.1.3 Approach and methodology

The assessment of social impacts associated with the project has used the social indicator method (Office of Social Policy, NSW Government Social Policy Directorate, 1995). This method uses social indicators such as availability and access to community services and the health and wellbeing of the community to measure and monitor impacts and changes to the social environment.

In implementing the social indicator method, the following steps have been followed:

1. identify the study area in which the project may result in socio-economic impacts;
2. identify the social indicators against which socio-economic impacts will be assessed and monitored;
3. undertake a desktop review of social indicators and other relevant data in order to create a baseline profile of the community;
4. identify and describe project components or activities that are likely to result in potential impacts, both positive and negative;
5. review the results of the traffic, noise, air quality, and landscape and visual amenity studies to identify and assess potential social impacts;
6. identify and assess potential social impacts and the significance of these social impacts, based on the extent, duration, severity of impacts and the sensitivity of different receivers and how they are likely to respond (based on knowledge of the community profile, their values, fears and aspirations, previous projects, etc.); and
7. recommend management measures to address socio-economic impacts and any residual impacts.

21.1.3.1 Identification of social indicators

Social impacts identified for the project have been measured against changes to the following social indicators:

- current population and projected population growth and trends;
- health and wellbeing of the community;
- housing;
- education;
- income and employment;

- availability and access to social infrastructure such as education facilities, health and emergency services, places of worship and sporting and recreational facilities; and
- community identity, including the shared values and goals, as well as community cohesion.

The use of the social indicator method, and the development of a community profile, relies on the use of statistics. Statistics for the social indicators identified above have been obtained from the 2016 Census of Population and Housing (Australian Bureau of Statistics (ABS), 2016).

21.1.3.2 Assessment of significance

A conceptual diagram of the methodology used to assess the significance of social impacts is outlined in **Figure 21-2**.

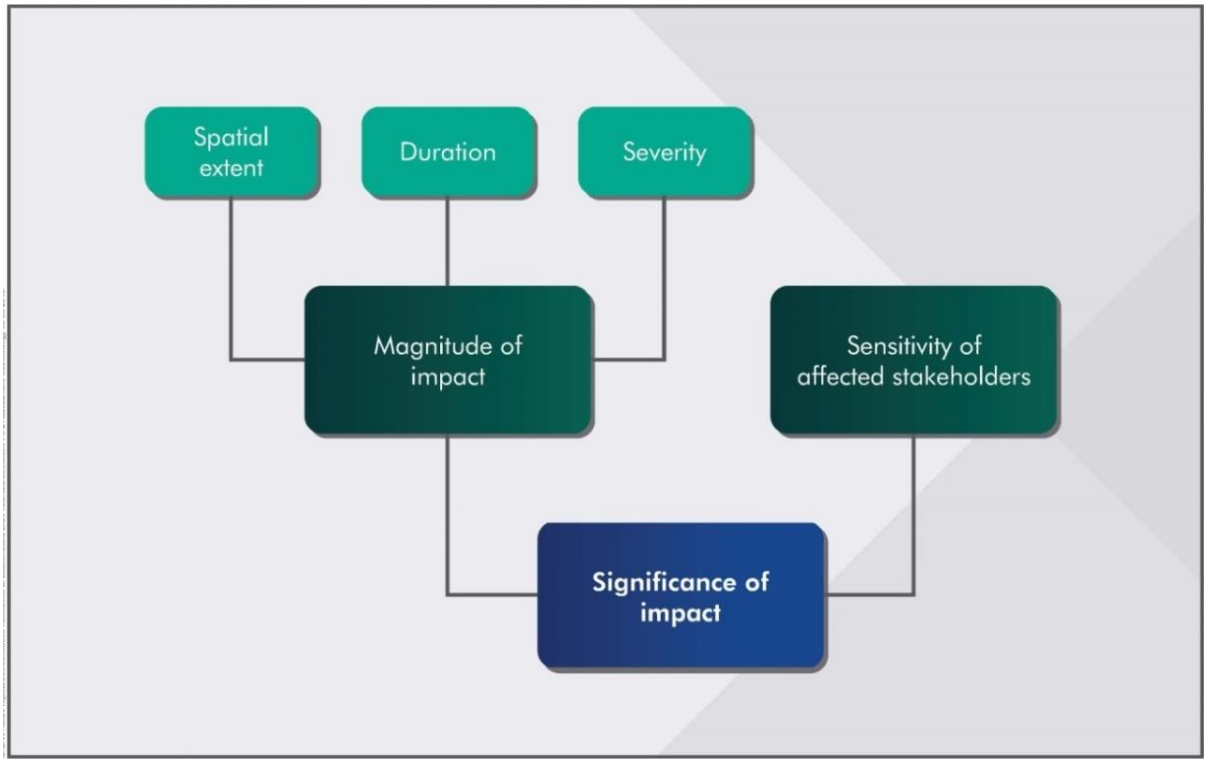

Figure 21-2 Assessment framework for determining significance of social impacts

The significance of each potential social impact was assessed considering the magnitude of the impact and the sensitivity of potentially affected receivers. The criteria to assess magnitude and sensitivity were established based on definitions provided in the Social Impact Assessment Guideline for resource projects (DPE, 2017), as follows:

- magnitude comprises of:
  - spatial extent: the geographic area affected by the impact, considering the number or proportion of people affected;
  - duration: the timeframe over which the impact occurs;
  - severity: the scale or degree of change from the existing condition as a result of the impact; and
- sensitivity: the susceptibility or vulnerability of people, receivers or receiving environments to adverse changes caused by the impact, or the importance placed on the matter being affected.

The magnitude criteria presented in **Table 21-1** was used to identify the magnitude of an impact, with regard to the spatial extent, duration and severity of that impact.

Table 21-1 Magnitude rating definitions

Magnitude criteria	
Negligible	No discernible positive or negative changes caused by the impact
Minor	• small change caused by the impact; • generally temporary or short term in duration; • impacts confined to a small number of receivers within the study area or immediate locality; and • able to be mitigated or managed such that impacts are deemed to be low.
Moderate	• moderate change caused by the impact; • generally temporary or short to medium term in duration; • spatial extent of impacts may vary across the affected LGAs; and • able to be mitigated or managed such that impacts are deemed to be moderate.
Major	• large change caused by the impact; • generally medium to long term in duration; • spatial extent of impacts may vary across the affected LGAs, or the broader region or state; and • negative impacts would require extensive mitigation and consultation with affected stakeholders.

The sensitivity criteria presented in **Table 21-2** was used to identify the sensitivity of potentially affected receivers/receptors, based on the ability of receivers to adapt to change, their vulnerability and the level of concern raised in feedback from stakeholders.

Table 21-2 Sensitivity rating definition

Sensitivity criteria	
Neutral	• high resilience or ability to adapt to change; and • issues not raised in feedback from stakeholders.
Low	• high resilience or ability to adapt to change; • low vulnerability or low number of sensitive receivers/receptors[1] affected; and • issues rarely raised in feedback from stakeholders.
Medium	• moderate resilience or ability to adapt to change; • moderate vulnerability or moderate number of sensitive receivers/receptors affected; and • issues raised in feedback from some stakeholders.
High	• low resilience or ability to adapt to change; • high vulnerability or high number of sensitive receivers/receptors affected; and • issues raised in feedback from most stakeholders.

The assessment matrix presented in **Table 21-3** has been used to determine the significance of each social impact as a function of the magnitude of the impact and the sensitivity of potentially affected receivers.

[1] Sensitive receiver/receptors include residences, educational institutions (including preschools, schools, universities, TAFE colleges), healthcare providers (including nursing homes, hospitals), religious facilities (including churches), child care centres, passive recreation areas (including outdoor grounds used for teaching), active recreation areas (including parks and sports grounds), commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, retail spaces and industrial premises).

Table 21-3 Significance assessment matrix

	Magnitude			
Sensitivity	**Negligible**	**Minor**	**Moderate**	**Major**
Neutral	Negligible	Negligible	Low	Medium
Low	Negligible	Low	Medium	Medium
Medium	Low	Low	Medium	High
High	Low	Medium	High	High

21.1.3.3 Community and stakeholder consultation

Consultation undertaken for the project to date has enabled TransGrid to obtain an understanding of the community's perceptions and values about their environment, their community, and the project.

Stakeholders for the project include:

- City of Sydney Council, Canterbury-Bankstown Council, Inner West Council, and Strathfield Council;
- government authorities including Roads and Maritime Services, NSW Environment Protection Authority, NSW Office of Environment and Heritage, Department of Industry – Water, Water NSW, Transport for NSW, Greater Sydney Commission, Sydney Coordination Office and Department of Education NSW;
- major development proponents/operators including Sydney Motorway Corporation, Sydney Metro, Sydney Light Rail and Sydney Trains;
- utility providers including Sydney Water, Telstra, Optus, Jemena and Viva Energy;
- directly affected receivers including schools, child care centres, businesses, property/landowners, residents, hospitals, healthcare providers, community groups and places of worship;
- the wider community, including local environment groups, resident action groups, pedestrian and bicycle safety groups, precinct committees, and Chambers of Commerce; and
- elected government officials.

Community and stakeholder consultation for the project began in late 2016. Consultation was carried out with stakeholders to assist in the identification and evaluation of route options. A series of community consultation events were carried out in mid-2017 to inform the community about the preferred route selection.

TransGrid started consultation to assist EIS development in late 2017. In early 2019, a revised route was identified - the rationale for the revised route is described in **Chapter 3 Project development and alternatives**. Community and stakeholder consultation on the revised route commenced in early 2019.

Consultation will be carried out during and after the public exhibition of the EIS and would be ongoing during detailed design and construction.

Key issues and/or themes relevant to the assessment of socio-economic impacts raised during community consultation for the project include:

- business and economic impacts associated with the construction of the project;
- amenity impacts on local businesses, including effects on the ability of customers, employees or business owners to enjoy and have access to their workplace and daily activities;
- access and connectivity issues for residents along the transmission cable route;
- amenity impacts such as noise, air quality and visual to individual receivers;
- amenity impacts to users of parklands; and
- amenity and biodiversity impacts associated with the removal of street trees.

Consultation activities undertaken for the project to date are described in **Chapter 6 Consultation**.

21.2 Existing environment

This section provides an overview of the social and economic characteristics of the study area per construction precinct. Social and economic characteristics are based on demographic profiles, community values, social infrastructure, business and transport services.

21.2.1 Study area context

Table 21-4 describes the land uses and key community infrastructure located within the local study area.

Table 21-4 Summary of the local study area

Construction precinct	LGA	Suburbs	Local study area summary
Precinct 1 Including Rookwood Road substation	Canterbury-Bankstown	Potts Hill, Yagoona, Chullora	Precinct 1 has an industrial character, consistent with its land zoning. This area includes the existing substation facility located at the intersection of William Holmes Street and Rookwood Road in Potts Hill, the former TAFE NSW South Western Sydney Institute Chullora campus (TAFE Chullora Campus) and industrial properties on the eastern side of Rookwood Road. The Rookwood Road substation has no nearby sensitive receivers. Along Muir Road there are large warehousing/light industrial premises with extensive hard surface areas and at-grade parking areas. This precinct also includes the construction laydown area at 12 Muir Road, Chullora.
Precinct 2	Canterbury-Bankstown	Greenacre, Lakemba, Belfield, Campsie	Precinct 2 is characterised by low density residential development and is interspersed with pockets of other land uses. These include a sports field in Maiden Street and a small area at the intersection of Hillcrest Avenue and Rawson Road which features a row of one and two storey shop top premises. There is also a small group of local shops at the intersection of Rawson and Waterloo roads. Along Wangee Road, there are some light industrial businesses and a mosque, where the area becomes characterised by low density residential again. The transmission cable route then crosses under the freight rail line at Belfield and continues through a low density residential area until the end of the precinct. This precinct also includes the construction laydown area at Cooke Park, Belfield.
	Strathfield	Greenacre, Belfield	
Precinct 3	Canterbury-Bankstown	Croydon Park	Precinct 3 is characterised predominantly by low density residential development and is interspersed with pockets of other land uses including mixed use, business development, high density residential (near Arlington Light Rail) and public open space at Henson Park
	Inner West	Ashbury, Ashfield,	

Construction precinct	LGA	Suburbs	Local study area summary
		Dulwich Hill, Marrickville	and Amy Street Playground. Cooks River crosses through Precinct 3 near Croydon Park and Lees Park. Route and special crossing options in Precinct 3 are described in **Chapter 4 Project description**. This precinct also includes the construction laydown area at Peace Park, Ashfield.
Precinct 4	Inner West	Marrickville, Enmore, Newtown	Precinct 4 is predominantly residential with light industrial/warehousing land uses around Addison Road and on the southern side of Edgeware Road. There are various open spaces including Enmore Park.
Precinct 5 Including Beaconsfield West substation	Inner West	St Peters	The predominant land use and built form character for Precinct 5 is open space, such as Sydney Park, and a mix of employment uses including commercial and light industrial. The area also includes the Beaconsfield West substation which is located between Burrows Road and the Alexandra Canal in Alexandria. There are no sensitive receivers in proximity to this substation. The study area also includes the construction laydown areas at Camdenville Park, St Peters and Beaconsfield West substation, Alexandria.
	City of Sydney	Alexandria	
Sydney South substation	Canterbury-Bankstown	Picnic Point	Sydney South substation is an industrial site and is located adjacent to Henry Lawson Drive and is surrounded by Georges River National Park that includes a number of walking and cycling tracks. A residential area is located to the north of the National Park and there are several recreational facilities nearby including Revesby Beach, Cattle Duffers Flat picnic area and sporting facilities at Bill Delauney Reserve.

21.2.2 Socio-economic profile

The following profile of the existing socio-economic environment of the study area has been informed by the most recent release of the Census of Population and Housing (ABS, 2016). The socio-economic profile presented through socio-economic statistics informs the assessment of sensitivity of the community. **Table 21-5** provides a summary of the socio-economic profile for the study area.

Table 21-5 Summary of socio-economic profile

Summary	
Population demographics	
Population growth	There is an overall population growth of the LGAs, reflected through the growth of the local suburbs across the study area. Between the 2011 Census and 2016 Census, population growth across the suburbs has typically ranged from nine percent (at Greenacre) to 15% (at Alexandria). Outside of this trend, Chullora does not accommodate a residential population due to the industrial zoning of the

Summary	
	suburb, and Potts Hill has recorded a 100% growth in population from 2011 to 2016, attributed to significant residential development in recent years. Population projections for the years 2011 to 2036 provided by DPE (2016) anticipate population growth for all LGAs within the study area, with the highest growth anticipated for Strathfield (74%) and City of Sydney (72%).
Age and gender structure	The gender profile and distribution of female and male populations across the study area indicates an even distribution of males and females, which is in line with the overall gender distribution for NSW as a whole. Within the study area, the percentage of the population aged 65 years and over is the lowest in City of Sydney LGA (eight percent) and highest in Canterbury-Bankstown LGA (14%).
Household composition and family structure	Potts Hill (87%) and Ashbury (85%) have the highest proportions of family households compared to the overall study area. Newtown (51%) and Alexandria (57%) have the lowest proportion of family households and reported comparatively higher proportions of single (i.e. lone person) and group (i.e. multiple unrelated persons) households. There are relatively higher proportions of couples without children in Alexandria (62%), St Peters (52%), Marrickville (40%), Dulwich Hill (39%) and Ashfield (41%). Suburbs located away from the city towards the west reported a higher proportion of couples with children, with Lakemba having the highest percentage of 61% and Alexandria having the lowest proportion, at 28%. Belmore recorded the highest proportion of single parent families (21%) with Alexandria having the lowest proportion (8%). Greater Sydney had 50% of couples having children and 33% of couples without.
Ethnic diversity	Suburbs located in the eastern portion of the study area (Alexandria, St Peters, Marrickville and Dulwich Hill) recorded a higher proportion of Indigenous people (2%), while the remaining suburbs and Greater Sydney had 1% or lower proportions of Indigenous people. Suburbs covered by the study area showed a diverse proportion of people born overseas, ranging from 24% to 72%. The suburbs of Campsie (72%), Lakemba (69%), Ashfield (61%), Potts Hill (61%), Belmore (56%), Yagoona (50%), Greenacre (47%), Marrickville (45%), Belfield (44%) and Croydon Park (44%) have a higher percentage of the population born overseas compared to Greater Sydney (43%). Suburbs within the western portion of the study area reported a high proportion of households where a language other than English is spoken at home including Lakemba (83%), Greenacre (73%), and Yagoona (68%). The eastern portion of the study area reported a lower number of households where a language other than English is spoken at home. Ashbury has the lowest proportion of households where a language other than English is spoken at home (15%), followed by Newtown (21%) and Alexandria (23%). Greater Sydney has a total of 38% of households where a language other than English is spoken at home.
Health and wellbeing	
Health services	The local study area is serviced by a wide range of healthcare facilities, including numerous local medical centres and the MetroRehab hospital, Petersham.
Need for assistance	Need for assistance refers to people with a profound or severe disability who require help or assistance in areas of self-care, mobility and communication due to long-term health conditions or a disability lasting six months or more, or from old age. The percentage of persons with a need for assistance ranges across the study area from 2% in Alexandria and Newtown, to 8% in Yagoona, Greenacre and Belmore. City of Sydney LGA has the lowest percentage of persons with a

Summary	
	need for assistance at 2% and Canterbury-Bankstown LGA with the highest at 7%. This is reflected in the number of aged care facilities available in the study area in Canterbury-Bankstown. Greater Sydney showed an average of 5%.
Socio-economic Indexes for areas (SEIFA)	SEIFA aids in providing an assessment of the welfare of Australian communities and helps to determine areas that require funding and services (ABS, 2013). Suburbs within the study area vary significantly in terms of their SEIFA rankings and subsequent decile score. Lakemba and Yagoona are ranked as the area subject to the highest level of disadvantage (decile 1) and Alexandria is ranked as the least disadvantaged (decile 10).
Housing	
Dwelling type	A significant proportion of all dwellings within the Canterbury-Bankstown and Strathfield LGAs are separate houses (making up 57% and 42% of total dwellings respectively). The next highest proportion of dwelling types within the study area are flats, units or apartments with City of Sydney LGA (78%), Strathfield LGA (41%), Inner West LGA (40%) and Canterbury-Bankstown LGA (26%). Flats, units or apartments make up 28% in Greater Sydney. Semi-detached, terrace house or townhouses makes up the smallest proportion with Inner West LGA at 33%, City of Sydney LGA at 20%, Canterbury-Bankstown LGA at 16% and Strathfield LGA at 5% of this dwelling type. Semi-detached, terrace house or townhouses makes up 14% in Greater Sydney.
Housing affordability and availability	Greenacre recorded the highest proportion of household income which contributes to mortgage repayments (40%), followed by Belmore, Belfield and Yagoona with 39%, 38% and 38% respectively. These percentages are relatively high compared to the Greater Sydney area (26%) and the NSW average (31%). Lakemba recorded the highest contribution to rental payments, at 35% of total household income. Alexandria contributes the lowest proportion 24% which generally aligns with those of the Greater Sydney area (25%) and NSW (26%).
Education	
Qualifications	The highest percentages of people attaining education at a bachelor's degree level and above are in the suburbs of Alexandria (50%), Newtown (48%) and St Peters (40%). The suburbs with the lowest rate are Greenacre and Yagoona at 15%. A higher proportion of postgraduate and bachelor's degree qualifications were recorded for the LGAs of City of Sydney (12% and 27%, respectively) and Inner West (10% and 23%, respectively) in comparison with Greater Sydney (6% and 16%, respectively).
Income and employment	
Income	Median household incomes were recorded in the 2016 census as relatively higher for the City of Sydney ($1,926 per week) and Inner West ($2,048 per week) LGAs, when compared with NSW as a whole ($1,780 per week). Canterbury-Bankstown LGA ($1,298 per week) had a much lower rate compared to both Greater Sydney ($1,750 per week) and NSW ($1,780 per week). Strathfield LGA was relatively the same as NSW. The lowest median household income within the regional study area was recorded for the suburb of Lakemba ($1,012 per week) and the highest median household income was recorded for Alexandria ($2,421 per week).
Employment	At the time of the 2016 Census, the rate of unemployment as a total of the available labour force within the regional study area was lower than that of NSW as a whole (6%). However, the suburbs of Lakemba and Yagoona recorded the highest unemployment rates (13% and 10%, respectively). The lowest unemployment rate was recorded in Ashbury and Picnic Point (2%). Alexandria (75%), St Peters (71%), Potts Hill (66%), Dulwich Hill (65%), Marrickville (63%),

Summary	
	Potts Hill (66%) and Croydon Park have a higher full-time employment rate than the total for Greater Sydney at 61%. According to the 2016 Census data, trends in employment by industry sector for the regional study area show that 'health care and social assistance', 'retail trade', 'professional, scientific and technical services', 'education and training' and 'construction' sectors employ the highest proportion of the labour force across the suburbs within the regional study area. This reflects the industry sector percentage for Greater Sydney and the state of NSW. According to the 2016 Census data, there are a higher percentage of occupations within the white-collar trade within the regional study area. The top occupations recorded at the time of the 2016 Census included 'professionals', 'managers and clerical and administrative', 'managers' and 'technicians and trade workers'.

21.2.3 Social infrastructure

The City of Sydney, Inner West, Canterbury-Bankstown and Strathfield LGAs are well-established suburban regions which provide a significant number of recreational facilities and community infrastructure which are essential to meeting the educational, cultural, entertainment, health and social needs of local and regional communities. Recreational and community infrastructure include:

- educational facilities;
- child care centres;
- places of worship;
- health, medical and emergency services;
- aged care facilities;
- community service facilities (such as libraries, community halls, civic centres); and
- sporting and recreational facilities.

Recreational and community infrastructure within the regional study area are identified in **Appendix M** and are shown in **Figure 21-3** to **Figure 21-6**.

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COMMUNITY FACILITIES IN PROXIMITY OF THE PROJECT AREA - PRECINCT 1 TO 2

Powering Sydney's Future
Potts Hill to Alexandria Transmission Cable Project

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

FIGURE 21-3

G:\ENV\GIS\Projects\605\60558835 Rookwood to Beaconsfield EIS\FIGURES\2019\60558835 F21.4 Sensitive Receptors - Map 2 01 10 2019

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COMMUNITY FACILITIES IN PROXIMITY OF THE PROJECT AREA - PRECINCT 2 TO 3

Powering Sydney's Future
Potts Hill to Alexandria Transmission Cable Project

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

FIGURE 21-4

G:\ENV\GIS\Projects\605\60558835 Rookwood to Beaconsfield EIS\FIGURES\2019\60558835 F21.5 Sensitive Receptors - Map 3 01 10 2019

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COMMUNITY FACILITIES IN PROXIMITY OF THE PROJECT AREA - PRECINCT 3

Powering Sydney's Future
Potts Hill to Alexandria Transmission Cable Project

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

FIGURE 21-5

G:\ENV\GIS\Projects\605\60558835 Rookwood to Beaconsfield EIS\FIGURES\2019\60558835 F21 6 Sensitive Receptors - Map 4 26 08 2019

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COMMUNITY FACILITIES IN PROXIMITY OF THE PROJECT AREA - PRECINCT 3 TO 5

Powering Sydney's Future
Potts Hill to Alexandria Transmission Cable Project

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

FIGURE 21-6

21.2.4 Community values

The identification of community values and goals aid in the assessment of potential social and economic impacts by providing insight into how the community may perceive these impacts and assists in the assessment of indirect impacts on community identity, cohesion and sense of place.

The LGAs share a number of common themes within their defined community identity, where the theme of supporting and celebrating diversity in terms of age, lifestyle and cultural background to foster a strong sense of community is the most prevalent. The community values and goals that have been defined by each LGA closely align with the community identity themes of equality, diversity and inclusion, community cohesion, provision of community facilities to support education, health, sport and fitness, artistic and cultural expression and sustainability. As such, key priorities across all LGAs include themes such as:

- maintain and support diversity;
- ensure a safe community;
- provide adequate open and recreational space;
- ensure provision of accessible transport;
- ensure adequate access to community facilities and healthcare services;
- provide leadership in environmental sustainability and waste management; and
- provide opportunities for the local economy to grow through business development and support of existing industries.

City of Sydney, Strathfield and Canterbury Bankstown LGAs also identify the provision of services and facilities for transport, education, health, sport and fitness, art and cultural expression as important defining elements of their communities. Strathfield LGA also has a focus on future sustainability in their community identity.

21.3 Assessment of potential construction impacts

A detailed description of the construction activities for the project, including their estimated duration and overall timing for construction, is provided in **Chapter 4 Project description**.

21.3.1 Changes to land use

During construction, the main land use change is associated with establishment of construction laydown areas. The construction laydown areas would be in use for up to two years and following construction, the land would be returned to its original condition (or otherwise agreed with the land owner), therefore the impact is short-term. Works within these properties would require temporary access to the land prior to construction commencing and is likely to temporarily disrupt the existing use of these areas during their occupation (e.g. by reducing the available land area and through access and amenity impacts). This would be the case for construction laydown areas proposed at Peace Park, Ashbury, Cooke Park, Belfield and Camdenville Park, St Peters. However, there are a number of alternative recreational spaces and parks in the local study area that would be available to recreational users.

Special crossings would involve either the installation of a cable bridge or underboring and these crossings are primarily located on public recreation areas and areas zoned as infrastructure (e.g. rail corridor). Construction for special crossings is expected to take up to 10 weeks to complete in total, however works would be staged and not continuous over a 10 week period. For this period, there would be a temporary change in land use which would only affect the direct area at each special crossing location. There is one cable bridge to be constructed over an active rail corridor at Bedwin Road and works would be timed with other rail works to limit disruption to freight and/or passenger rail services.

Works at the substations would be confined to the existing substation boundaries and would therefore not require any property acquisition or land use changes.

As such, the sensitivity of affected receivers to the temporary occupation of land for the project is considered to be medium. Given the duration of the occupation of land, the small overall area to be occupied and the number of alternative recreational spaces available within the local study area, the magnitude of impacts due to occupation of land for the project is considered to be moderate. As such, the significance of the overall impacts due to temporary occupation of land for the project is medium.

21.3.2 Changes to demographic profile

As the project is located in inner and western Sydney and is accessible by car and public transport, it is unlikely that construction workers would need to permanently relocate to the study area and as such it is unlikely that the demographic profile of the study area would change as a result of the project.

Employment generated during the construction of the project would temporarily increase the number of people working in the study area as well as the number of people travelling to the study area for work. The project would require a peak construction workforce of 70 personnel which is expected to be sourced from the Greater Sydney area.

The existing demographic profile of the study area indicates the presence of potentially vulnerable groups that may require special consideration during construction planning and management. This may include:

- construction communication that is sensitive to diverse ethnic backgrounds and potential language barriers; and
- construction planning and scheduling that considers potential sensitive demographic groups such as young families with children and people over 65 who may be home-bound and particularly exposed to amenity impacts (e.g. noise and dust) during construction.

Given the diversity of the local communities and projected population growth for the region, the sensitivity of receivers is considered high.

The presence of construction workers is expected to have a negligible effect on housing, population and demographics given the diversity of the local communities (as presented in **Section 21.2.2**), projected population growth for the study area and the ability of construction workers to travel to and from work site locations.

As such, the significance of the overall impacts to the demographic profile as a result of the project would be low.

21.3.3 Amenity impacts

Amenity refers to the quality of a place, its appearance, feel and sound, and the way its community experiences the place. Amenity contributes to a community's identity and its sense of place. Aesthetic qualities are an important part of amenity, but the broader concept of amenity is determined also by the physical design of a place and the human activity that takes place within it.

Changes in amenity may conflict with community values, contributing to a loss of or change in a community's sense of place, and subsequently a community's perceived identity. Amenity impacts include any factors that affect the ability of a resident or visitor to enjoy their home and daily activities, for example, generation of noise or vibration, changes to air quality, changes to views, removal of vegetation or increased traffic generation. A summary of the significance of these impacts is discussed in **Table 21-6**. The summary has been informed by various reports, i.e. Construction Noise and Vibration Impact Assessment (**Appendix E**), Air Quality Impact Assessment (**Appendix F**) and Landscape Character and Visual Impact Assessment (**Appendix G**).

Table 21-6 Summary of significance of amenity impacts

Precinct	Impact summary	Significance of impact
Noise and vibration	Noise and vibration associated with construction of the project has the potential to impact the amenity of the study area and sensitive receptors. A proportion of construction works, such as those within major road reserves or rail corridors, those in the vicinity of signalised intersections, or those activities that need to proceed continuously, would need to be undertaken outside of standard construction hours. This is due to safety	High

Precinct	Impact summary	Significance of impact
	and traffic management reasons, or to meet the requirements of government agencies. These activities would inevitably result in greater noise amenity impacts upon nearby sensitive receivers. Impacts are likely to be more explicitly felt in proximity to the project area and impacts to noise amenity would be dependent on existing background noise levels within each noise catchment area and whether activities are undertaken at night-time. As the works for the transmission cable route progress closer to a receiver and then move further away, the noise levels would first increase and then reduce. Noise at construction laydown areas may be from construction plant parking, spoil haulage, storage of equipment and deliveries. However, noise generating activities at the construction laydown areas would likely be intermittent primarily occurring at the start and end of shifts and during the delivery of plant and material rather than continuously over the construction period. Key noisy activities during construction include the use of jackhammers, diamond saws, and rock breakers during the trenching and excavation work required for cable installation and joint bays. Sensitivity of receivers for Precinct 1 and Sydney South substation is low. This is due to the industrial character of Precinct 1 wherein the ability of receivers in this precinct to adapt to the proposed change would be higher due to the existing noise environment and the lack of nearby receivers to the substation. Although truck movements to and from the 24 hour construction laydown area at 12 Muir Road would generate noise impacts for up to two years, the magnitude of impact would be minor given that no receivers are expected to be highly noise affected as the acoustic environment for this precinct is characterised by constant road traffic noise and some industrial noise. Sensitivity of receivers for Precincts 2 to 5 is high**,** given the nearby residential land use. In these precincts, the transmission cable route is adjacent to several businesses, places of worship and educational facilities. Some of these receiver groups are likely to value a quiet environment. Given the types of sensitive receivers, the ability to adapt to higher noise levels would be low. The magnitude of impact would be major, given that the geographic area is categorised primarily by residential land use, educational facilities and businesses. The scale of change from the existing noise environment would be noticed by residents, students and teachers and businesses nearby the project area and other sensitive receivers for these precincts.	
Air quality and odour	Sensitivity of receivers for Precinct 1 and Sydney South substation is low given the industrial character of the area and the lack of nearby receivers. Sensitivity of Precincts 2 to 5 are medium given the receivers in these precincts are sensitive to air quality impacts such as residents, those living in aged care facilities, children attending educational facilities, workers at businesses and users of recreational and sporting facilities. However, the implementation of mitigation and management measures during the project would be sufficient to minimise the potential for off-site dust and odour impacts. Impacts are likely to be more explicitly felt in proximity to the transmission cable route, special crossings and construction laydown areas. The magnitude of impacts for Precincts 1 to 5 and Sydney South substation would be minor given the anticipated duration of works in any one location, the relatively small volumes of work to be undertaken in any one location and range of mitigation measures proposed during the	Low

Precinct	Impact summary	Significance of impact
	project would be sufficient to minimise the potential for off-site dust and odour impacts. Given that earthworks required for construction would occur over a relatively small area at any one time, dust emissions from construction are anticipated to be low. In addition to dust, potential odour impacts associated with a release of landfill gas were identified at the former landfill sites at Camdenville Park and Sydney Park. The landfill at these parks is now more than 30 years old and as such is not expected to be producing any substantial quantities of gas. Given the lack of methane detection during previous geotechnical investigations in the area, and the anticipated short duration of excavation works (for both trenching and underboring) in any one area, it is considered unlikely that significant odour impacts would arise during the project. Potential odour impacts within the project area closest to Arlington Oval and Marrickville Park and where it traverses Henson Park are unknown and would require further site investigations prior to the commencement of construction in accordance with the *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW EPA, 2012). Overall, although odour impacts are not considered likely, precautionary measures would be adopted.	
Visual aesthetics	Receivers in the local study area may experience temporary visual impacts due to construction works and construction vehicle movements. During the installation of the transmission cable circuit, excavation works would be required in close proximity to the root zone of some street trees. This has the potential to affect their viability and therefore removal of trees may be required. Where required, tree removal could affect views in affected streets, with the character of the streetscape of some streets and public recreational spaces (e.g. those with more mature street trees or that are within heritage conservation zones) being affected to a higher degree. The replacement of trees in the same location may not be possible due to the presence of the underground transmission cable. In these circumstances, replacement of trees in more suitable locations would be considered in consultation with the relevant council. In addition, construction activity associated with the transmission cable circuit that would be seen at certain locations includes the presence of tents or demountable buildings at joint bays to facilitate cable jointing. Construction laydown areas would need to be operational at night to facilitate work outside of standard construction hours or to accept deliveries or spoil and therefore they would have flood-lit night lighting. This is likely to be noticeable by the nearest receivers. Night lighting within the streetscape would also increase in brightness and frequency during the construction period but would be directed away from residential properties to avoid light spill into properties at night. Mitigation measures such as lighting directed away from receivers would be implemented to minimise impacts. The sensitivity of receivers in Precinct 1 is low given that most receivers are currently exposed to the industrial landscape character and therefore would have a higher ability to adapt to change. The magnitude	High

Precinct	Impact summary	Significance of impact
	of impact for this precinct is moderate given the temporary nature of works in any one location and views to the construction laydown area from Muir Road would be partially screened from the fencing and mature street trees. However, the potential removal of street trees which currently form a continuous landscape element along Muir Road would open up views to the construction laydown area from the road. The sensitivity of receivers in Precinct 2 is high given the predominant residential landscape character and local businesses. Residents are a sensitive receiver group as they have a proprietary interest in the views from their homes and properties. The magnitude of impact for this precinct is major given that residential receptors at this location would view construction activity (including the tents or demountable buildings over joint bays and works associated with the underboring work) within the road reserve and with little screening. The change from the existing condition would also include underboring activities for the crossing of the freight light rail for the duration of up to 10 weeks and the views to the construction laydown area at Cooke Park for up to two years. The sensitivity of receivers in Precinct 3 is high given the predominant residential landscape character and recreational landscape. The magnitude of impact for this precinct is major given that residential receptors at this location would view construction activity (including the tents or demountable buildings over joint bays and works associated with the underboring work at three potential locations) within the road reserve and with little screening. Receptors at the Cooks River crossing adjacent to the existing Lindsay Street pedestrian bridge would be viewing the construction activity within the quiet cul-de-sac and from a parkland setting. The options to underbore at the Arlington light rail corridor would have a high magnitude of change given that receptors would see the construction activity associated with the underboring of the rail corridor, and the increased traffic on the quiet residential streets that lead to and from the light rail station would be a change from existing conditions. The magnitude of change during construction at Henson Park and Amy Street Playground would be moderate, given that receptors at this location would have a limited visibility of most of the construction works due to the angle of the path around the playground and the screening provided by the mature trees. The change from the underboring activities at these three potential locations would be for up to 10 weeks. Views to the construction laydown area at Peace Park would be for up to two years. The sensitivity of receivers in Precinct 4 is high given the predominant mixed-use landscape character, with sensitive receivers such as residents, businesses and community receivers attending schools, church and public recreational space. The magnitude of impact for this precinct is moderate as there are no construction laydown areas proposed in this precinct and there is a relatively low number of residential receivers. The change from the existing conditions would include trenching and excavation works, site preparation works such as safety barriers and road signage, deliveries and storage of plant and equipment to work sites and installation of a tent or demountable building over the joint bays. The sensitivity of receivers in Precinct 5 is high given the predominant mixed-use and recreational landscape character. The magnitude of impact for this precinct is major given the potentially longer term impacts at construction laydown areas (Camdenville Park and Beaconsfield West substation) for a period of up to two years. The magnitude of change	

Precinct	Impact summary	Significance of impact
	during construction at Sydney Park would be high, given that receptors at this location would be viewing construction activity uncharacteristic for this setting within a park of high scenic value. However, these changes would be seen for a short period of time, during the construction of the project at this location. The sensitivity of receivers for Sydney South substation is neutral given no receivers are located within the vicinity of the substation. The magnitude of impact for Sydney South substation is negligible as changes would be contained within a utilitarian infrastructure site with low scenic value.	

The assessment of significance for noise and visual amenity impacts during construction is high based on the number of receivers that are sensitive to these impacts and their ability to adapt to changes in their environment.

The assessment of significance for air quality during construction is low as impacts are likely to be more explicitly felt in proximity to the transmission cable route, at special crossings and at construction laydown areas. However, dust emissions would decrease as the works progress through each area moving further away from these receivers and earthworks required for construction would occur over a relatively small area at any one time.

21.3.4 Access and connectivity impacts

Construction of the project would require temporary road closures, lane closures, reductions in speed limits, or other traffic control and construction management measures. These temporary changes may impact connectivity of the road network and active and public transport networks, short-term availability of on-street parking along and adjacent to the transmission cable route, and access to businesses, residences, community infrastructure and facilities within the study area. A summary of the significance of these impacts is discussed in **Table 21-7**. The summary has been informed by the Traffic and Transport Assessment report (**Appendix D**).

Table 21-7 Summary of significance of access and connectivity impacts

Precinct	Impact summary	Significance of impact
Road network	Impacts are likely to be more explicitly felt by those businesses and residences located adjacent to the transmission cable route that would experience changes to access, connectivity and reduced availability of parking. Impacts would also be experienced by passers-by travelling along roads where temporary changes to access, detours or road closures would occur. Indirect impacts would be felt on local roads across the local study area for the duration of construction due to a minor increase in traffic as a result of the presence of construction vehicles, road closures and detours. On-street parking along and adjacent to the route would also be restricted during construction in any one location. Parking restrictions would impact receivers located along the transmission cable route in every precinct. The sensitivity of receivers in Precinct 1 is high considering the presence of businesses in this precinct that rely on access for deliveries and parking for customers and staff. The magnitude of impact for this precinct is moderate given the temporary nature of works in any one location. Key impacts in this precinct include diversions on William Holmes Street and delays in travel times. The sensitivity of receivers in Precincts 2 to 5 is high considering the	High

Precinct	Impact summary	Significance of impact
	presence of businesses, residences and social infrastructure in this precinct that rely on access to their properties and on-street parking. The magnitude of impact for Precinct 2 is moderate given the temporary nature of works in any one location. Key impacts to this precinct include diversions to regional and local roads such as Burwood Road and Seventh Avenue. This traffic management approach has the potential to result in delays in travel times, temporary loss of on-road parking and reduced speed limits. Residential receptors along local streets would be affected as works would be undertaken during the day with traffic diversion and lane closure causing delays to property access or to their destination. The magnitude of impact for Precinct 3 is moderate given the temporary nature of works in any one location. Diversions of local streets and roads have the potential to result in delays in travel times, temporary loss of on-road parking and reduced speed limits. Residential receptors along local streets would be more affected as works would be undertaken during the day with traffic diversion and lane closure causing delays to property access or to their destination. The magnitude of impact for Precinct 4 is moderate given the temporary nature of works in any one location. Diversions required in this precinct are on Illawarra Road and Addison Road (regional roads) and Agar Street and Newington Road (local roads). This would affect businesses on Addison Road and have the potential to result in impacts such as delays in travel times on the regional roads and temporary loss of on-road parking. The magnitude of impact for Precinct 5 is moderate given the temporary nature of works in any one location. Key impacts to this precinct include diversions on May Street which is a regional road with several operating businesses. This has the potential to result in delays in travel times, temporary loss of on-road parking and delays to property access or to their destination. Traffic flow would be maintained on Princes Highway and local roads such as Barwon Park Road, Euston Road and Burrows Road. Access to properties and businesses would be maintained at all times, where possible. Where access to a property cannot be maintained, consultation would be undertaken with affected landowners/occupants to identify appropriate timeframes for restricting access, or to negotiate alternative solutions. Emergency services access would be maintained at all times. To ensure disruption to the road network is minimised during construction of the project, management measures have been proposed including alternate construction methodologies to minimise the required work zone and avoid the need for road closures. Where road closures cannot be avoided, they would be managed through the implementation of traffic control measures in consultation with the relevant road authority. The magnitude of impact at Sydney South substation is negligible as works would be contained within the substation site and no road networks would be affected.	
Active and public transport	Given the works are contained primarily within the road reserve, it is anticipated that there would be minimal impacts to the pedestrian network (mainly footpaths). Pedestrian access to residences and	Medium

Precinct	Impact summary	Significance of impact
networks	businesses would be maintained at all times during construction of the project. Construction of the project may result in pedestrians having to use alternate access arrangements e.g. footpaths on the other side of the road. Sections of the cycleway network likely to be impacted are: • Lees Park or Croydon Park (Cooks River cycleway); • Johnson Park at Arlington Station (the Greenway shared path); • May Street between Campbell Street and Applebee Street (shared path); and • multiple shared pathways through Sydney Park. The shared facilities would be reinstated after the completion of the construction works. Alternative cycle routes would be identified and would be signposted for cyclists with prior warning to guide them around work sites. All efforts would be made to ensure access is maintained along the Greenway shared path by locating the send and receive pits for the underbore away from the shared path. The assessment of impacts to the public transport network as part of the Traffic and Transport Assessment (refer to **Appendix D**) found that there may be impacts to the bus network along the transmission cable route during construction of the project. The majority of the bus routes would be able to continue to operate uninterrupted with minor temporary amendments to the location of the bus stops when the construction works occur near a bus stop. However, some bus routes may need to be diverted due to instances where roads are too narrow for a bus to pass when construction works are in progress. The assessment determined that no impacts to rail and light rail services are anticipated as a result of the construction of the project. The sensitivity of receivers in Precinct 1 is low due to the number of receivers and bus services affected. The magnitude of impact for this precinct is minor given the temporary nature of works in any one location, and the potential relocation of bus stops for the M92, 925 buses on Rookwood Road, Muir Road and the Hume Highway would be short term. The sensitivity of receivers in Precinct 2 is medium due to the number of receivers and services affected. The magnitude of impact for this precinct is minor given the temporary nature of works in any one location, and the potential bus route diversions and relocation of bus stops for some bus services travelling along Hillcrest Avenue, Waterloo Road, Rawson Road, Wangee Road, Yangoora Road, Burwood Road and Seventh Avenue would be short term. The sensitivity of receivers in Precinct 3 is medium given the number of receivers that may be affected by the temporary relocation of bus stops and temporary closure of the cycleways within this precinct. The magnitude of impact for this precinct is moderate due to the temporary nature of diversions to the active and public transport networks and duration of works in any one location. Key impacts include the potential relocation of bus stops for some buses on Roslyn and King Street, Old Canterbury and Livingstone Road and Centennial Street. The sensitivity of receivers in Precinct 4 is medium due to the number	

Precinct	Impact summary	Significance of impact
	of receivers and services affected. The magnitude of impact for this precinct is minor due to the temporary nature of lane closures and diversions to the public transport network and duration of works in any one location. The potential relocation of bus stops on Enmore and Edgeware Road and bus route diversion on Addison Road would be short term. The sensitivity of receivers in Precinct 5 is low given the number of receivers that may be affected by the temporary closure of the cycleway within this precinct. The magnitude of impact for this precinct is minor due to the temporary nature of section closures to the public transport network and duration of works in any one location. No bus routes in this precinct would be affected. The magnitude of impact for Sydney South substation is negligible as works would be contained within the substation site and no active or public transport would be affected.	

The traffic and transport impacts to the regional study area are anticipated to be relatively minor, given existing alternate routes. There would also be minimal impacts to rail and light rail services as it is proposed to align the works with scheduled rail maintenance days or during the night where possible. Impacts to the cycling infrastructure/bicycle network along the route are also considered to be minimal and where diversion routes are proposed along bicycle friendly roads, cyclists would follow the diversion routes. Works at the substations would not have adverse impacts on the surrounding road network, due to the works being contained within the site and the low traffic numbers for each site.

As such, the overall impact to access and connectivity based on the assessment for the road networks and active and public transport networks is considered to be medium.

21.3.5 Social infrastructure impacts

Social infrastructure impacts would be as a result of changes to land use, demographic profile, amenity, access and connectivity, and utilities impacts, as outlined previously. General amenity impacts which would be experienced by social infrastructure facilities located within the local study area include:

- temporary changes to access and connectivity, with the potential to result in increased wait times, detours due to road closures or additional traffic management measures during construction;
- temporary impacts to local amenity due to increased noise and vibration associated with construction works, air quality impacts due to dust generated by construction activities, reduced visual amenity due to the presence of construction machinery and activities and amenity impacts due to increased traffic during construction; and
- indirect impacts such as increased travel times due to changes to traffic as a result of road disruptions may also be experienced by social infrastructure facilities.

A summary of impacts on social infrastructure is discussed in **Table 21-8**.

Table 21-8 Summary of impacts on social infrastructure

Precinct	Impact summary	Significance of impact
Educational facilities	Precincts 1, 5 and Sydney South substation have no educational facilities that would be affected. However, there are a number of educational facilities (primary and secondary schools, tertiary institutions and child care centres) located adjacent and nearby to the project area in Precincts 2, 3 and 4 that may be subject to direct and indirect project impacts. The overall sensitivity of receivers is expected to be high considering employees and students at educational facilities are likely to value and rely on a quiet environment during school hours. The ability of these receivers to adapt to a higher noise environment, for example, would be low. The magnitude of impact for Precincts 2, 3 and 4 is moderate, given the anticipated duration and temporary nature of construction in any one location. Temporary impacts which would be experienced by educational facilities located adjacent to the project area include changes to access and connectivity and increased noise and vibration associated with construction works. Impacts such as increased travel times due to changes to traffic as a result of diversions may also be experienced by educational facilities across the local study area. Construction directly adjacent to schools would be undertaken outside of school hours wherever possible to minimise impacts to amenity, traffic and access. Where full road closures are required adjacent to schools, which would affect school access, work would be undertaken outside of school hours to minimise access and traffic impacts, wherever possible. Consultation with the schools would be undertaken, in accordance with the Community Consultation Framework (CCF), to identify appropriate timeframes for restricting access, or to negotiate alternative solutions.	High
Health, medical and emergency services facility	There are no healthcare providers located adjacent to the project area within Precincts 1, 5 and Sydney South substation. Precincts 2, 3 and 4 have a number of health and medical facilities within the local study area, with a limited number of these facilities located adjacent to the transmission cable route. Receivers (employees and patients) may be subject to direct and indirect project impacts and as such, the overall sensitivity of receivers is expected to be medium considering patients are likely to value their ability to efficiently access these services. The magnitude of impact for Precincts 2, 3 and 4 is moderate given the anticipated duration of construction in any one location and temporary lane closures and/or diversions. Impacts which would be experienced by medical services located adjacent to the transmission cable route include disturbance of patients due to construction noise and activity temporary changes to access and connectivity and potential loss of on-road parking. Indirect impacts such as increased travel times due to changes to traffic from temporary road closures may also be experienced by health and medical facilities across the local study area.	Medium
Aged care facilities	Precinct 1, 5 and Sydney South substation have no aged care facilities within or adjacent to the project area. As such, sensitivity of receivers is considered to be neutral and magnitude of impact is negligible for these precincts. Precincts 2, 3 and 4 have several aged care facilities within the project area and therefore the sensitivity of receivers is considered to be high. The magnitude of impact is minor given the anticipated duration of	Medium

Precinct	Impact summary	Significance of impact
	construction in any one location. The aged care facilities in these precincts are not located directly adjacent to the construction works and therefore would not be affected by direct amenity impacts such as noise and air quality. Receivers may experience changes to access and connectivity due to the presence of construction vehicles and temporary diversions.	
Places of worship	No places of worship are located within the vicinity of construction laydown areas or proposed special crossings. No places of worship are located within Precinct 5 and Sydney South substation, as such the magnitude of impacts during construction is considered to be neutral. Precincts 1 to 4 have a number of places of worship located within the local study area. As the attendees of the places of worship are a sensitive receptor group and given the cultural and religious importance of these places, the overall sensitivity of receivers is expected to be high. The magnitude of impact for these precincts is considered to be moderate given the anticipated duration and temporary nature of construction in any one location. Impacts which would be experienced by places of worship located adjacent to the transmission cable route (Lakemba Mosque, Marrickville Kingdom Hall of Jehovah's Witnesses and St Pius Catholic Church) include disturbance of community members attending service due to construction noise and temporary changes to access and connectivity, with the potential to result in increased travel times, detours due to road closures.	High
Community service facilities	No community service facilities are located adjacent to construction laydown areas or proposed cable bridges. No community service facilities are located within the study area for Precinct 1 and Sydney South substation, as such the magnitude of social infrastructure impacts during construction is considered to be negligible. Precincts 2 to 5 have community facilities located within the project area. Given the limited amount of community facilities adjacent to the project area. Community services within the local study area are provided indoor in Precincts 2 to 5 the overall sensitivity of receivers is expected to be low. The magnitude of impact for these precincts is minor considering the temporary nature and duration of construction in any one location. Impacts which would be experienced by community service facilities located adjacent to the transmission cable route include disturbance due to construction noise and activity, and temporary changes to access and connectivity, with the potential to result in increased travel times, and detours due to road closures. Indirect impacts such as increased travel times due to changes to traffic from road closures may also be experienced by community members using these facilities across the local study area.	Low
Recreational and sporting facilities	Given the number of affected recreational spaces in Precincts 2, 3 and 5, the temporary nature of construction and the number of alternative recreational spaces available within the local study area, the sensitivity of these precincts is considered to be medium. Precinct 5 includes Sydney Park which is a regionally significant area of public open space, and the largest area of public open space traversed by the	Medium

Precinct	Impact summary	Significance of impact
	project area. The magnitude of impact for these recreational spaces is considered to be moderate given the anticipated duration, temporary nature of construction and the small overall area to be occupied for the construction laydown areas at Cooke Park, Peace Park and Camdenville Park. Users of the recreational and sporting facilities located in these precincts would be affected by noise impacts from trenching and excavation works and truck movements to and from the construction laydown areas. The nature of works proposed could result in temporary changes to visual amenity and access and connectivity. In Precinct 3, the construction works for the special crossing (underbore or cable bridge) at Cooks River would be noticeably different than the existing land use, however impacts would only affect a limited area at the selected recreational spaces and the work site areas for all options would be located away from the primary areas users are likely to occupy, such as the sports fields and playgrounds. This impact would be for a period of up to 10 weeks. In Precincts 1 and 4, the sensitivity of receivers is medium given the temporary nature of construction and receivers using the sports fields would have views to the project for short periods of time. Construction works in Precinct 4 includes works adjacent to Enmore Park and users would only be temporarily affected by the amenity change. There are several alternative recreational spaces available nearby that offer similar facilities. The magnitude of impact for both precincts is minor given the anticipated duration and temporary nature of construction works adjacent to Potts Park and Enmore Park. Potts Park would not be affected by any direct amenity impacts. Enmore Park users would see the changes from the boundaries of the park, and through screening vegetation within the park. Furthermore, only a section of the park would be adjacent to the project area on Enmore Road and as such, users would still be able to use the park facilities (such as the playground) without being directly affected by amenity impacts. The significance for Sydney South substation is negligible considering the temporary nature of construction and works would be contained within the substation site and no walking and cycling tracks located in the vicinity of Sydney South substation would be affected.	

Social infrastructure facilities across the local study area would be affected by construction activities. Those facilities located closer or adjacent to construction works and construction laydown areas would experience higher levels of amenity impacts. Precincts 2, 3, 4 and 5 are mainly characterised by urban development with educational facilities, health and aged care services, places of worship and recreational and sporting facilities.

There are three public recreational spaces that would be used for the construction laydown areas and a few public recreational spaces that would be affected by special crossings. Impacts would be for a period of up to two years at recreational areas used for construction laydown areas and for a period of up to 10 weeks for other construction activities. However, only a limited area at each recreational area would be taken up for the works and the selected area would be separated from the main area of these parks (i.e. picnic area, open field and playground area).

Given this, users of these services and facilities were assessed to have a higher level of sensitivity to amenity changes during construction. As such, the overall significance for social infrastructure impacts during construction in the study area is considered to be medium.

21.3.6 Business and economic impacts

Potential economic impacts, both positive and negative, from construction of the project are anticipated to include:

- changes in business turnover, demand for services and employment due to construction expenditure;
- an increase in construction workforce and employment;
- changes to amenity of local businesses; and
- changes to accessibility of local businesses, including passing trade.

Expenditure associated with the construction of the project would be of value to the local and regional economies through increased expenditure at local businesses due to purchases by construction workers and potential increased employment as a result of the project. Construction expenditure and employment for the project also aligns with the local community goals of economic prosperity, thriving local business and local employment opportunities (refer to **Section 21.2.4**).

Employment of construction contractors would be required for the works, with the employment of an estimated 70 construction and site management personnel at the peak of construction. Demand for construction workers associated with the project and other major construction projects occurring across Greater Sydney may result in increased demand for construction personnel. Businesses that may directly benefit from construction of the project are likely to include specialist construction subcontractors and those businesses who service or supply goods to the construction industry such as food and beverage retailers, construction materials suppliers and plant and equipment suppliers.

However, there is also the potential for impacts on amenity of local businesses during the construction works, with impacts potentially resulting in loss of trade as customers may shop elsewhere to avoid adverse conditions during construction of the project. A full list of businesses located within the local study area is provided in **Appendix M**.

Changes to traffic and access during construction of the project may also impact on local revenue. Potential impacts include reduced passing trade due to construction and access restrictions, increased travel time for employees, service and delivery vehicles and customers; and temporary impacts to employee and customer parking and access.

Businesses located within Precinct 1 include industrial and wholesale businesses and a veterinary hospital. Given the existing industrial character of Precinct 1, the sensitivity of these businesses to changes in amenity and access relating to construction of the project is considered to be medium. Given the predominant landscape character in these precincts is industrial development and considering the temporary nature of works in any one location, and the small number of receivers, the magnitude of social amenity impacts and changes to access to local businesses during construction is considered to be moderate. As such, the significance of construction impacts on businesses in Precinct 1 is considered to be medium.

Businesses located within Precincts 2 to 5 include retailers, restaurants, cafes, hotels, real estate offices, auto repairs and dance schools. The sensitivity of these businesses to changes in amenity and access relating to construction of the project is considered to be high. Due to the large number of potentially impacted receivers and considering the temporary nature and short duration of works in any one location, the magnitude of amenity impacts and changes to access to businesses during construction is considered to be moderate. As a result of this, the significance of construction impacts on businesses in Precincts 2 to 5 considered to be high.

Overall, given the sensitivity of local businesses such as cafés, restaurants and retailers to changes in amenity during construction, and the nature of the businesses reliant on access to connect with and attract customers, the sensitivity of affected receivers to construction amenity impacts is considered to be high. Considering the large number of impacted receivers, the magnitude of impacts to businesses from changes to amenity and access during construction is considered to be moderate. As such, the significance of the overall impacts to local businesses during construction of the project is assessed to be high.

21.4 Assessment of potential operational impacts

The project would provide greater security for Sydney's electricity network, contributing to improvements in the reliability, affordability and sustainability of supply and is critical to supporting future growth in Sydney.

Once the transmission cable circuit and other associated infrastructure (e.g. the special crossings) have been installed, the project is likely to have a negligible impact on the surrounding environment. As such, socio-economic impacts associated with the operation of the project are anticipated to be negligible and consistent with existing electricity transmission infrastructure in the local area.

In most cases, during operation of the project, only periodic visual inspections along the transmission cable route would be required and ongoing physical access to the transmission cables is anticipated to be minimal. Occasional access would be needed for maintenance or to rectify any equipment faults. No additional permanent workforce is anticipated to be required for the operation of the project.

21.4.1 Changes to land use

The transmission cable route has been limited to roadways and existing infrastructure corridors wherever possible. However, in some instances, the transmission cable route would utilise public open space and some industrial land. TransGrid would require an easement to protect the new underground infrastructure across private land. No freehold acquisition of property is required for this project.

Land along the transmission cable route would be reinstated to its prior condition following construction allowing the majority of existing land uses to continue during operation. However, there would be restrictions on future development and activities along and in proximity to the transmission cable route.

While construction work sites would be reinstated following construction and would therefore maintain their existing land uses during operation, easements over two private properties, the presence of the transmission cable circuit and cable bridges have the potential to impact upon future development.

Cable bridges are proposed to be located primarily in land zoned as SP2 (Infrastructure) or RE1 (Public recreation). The proposed cable bridge at Muir Road in Precinct 1 encroaches onto private property, therefore an easement would be required over a part of this land. This impact on land use would be minor due to the relatively small footprint of the cable bridge.

There would be no change to land use at the substations as a result of the project.

An assessment of impacts due to acquisition of easements and changes to land use is provided in **Chapter 20 Land use and property**.

Overall, the sensitivity of users to changes in land use would be low because of the limited number of receivers who would be affected by changes to land use. The magnitude of these impacts is also predicted to be minor because of the limited areas subject to land use change, and the limited scope of the change. On this basis the significance of the overall impact on the social and economic environment due to changes in land use during operation would be low.

21.4.2 Changes to demographic profile

Operation of the project is not anticipated to affect the demographic profile of the study area, as much of the project's operational infrastructure would be unmanned or would only require a small operational workforce for maintenance. Given that there would be no change in the demographic profile of the study area during operation, no assessment of significance has been undertaken.

21.4.3 Noise and vibration impacts

The project does not include the installation of permanent noise generating plant, nor does it include any work which would generate road traffic during operation. No additional noise emissions to the existing environment are expected to occur. As such, the operational noise environment is expected to remain largely unchanged.

Given that there would be no operational noise and vibration generated during operation, no assessment of significance has been undertaken.

21.4.4 Air quality and odour impacts

All ground surfaces disturbed during construction would be returned to a condition similar to their original state (or as agreed with relevant road authority or local council) post-construction. Based on this, dust emissions are not anticipated during operation of the project except for during maintenance activities or emergency works along the transmission cable route or at the substations, which would be infrequent and generally only involve visual inspections and potentially small amounts of excavation.

The transmission cable circuit through locations with landfill gas present would be designed such that no preferential migration pathway for landfill gas exists. Based on this there would be no sources of odour emissions anticipated during operation of the project. If maintenance works are required, then potential odour emissions would be managed according to measures identified **Appendix F**.

Given that there would be no dust or odour generated during operation, no assessment of significance has been undertaken.

21.4.5 Visual amenity impacts

Impacts to landscape character and visual amenity have the potential to adversely affect local amenity during operation of the project, particularly the establishment of cable bridges and changes to views due to tree removal during construction. There would be no change to night lighting during operation.

Cable bridges affect the views when they are situated within or near public open space or where they are close to residential properties. However, as the cable bridges would be installed alongside existing bridges they do not represent a significant departure from the current character at that location.

Where tree removal is required during construction, this would affect views in impacted streets, with the character of the streetscape of some streets with mature street trees or within heritage conservation zones more significantly affected than others. Tree replacement and augmentation planting within affected road reserves (where feasible) may, over time, reduce the visual impact of tree removal, although the speed at which the view would be improved depends on the growth rate of the tree species and the maturity (pot size) of the street trees replanted.

Given the primarily residential land uses within the local study area, the presence of social infrastructure and recreational areas sensitive to changes in visual amenity, and community concern for biodiversity values, the sensitivity of affected receivers to operational visual amenity impacts is considered to be medium. The magnitude of visual amenity impacts during operation is considered to be moderate. As such, the significance of the overall visual impacts to amenity is medium.

21.4.6 Access and connectivity impacts

Prior to operation, all road surfaces and footpaths as well as bus stops impacted by the project would be returned to their former state or as otherwise agreed with the relevant authority. During operation, there may be minimal disruption to footpaths from maintenance works requiring access to link and sensor boxes in the footpath. Should access to the transmission cable circuit be required to repair a fault (a rare occurrence), some lane or road closures or diversions may also be required. Inspections of cable bridges would involve maintenance crews and appropriate traffic management measures when undertaking work at the roadside. Operation and maintenance at the substations would be within the existing operating footprint. Any vehicles associated with these works can be accommodated within the substation site. Overall, the operation of the project is likely to have a negligible impact on the traffic network.

21.4.7 Economic impacts

Uninterrupted electricity is vital for the economic productivity of inner Sydney and Sydney's continued participation in global markets. The inner Sydney area is a centre of economic activity, industry, tourism and critical infrastructure such as major transport infrastructure including road and public transport.

The project was estimated to have a lower cost compared with the other options considered, based on the use of non-network solutions to defer capital expenditure and the flexibility associated with the staged installation of cables. The capital investment for the project is approximately $285 million.

The project would maintain and improve the reliability, affordability and security of electricity supply across the inner Sydney area. Given the context of the inner Sydney area as an economic centre, the

rate of development within Sydney and the projected rate of population growth anticipated, the magnitude and significance of the economic benefits of the project are considered to be major. The significance of the economic benefits of the project is therefore anticipated to be high (positive).

21.4.8 Electric and magnetic fields.

A study of electric and magnetic fields (EMF) was undertaken to model the magnetic fields likely to be generated during operation of the project. The magnetic field predictions from the project were compared to the reference levels for human exposure to magnetic fields as outlined in the guidelines from the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), a Federal Government body whose responsibilities include protecting the health and safety of people, and the environment, from Extremely Low Frequency (ELF) EMF, have adopted the ICNIRP 2010 guidelines in Australia.

The assessment found that the highest level of magnetic fields is expected to occur directly above the transmission cable circuit, joint bay or cable bridge. Magnetic fields are relatively higher at the cable bridges than above the trench, however public access is only proposed at the Bedwin Road bridge. The assessment also found that the level of EMF exposure would be short term and below the ICNIRP guideline reference levels for assessing compliance of human exposure to magnetic fields.

The assessment also showed that magnetic fields reduce rapidly with increasing distance from the trench.

Overall, the study found that during operation of the transmission cable circuit, magnetic fields generated would be well within the recommended reference levels for human exposure.

21.4.9 Potential benefits

The project would provide an indirect economic benefit, by contributing to securing Sydney's electricity supply for the future. Both electricity network and land use planning for the Greater Sydney area recognise the need for infrastructure to cater for both increased employment and population growth in the inner Sydney area.

As Sydney continues to grow, increased pressure will be placed on the existing electricity network leading to increased risk of network failures or outages due to increased peak demand. Both the *Greater Sydney Vision Plan* (Greater Sydney Commission, 2017) and *A Plan for Growing Sydney* (DPE, 2014) recognise the importance of implementing solutions to cater for future growth and the project serves to support these plans. The project would serve to provide continuity and reliability benefits to consumers within the inner Sydney area including additional security for periods of peak demand.

TransGrid are and will continue to consult with relevant stakeholders including government agencies and other project developers to identify opportunities for community improvement projects and other initiatives in the project area. TransGrid would also establish a project-specific Community Partnerships Program (CPP) aimed at supporting community led projects and initiatives in the project area and to provide a positive project legacy. The CPP would be aligned with community values and needs identified during the EIS consultation. Refer to the Community Consultation Framework in **Appendix C** for further details on the CCP.

21.5 Environmental management and mitigation measures

Environmental management and mitigation measures proposed to manage and/or mitigate potential socio-economic impacts of the project are outlined in **Table 21-9**. The timing indicates at which stage in the project the proposed measure will be implemented. Refer to **Chapter 20 Land use and property** for mitigation measures related to land use changes.

Impacts resulting from changes to amenity, would be managed in line with mitigation measures identified for the following relevant technical disciplines, as summarised in **Chapter 23 Summary of Environmental Management Measures**:

- Traffic and transport;
- Noise and vibration;
- Air quality; and
- Visual amenity.

Table 21-9 Environmental management measures

No.	Impact/issue	Environmental management and mitigation measures	Timing
SE1	Community consultation	Implementation of the project Community Consultation Framework (**Appendix C**).	Detailed design and construction
SE2	Social infrastructure	Construction laydown areas within private and public reserves and parks will be planned to minimise impacts on existing recreational and sporting infrastructure, including playground equipment, with construction laydown areas located in areas of open space, where possible. Establishment and use of the laydown areas will consider public safety and maintain safe access to recreational areas. Private and public reserves and parks proposed for the construction laydown areas will be returned to their original or improved condition following construction (or as otherwise agreed with the relevant authority). Access to community facilities along the transmission cable route and in proximity to construction laydown areas will be maintained at all times unless an alternative solution has been negotiated with the landowner/occupier. Access to areas of reserves and parks not utilised for construction laydown areas will be maintained throughout construction.	Construction
SE3	Access and transport	Opportunities to enhance pedestrian and cyclist connectivity within the local study area, including design of cable bridges to accommodate pedestrian and cyclist movements, will be investigated further during detailed design, in consultation with relevant stakeholders. The construction workforce will be encouraged to travel to and from work sites via public transport or use car-pooling to reduce impacts on local street parking. Temporary relocation of bus stops will be undertaken in consultation with the relevant road authority, bus operators and Transport for NSW. The relocated bus stops will be reinstated at their original location as construction works are completed in each location. Vehicle access to residential properties will be maintained at all times, where possible. Where restricting access to properties is required to enable construction works, vehicle access will be restored as soon as possible. Where access to a property cannot be maintained, affected owners/occupants will be informed and feasible and reasonable solutions for access to their specific location discussed. Further measures to	Detailed design and construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
		address potential impacts to vehicle and active transport access and connectivity can be found in **Chapter 7 Traffic and transport**.	
SE4	Business impacts	Vehicle access to business properties will be maintained at all times, where possible. Where restricting access to properties is required to enable construction works, vehicle access will be restored as soon as possible. Where access to a property cannot be maintained, consultation will be undertaken with affected landowners/occupants, in accordance with the CCF, to identify appropriate timeframes for restricting access, or to negotiate alternative solutions. Construction activities undertaken in proximity to businesses will maintain the visibility of business frontage, associated signage and access points, where possible. Business impacts resulting from changes to amenity or access will be managed in line with mitigation measures identified for other relevant environmental issues.	Construction
SE5	Utilities impacts	Consultation and construction planning with relevant utility/service providers (including councils, Transport for NSW, Sydney Trains, ARTC and Sydney Water) and measures such as searches of Dial-Before-You-Dig will be undertaken to minimise the potential for damage or disruption to utilities and services.	Detailed design and construction
SE6	EMF impacts	Information about potential EMF levels and the relevant health guidelines will continue to be provided to stakeholders in proximity to the transmission cable route as part of community consultation undertaken for the project.	Construction
SE7	Sydney Park impacts	Construction works within Sydney Park will be undertaken in stages and appropriate diversions for access provided to minimise disruption to park users and the City of Sydney.	Construction

22.0 Cumulative impacts

This chapter provides an assessment of the potential cumulative impacts of the project, taking into consideration other developments and activities occurring or proposed near the project.

Impacts from a project, when considered in isolation, may be considered minor, however, when multiple developments/activities result in impacts to the same receivers, the impacts may be more substantial. These are what are referred to as cumulative impacts.

Cumulative impacts can be determined by an assessment of developments that are proposed, have been approved (but not yet under construction) and/or those that would be constructed or operating at the same time as the planning, construction or operation of the project.

Impacts can be either adverse or beneficial. Where an adverse impact is considered likely, mitigation and/or management measures would be implemented to avoid or reduce this impact. This chapter assumes that specific mitigation and management measures proposed for the project (as summarised in **Chapter 23 Environmental management and mitigation measures**) will be applied and therefore focuses on more strategic measures that may be implemented in coordination with other relevant developments.

22.1 Assessment methodology

Relevant registers and websites were searched for approved (i.e. determined), proposed (i.e. currently on exhibition/Secretary's Environmental Assessment Requirements (SEARs) issued) or future (i.e. committed with funding) developments that could interact with the project. Only developments of a 'material' scale were considered, with a 'material' development or proposal being one with a resultant impact that could potentially lead to a significant cumulative impact with the project. Searches included:

- a review of the NSW Department of Planning, Industry and Environment (DPIE) Major Projects website;
- a review of other government agency websites (such as Transport for NSW, Roads and Maritime Services, Department of Health and Sydney Water);
- searches of local council development registers, including:
    - Canterbury-Bankstown Council;
    - Strathfield Council;
    - Inner West Council;
    - City of Sydney Council; and
- a search and review of media releases relating to major projects.

22.1.1 Screening criteria

Following the identification of potentially relevant developments, two key criteria were applied to determine whether the project could potentially contribute to cumulative impacts, being:

- **Spatially relevant** – where a development either overlapped or was adjacent/proximal (i.e. within two kilometres) of the project. While searches for developments were generally undertaken within five kilometres of the project, those located further than two kilometres away were not considered likely to interact with the project; and
- **Temporally relevant** – where the expected timing of an identified development would occur immediately before, during or after construction of the project. Construction of the project is expected to commence in 2020 and to be completed in 2022.

Furthermore, identified developments must have had publicly available information with an adequate level of detail available at the time of preparing the project Environmental Impact Statement (EIS) to be included in the qualitative cumulative impact assessment outlined below.

If an identified development failed to meet all of the above screening criteria, it was excluded from further consideration in the cumulative impact assessment.

A list of identified projects with the potential to contribute to cumulative impacts is provided in **Table 22-1**. A rationale for why the project was included or excluded in the assessment, based on the above criteria, is also provided within the table.

Table 22-1 Screening of identified developments within the vicinity of the project area

Proponent	Development name	Description and timing	Approximate distance to project area	Included or excluded from the assessment
Transport for NSW	Sydney Metro City & Southwest Sydenham to Bankstown Upgrade (Chatswood to Sydenham)	Involves a proposed program of modifications to existing rail infrastructure, new passenger railway infrastructure, station upgrades and associated works and facilities, extending from Marrickville west through to the Canterbury-Bankstown local government area. The key features of the project include track and rail system facility works, station works and surrounding development, transport network alterations, ancillary corridor and construction work and interchange with Sydney Trains services. The works would impact the existing T3 Bankstown rail line. Under construction and expected to open in 2024.	Overlapping around Marrickville/St Peters	Included
Transport for NSW	CBD and South East Light Rail (CSELR)	Comprises a new light rail line between Circular Quay and Randwick with 20 stops, a vehicle stabling facility in Randwick and a maintenance depot in Rozelle. The CSELR requires a total of 13 kilometres of track including track required for proposed maintenance and stabling facilities. Under construction and expected to open late 2019.	At the closest location, the CSELR alignment and proposed Todman Avenue station at Kensington is around 2.5 km to the east of the Beaconsfield West substation	Excluded; not spatially relevant
Department of Education	Alexandria Park Community School Redevelopment	Involves the demolition of all existing buildings from the current Alexandria Park Community School site, including the temporary pop-up facilities and the construction of new school buildings. Anticipated construction between 2020 and early 2022.	Around 1.8 km to the northeast of the transmission cable route through Sydney Park and Beaconsfield West substation	Included
Roads and Maritime Services	WestConnex M4-M5 Link	Comprises a new, tolled multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters. It would involve construction works (including a construction ancillary facility) around the St Peters interchange (near Sydney Park) and underground tunnels to facilitate the link with the New M5 Motorway. Under construction and expected to open in 2024.	Overlapping around St Peters	Included
Roads and Maritime Services	WestConnex New M5	Comprises new multi-lane twin motorway tunnels between the M5 East Motorway and St Peters, and a new road interchange at St Peters as well as the upgrade of local roads at St Peters to connect to Campbell Road and	Overlapping around St Peters/ Alexandria	Included

Proponent	Development name	Description and timing	Approximate distance to project area	Included or excluded from the assessment
		Euston Road and to Gardeners Road, Mascot. Under construction and expected to open in 2020.		
Roads and Maritime Services	Western Harbour Tunnel	Involves a new twin tolled motorway tunnel crossing of Sydney Harbour, connecting WestConnex at Rozelle and the existing Warringah Freeway at North Sydney. A state significant infrastructure application has been lodged for the project and an EIS is anticipated for pubic release in 2019. Construction timing not yet known.	Around 4 km to the north of Sydney Park	Excluded; not spatially relevant and timing unknown
NSW Ports, Goodman Property Services Pty Ltd	Enfield Intermodal Logistics Centre (ILC) Modifications (MODs) 11,12, 13 and 14	Various modifications of the development approval: • MOD-11: Construction of a new warehouse within the ILC; • MOD-12: Additional rail sidings and office building; • MOD-13: Divestment and redevelopment of a 2.2 ha portion of the ILC; and • MOD-14: Modification of the original Master Plan to provide an additional 13 buildings and increase building height limits. Anticipated construction commencing in 2019.	Around 1 km north of the transmission cable route through Greenacre and around 500 m west of the Cooke Park construction laydown area	Included
Boral	St Peters concrete batching plant (CBP) and materials handling facility upgrade and expansion Modification 11 (DA 14/96)	Comprises an increase in the production capacity at the existing plant from 280,000 to 750,000 m^3 per year. To facilitate this production increase, the CBP will require upgrades, including the provision of 14 additional aggregate and sand storage bins, six additional cement and fly ash silos, two additional load bays and five additional slump stands. Construction is anticipated to take around 9 months however the date of commencement is unknown.	Around 1 km and 1.3 km to the southwest of Sydney Park Beaconsfield West substation respectively	Included
Hanson Construction Materials Pty Ltd	Glebe Island concrete batching plant	Construction and operation of a new aggregate handling and concrete batching facility with the capacity to produce up to 1 million cubic metres of concrete per annum and operate 24 hours a day, seven days per week. Construction timing not yet known.	Around 4 km to the north of Sydney Park	Excluded; not spatially relevant and timing unknown
Inner West	Ashfield	Includes decommissioning of the existing site and redevelopment of the	Around 1.8 km to the north	Excluded;

Proponent	Development name	Description and timing	Approximate distance to project area	Included or excluded from the assessment
Council	Aquatic Centre redevelopment	aquatic centre which will include three new outdoor pools, a health and fitness centre, green space and landscaped areas and an additional carpark. Under construction and expected to open in the summer of 2020.	of the transmission cable route through Ashfield	insufficient project information publicly available
Sydney Metro Airports	Bankstown Airport Upgrade	As part of the Bankstown Airport 2014 Master Plan, a number of development applications have been approved or submitted and are under consideration to support redevelopment activities over the next twenty years. These include construction of new warehouses, storage facilities, utility relocation and other projects. Construction timing is variable, but construction of some components, including road improvements, is likely to occur between 2019 and 2021.	Around 5 km to the southwest of Rookwood Road substation	Excluded; not spatially relevant
The University of Sydney	Camperdown Campus - Health Precinct Stage 1 Building	Construction of an eight-storey building with around 21,198 m^2 of ground floor area, accommodating various office, teaching, research, clinical and support spaces. Around 30 public car spaces and 157 bicycle spaces would be included. Anticipated construction between 2019 and 2020.	Around 2.5 km to the northeast of the project area within Sydney Park	Included
Flower Power Pty Ltd	127 Cosgrove Road, Strathfield South, Development Application 2016/132	Fit-out and use of a former tarpaulin shed for the purposes of a garden centre with ancillary café, fruit and vegetable shop, pool shop, pet store, and hardware and building supplies centre along with an at grade parking area. Anticipated construction potentially simultaneous with project activities.	Around 550 m north of the transmission cable route through Belmore and around 550 m southwest of the Cooke Park construction laydown area	Included
Australian Refined Alloys Pty Ltd	202-212 Euston Road, Alexandria, Development Application D/2019/381	Removal of 68 trees and remediation of the site.	Overlapping around Alexandria	Excluded; insufficient project information publicly available and timing unknown

22.2 Assessment of potential impacts

Following the screening presented in **Table 22-1**, developments carried forward in the cumulative impact assessment included:

- Sydney Metro City & Southwest Sydenham to Bankstown Upgrade (Chatswood to Sydenham);
- Alexandria Park Community School Redevelopment;
- WestConnex M4-M5 Link;
- WestConnex New M5;
- Enfield intermodal logistics centre modification;
- St Peters CBP and quarry materials handling facility upgrade and expansion;
- University of Sydney Camperdown Campus Health Precinct Stage 1 Building; and
- Flower Power garden centre.

Figure 22-1 shows the general location of these projects.

22.2.1 Potential cumulative interactions

Subject to planning approval, the project would be expected to begin construction in 2020 and take around two years to complete (2022). The following interactions could result where the identified spatially relevant developments occur concurrently (i.e. simultaneously) with construction of the project:

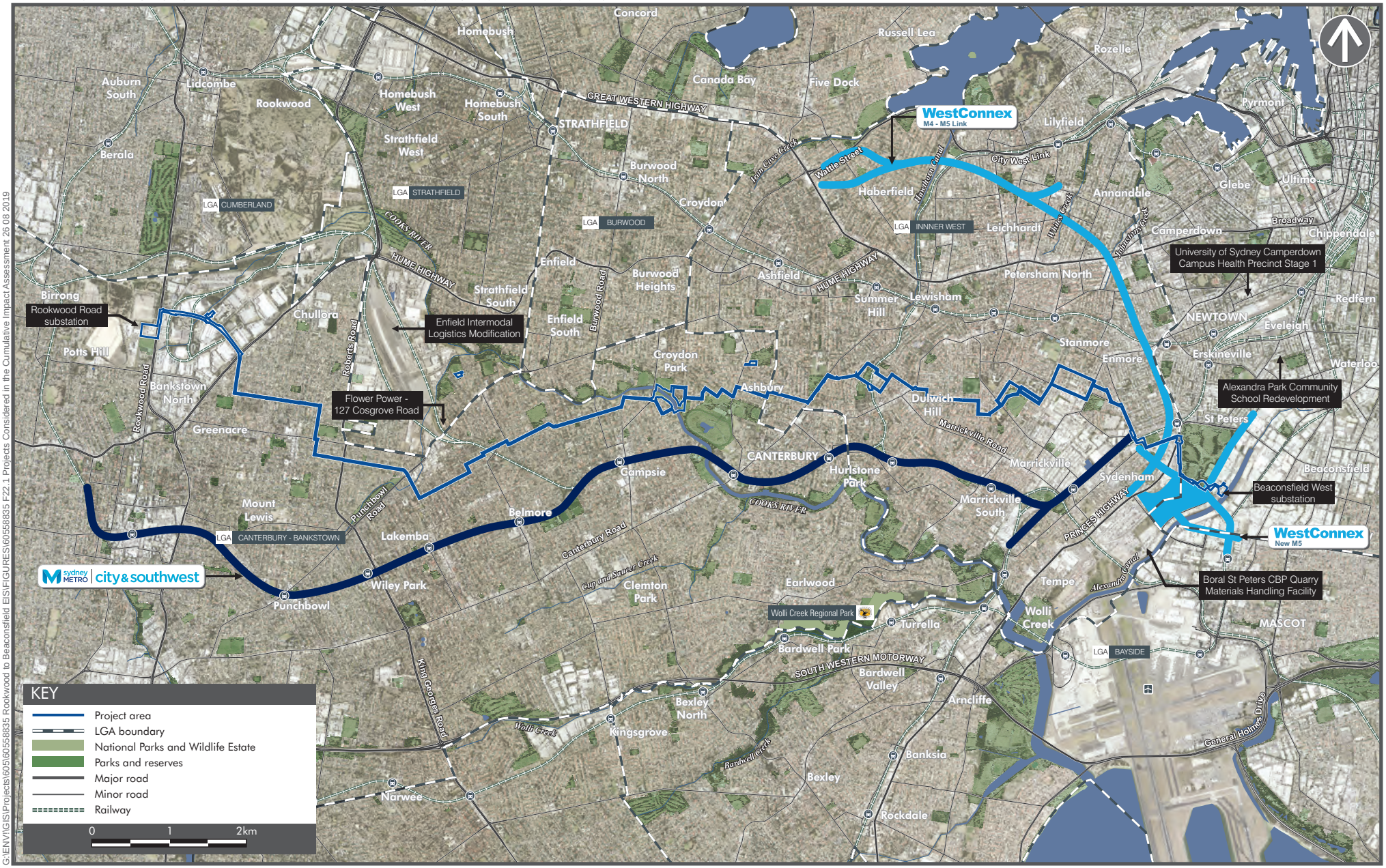
- Traffic and transport – increased construction traffic potentially increasing congestion and delays and increased number of work sites within roadways that could result in delays, road closures and detour routes;
- Noise and vibration – resulting from heavy vehicle movements and high noise generating construction equipment, particularly during sensitive periods (night-time and weekend works) or near sensitive receivers;
- Air quality – generation of dust and emissions from vehicles/equipment at adjacent/proximal work sites;
- Soils, contamination and water quality – runoff from multiple work sites resulting in water quality issues within local watercourses;
- Resource use and waste management – high demand for materials, generation of waste and requirement for disposal;
- Biodiversity – clearing of native vegetation and street trees, loss of habitat for threatened species;
- Landscape character and visual amenity – reduced amenity at sensitive receivers from concurrent construction activities or multiple work sites in the same visual catchment; and
- Social and economic – stress and anxiety from concurrent construction activities including construction fatigue.

Based on the nature of the project, potential interactions during operation of the project are not anticipated, nor are operational impacts expected to result in cumulative impacts as a result of the project.

TransGrid will plan for and manage potential concurrent impacts from multiple project work sites, for example, during trenching and excavation of the transmission cable route.

22.2.2 Potential cumulative impacts during construction

Table 22-2 describes the potential cumulative impacts during construction of the project. It is important to recognise that these are potential impacts and would be largely subject to the final timing, location and status of each development during construction of the project. The impacts described below generally assume a worst case scenario.



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PROJECTS CONSIDERED IN CUMULATIVE IMPACT ASSESSMENT

Powering Sydney's Future

Potts Hill to Alexandria Transmission Cable Project

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

FIGURE 22-1

Table 22-2 Potential cumulative impacts during construction

Issue	Potential cumulative impacts during construction
Traffic and transport	• Construction of the Sydney Metro would result in temporary lane and road closures, which when combined with other lane and road closures resulting from the project, could increase pressure on the local road network around St Peters and Marrickville. Closure of the T3 Bankstown rail line for around 18 months to facilitate construction of Sydney Metro could also result in an increase in private vehicle traffic on local roads. • Construction around Sydney Park (both for WestConnex New M5 and M4-M5 Link as well as the Alexandria Park Community School redevelopment) could result in temporary lane and road closures as well as diversions during construction. This would in turn increase pressure on the local road network around Sydney Park for the duration of project construction. • The St Peters CBP upgrade and expansion would increase average daily truck movements on the local road network around the existing site in St Peters. Average agitator deliveries would increase from 255 per day to nearly 650, while cement tankers would increase from 9 to 23 deliveries per day. This would in turn increase traffic in an already congested area during construction, particularly with temporary road closures. • The Flower Power garden centre development could result in increased heavy and light vehicle movements during construction. This could add to increased local traffic associated with use of the Cooke Park construction laydown area and vehicle movements to and from the laydown area and work sites along the transmission cable route.
Noise and vibration	• Potential cumulative noise and vibration impacts on receivers resulting from ongoing truck movements, high noise generating construction equipment (excavators, jackhammers, etc.) and tunnelling works in areas surrounding the following locations: - in the vicinity of Sydney Park (Euston Road/Burrows Road) with the proposed WestConnex program of works and St Peters CBP upgrade and expansion; - in the vicinity of Bedwin Road/Edgeware Road with the proposed Sydney Metro; - in the vicinity of the Enfield ILC at Punchbowl Road with the various modifications for the ILC; and - in the vicinity of Cosgrove Road/Punchbowl Road with the proposed Flower Power garden centre development.
Air quality	• While the project is not anticipated to result in significant impacts on receivers from dust and/or vehicle/plant emissions, when combined with potential increases resulting from surface works for the WestConnex New M5 and M4-M5 Link (around St Peters/Sydney Park), there is the potential to exceed the NSW EPA thresholds for air quality metrics (e.g. health criteria for dust, $PM_{2.5}$) based on the additive nature of multiple projects in the same location and result in a more than minor impact to surrounding communities and users of Sydney Park.
Soils, contamination and water	• Water quality in receiving local waterways such as Alexandra Canal and Hawthorne Canal may be impacted by runoff and sedimentation associated with cleared areas and new work sites for multiple projects including WestConnex and Sydney Metro. Cumulative groundwater impacts are not anticipated.
Waste management	• Cumulative amounts of waste generated, including spoil, is not expected to exceed the capacity of available waste facilities, however this would be evaluated further during detailed design and opportunities investigated for reuse of materials.
Biodiversity	• While the project is only anticipated to remove a relatively small amount of vegetation (not more than 10 ha), which mainly comprises urban exotic/native species, when combined with the vegetation clearing required for WestConnex New M5 and M4-M5 Link, this could negatively impact on habitat for urban dwelling threatened species such the Grey-headed Flying Fox (*Pteropus poliocephalus*).

Issue	Potential cumulative impacts during construction
Landscape character and visual amenity	• There is a potential for visual amenity impacts resulting from the ongoing construction of multiple construction projects, particularly in Precinct 5. However, based on the estimated rate of excavation and trenching progress (up to 20 metres per day) these impacts are anticipated to be minor in the scheme of the larger works occurring in the surrounding areas (WestConnex New M5 and M4-M5 Link and Sydney Metro).
Social and economic	• Residents may experience construction fatigue (refer to **Section 22.2.2.1** for further discussion on construction fatigue). • Businesses may experience a temporary loss in revenue during the duration of construction as customers may choose to frequent businesses outside of the impacted area. Furthermore, temporary loss of access, if not appropriately staged, could further lead to lost business.

22.2.2.1 Construction fatigue

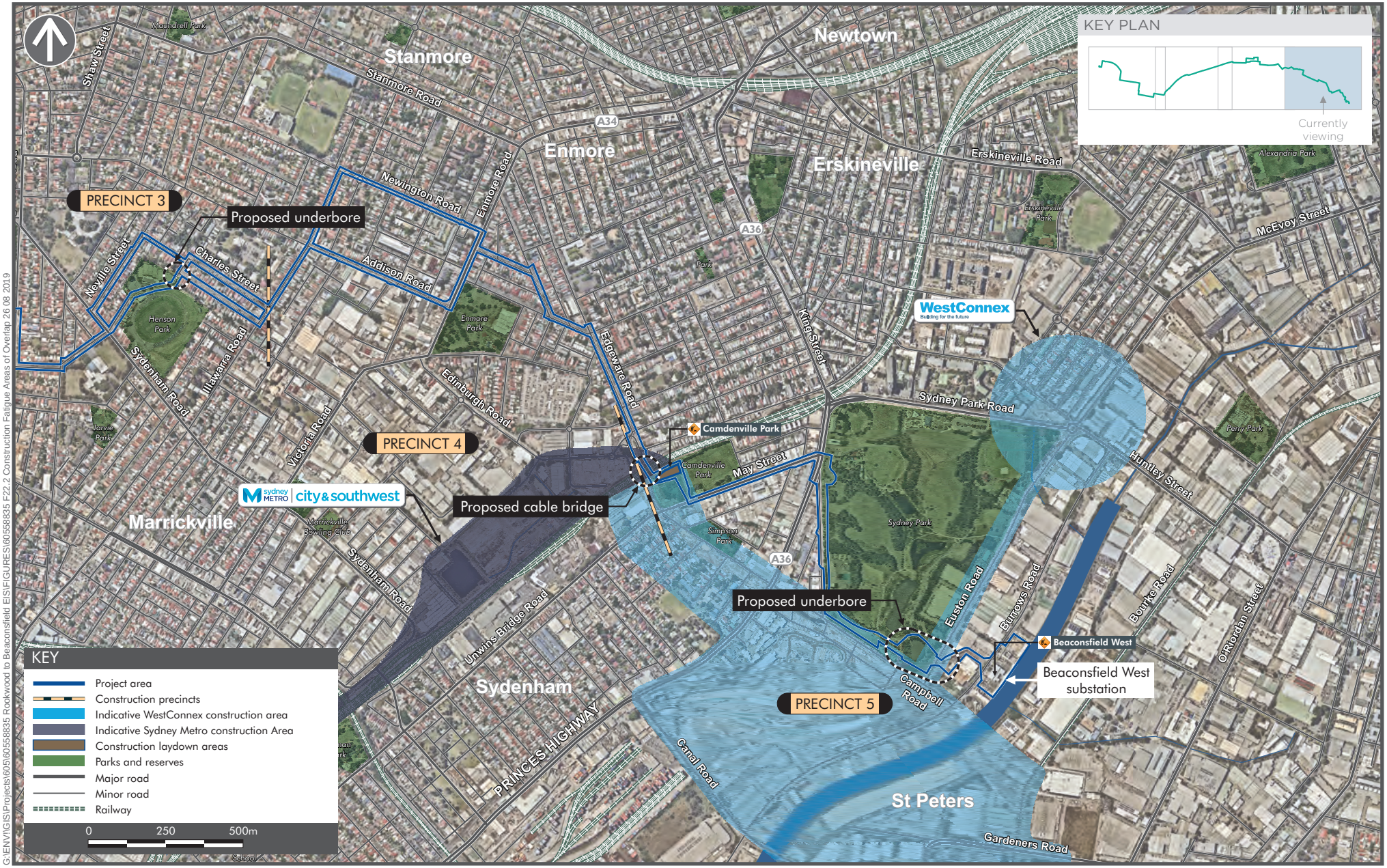
Where concurrent or consecutive (i.e. 'back-to-back') construction activities occur over an extended time, construction fatigue can occur. Construction fatigue can be experienced by local receivers within the vicinity of where construction activities overlap and/or have minimal respite between activities. It is possible that construction fatigue may occur in the areas described below and shown on **Figure 22-2**.

Edgeware Road/Bedwin Road

Areas surrounding the Edgeware Road/Bedwin Road intersection in Marrickville (Precinct 4 and Precinct 5) near Camdenville Park would be subject to the construction of Sydney Metro before, during and after the project and may experience construction fatigue, should works occur concurrently. This area is also located on the edge of the construction footprint for WestConnex New M5 and based on construction timing, construction activities for the New M5 would occur just prior to the project, further contributing to potential construction fatigue from consecutive construction activities. Construction fatigue resulting from these two projects would largely be centred around ongoing noise and vibration with minimal respite as well as the potential ongoing traffic impacts resulting from local detours, lane and road closures and an increase in heavy vehicles.

Campbell Road/Euston Road

Areas around Campbell Road and Euston Road in St Peters and Alexandria (Precinct 5) would be subject to construction of the WestConnex New M5 and the M4-M5 Link projects including use of a construction ancillary facility at St Peters (near the intersection of Campbell Road and Euston Road) both immediately prior to and possibly concurrently with the project. Construction fatigue in these areas would largely be based on local traffic impacts due to temporary lane and road closures, detour routes and an increase in heavy vehicle movements during the construction period. Furthermore, ongoing noise and vibrational impacts resulting from construction would be expected.



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CONSTRUCTION FATIGUE AREAS OF OVERLAP

Powering Sydney's Future
Potts Hill to Alexandria Transmission Cable Project

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

FIGURE 22-2

22.3 Environmental management and mitigation measures

Significant cumulative impacts with other developments in the vicinity of the project are considered unlikely. Opportunities to further minimise construction impacts from the project beyond those considered in this EIS would be undertaken during detailed design and construction planning, through the application of appropriate management and mitigation measures and through consultation with affected landowners and key stakeholders.

Construction scheduling for the project would aim to coordinate multiple work crews and the surrounding developments (in particular in Precinct 4 and Precinct 5) wherever possible, with a focus on minimising cumulative effects on the community and environment (i.e. avoiding overlapping works where feasible and reasonable to allow for respite).

The management and mitigation measures outlined in **Table 22-3** are intended to assist in reducing the potential cumulative impacts resulting from the project.

Table 22-3 Environmental management and mitigation measures

No.	Impact/issue	Environmental management and mitigation measures	Timing
CE1	General	TransGrid will explore project refinements and opportunities (including construction scheduling) to further minimise impacts on the environment and communities.	Detailed design
CE2	General	Key stakeholders, including relevant government agencies, councils and developers (including project proponents), will be kept informed of construction progress and scheduling in an effort to minimise community impacts. The frequency and method of this communication will be outlined in the project Construction Environmental Management Plan (CEMP) and Community Consultation Framework.	Construction
CE3	General	TransGrid will review the environmental impacts of the project before the start of construction and periodically during construction to identify further opportunities to reduce cumulative impacts. Any potential changes to impacts or mitigation measures will be captured in the CEMP.	Detailed design and construction
CE4	General	Consultation and construction planning will be undertaken with relevant stakeholders, particularly proponents for other developments within proximity to the project.	Detailed design and construction

23.0 Environmental management and mitigation measures

This chapter summarises the environmental management and mitigation measures for the project that were identified through the impact assessment process (**Chapter 7** through to **Chapter 22**).

The environmental management and mitigation measures outlined in this Environmental Impact Statement (EIS) would be implemented at various stages of the project, including:

- detailed design;
- construction (including pre-construction activities such as construction planning); and
- operation (including maintenance activities).

The implementation of these measures aims to avoid or minimise potentially significant adverse impacts that the project would have on the surrounding environment and communities. This intent is consistent with TransGrid's Environment Policy[1].

23.1 Construction environmental management

Should the project be approved, a Construction Environmental Management Plan (CEMP) will be prepared prior to the commencement of construction. The CEMP would demonstrate an understanding of the environmental objectives and outcomes described within the EIS and the requirements set out in the conditions of approval for the project and any other legislative requirements. It would also document mechanisms for demonstrating compliance with the commitments made in this EIS (refer to **Section 23.3**) and the Submissions Report (yet to be prepared). The content and structure of the CEMP would reflect the size and nature of the project as well as the significant impacts identified in the EIS.

The CEMP will generally include the following information:

- objectives and scope of the CEMP;
- a brief description of the project;
- a detailed description of the proposed construction works including methodologies;
- an outline of the construction program including any staged activities;
- statutory requirements including conditions of approval and additional licencing/approval requirements;
- standards and/or performance measures for the various environmental issues associated with the project;
- a description of the management and mitigation measures to be implemented including timing and responsibilities;
- description of any proposed environmental monitoring including parameters, data collection methods and monitoring locations;
- risk assessment process for the identification and assessment of new risks;
- emergency response and incident management procedures;
- outline of personnel training on the CEMP and site induction procedures;
- details of stakeholder and community consultation including a complaints handling process;
- organisation structure, key project personnel and roles and responsibilities;
- outline of procedures for reporting within the project team and to relevant government agencies;

[1] https://www.transgrid.com.au/being-responsible/environment/Documents/Environment%20Policy.pdf#search=environment%20policy

- description of site inspection, compliance monitoring and auditing procedures including the process to be followed in the event of a non-compliance;
- process to record, implement and close out corrective actions; and
- CEMP review and revision process.

The CEMP may include a number of sub-plans and/or Work Method Statements to manage potential environmental issues including:

- soil and water;
- erosion and sediment control;
- waste;
- flora and fauna;
- traffic and access;
- dust;
- noise and vibration including works outside of standard construction hours; and
- landscaping and rehabilitation.

These sub-plans or method statements would also outline any monitoring requirements including method, frequency and associated reporting. An indicative list of sub-plans is provided below and shown on **Figure 23-1**.

- Construction Traffic Management Plan (CTMP), which will include:
  - Traffic Control Plans (TCPs);
  - Speed Limit Sign Location Plans;
- Construction Noise and Vibration Management Plan (CNVMP), which will include:
  - Out-of-hours Protocol;
- Air Quality Management Plan (AQMP), which will include:
  - Site-specific landfill gas management plans;
- Construction Heritage Management Plan (CHMP);
- Construction Soil and Water Management Plan (CSWMP), which will include:
  - Sampling, Analysis and Quality Plan (SAQP);
  - Asbestos Management Plan (AMP);
  - Acid Sulfate Soil Management Plan (ASSMP);
  - Soil Erosion and Sediment Control Plans (ESCPs);
  - Site-specific historic landfill management plans;
  - Flood Management Plan (FMPs); and
- Waste Management Plan.

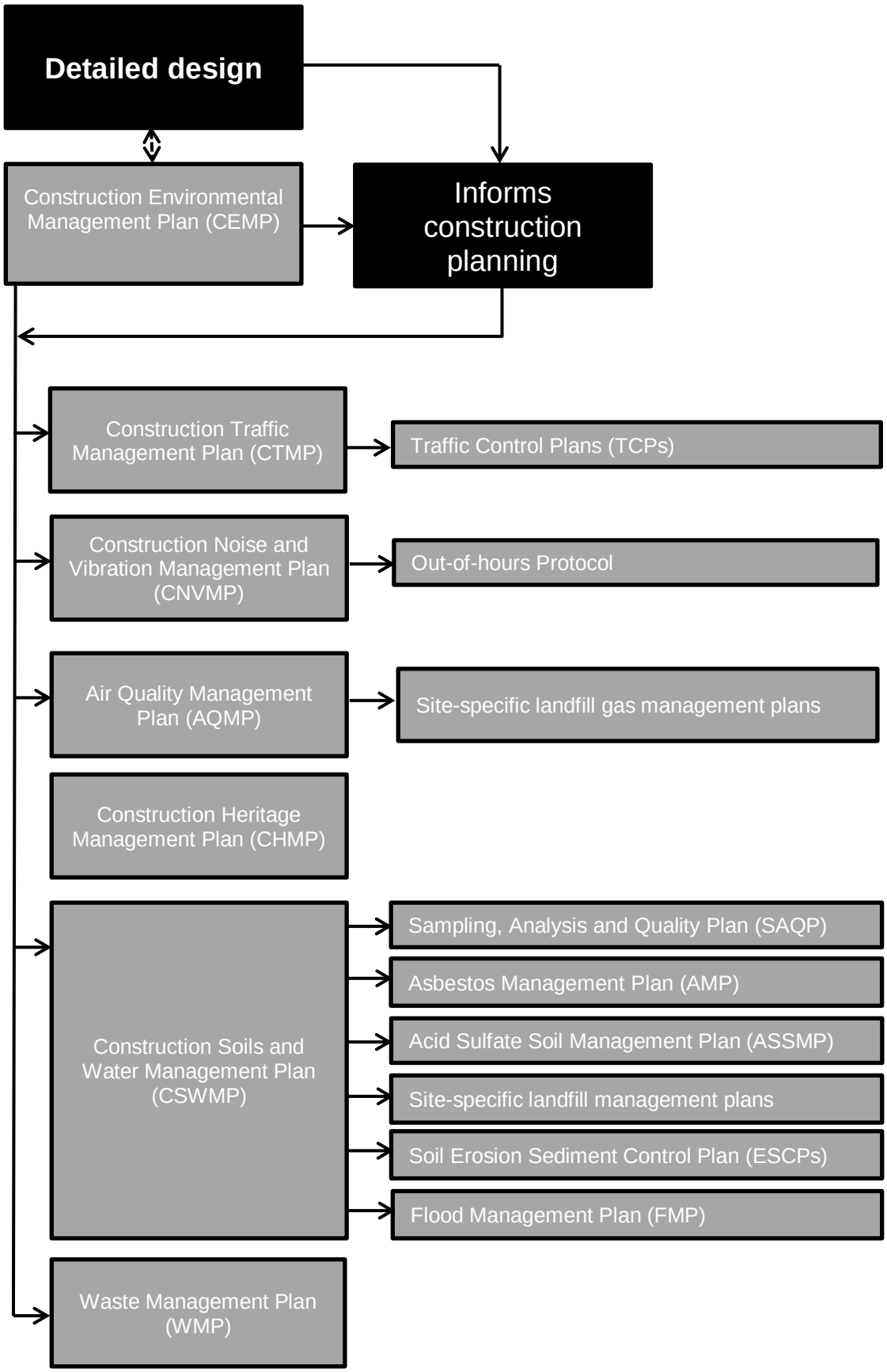

Figure 23-1 Project construction management plans and sub-plans

In addition to the plans, sub-plans and work method statements identified above as part of the CEMP, a number of additional strategies have been identified and committed to within the environmental management and mitigation measures for the project, including:

- tree replanting strategy;
- flood mitigation strategy; and
- groundwater management strategy.

TransGrid is the proponent and remains accountable for the execution of the project in accordance with the approval conditions and any other legislative requirements. TransGrid will appoint a suitably qualitied, independent Environmental Management Representative to periodically audit the construction work activities to ensure that all mitigation measures are being effectively applied and that the work is being carried out in accordance with the CEMP and all environmental approval and legislative requirements.

23.2 Operational environmental management

Operational environmental management and mitigation measures would be addressed through the practices, procedures and processes within TransGrid's existing Environment Management System (EMS). The EMS provides the means for TransGrid to identify, manage and monitor the environmental risks and impacts associated with the organisations activities and assets including the operation and routine maintenance of assets. It provides mechanisms for improving management practices, continuous improvement in environmental performance and demonstrates ongoing environmental compliance. TransGrid's EMS is certified to *AS/NZS ISO 14001:2004 Environmental Management Systems*. Further information can be found in TransGrid's Environmental Handbook[2] and EMS fact sheet[3].

[2] https://www.transgrid.com.au/being-responsible/environment/Documents/Environmental_Handbook_external.pdf#search=environmental%20handbook
[3] https://www.transgrid.com.au/being-responsible/environment/Documents/Overview%20of%20TransGrids%20Environmental%20Management%20System.pdf#search=environmental%20management%20system

23.3 Summary of environmental management and mitigation measures

Table 23-1 provides a summary of the environmental management and mitigation measures for the project.

Table 23-1 Summary of environmental management and mitigation measures

No.	Impact/issue	Environmental management and mitigation measures	Timing
General			
GE1	General	TransGrid will carry out the construction and operation of the project in accordance with the EIS, Response to Submissions Report (yet to be prepared) and the approval conditions.	Detailed design, construction and operation
GE2	CEMP	A CEMP will be prepared prior to the commencement of construction. The CEMP will demonstrate an understanding of the environmental objectives and outcomes described within the EIS and the requirements set out in the conditions of approval for the project and any other legislative requirements. It will also document mechanisms for demonstrating compliance with the commitments made in this EIS and the Response to Submissions report (yet to be prepared).	Construction
GE3	Environmental Management Representative	TransGrid will appoint a suitably qualitied, independent Environmental Management Representative to periodically audit the construction work activities to ensure that all mitigation measures are being effectively applied and that the work is being carried out in accordance with the CEMP and the environmental approval and legislative requirements.	Construction
GE4	Training	Construction personnel will undergo inductions in accordance with the CEMP and any other training commitments agreed as part of the project approval.	Construction
GE5	Approval and permits	All necessary approvals, licences and permits will be obtained for the project from the relevant approval authorities.	Detailed design, construction and operation
Traffic and transport			
TT1	General traffic impacts	Alternative construction methodologies and traffic management approaches will be considered to identify additional measures that may reduce potential impacts.	Detailed design and construction
TT2	General traffic impacts	A CTMP will be produced for the project that will outline the proposed methodology for managing traffic flow around the work sites, traffic assessment, traffic counts, modelling and/or mid-block capacity assessments to confirm measures to be put in place to manage network performance from lane closures and proposed diversion	Detailed design and construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
		routes. The CTMP will include effective traffic management measures for the proposed work sites to ensure the construction activities can be undertaken in a safe manner. The CTMP will also consider worker parking requirements and the temporary loss of on-road parking. The CTMP will be supported by TCPs.	
TT3	General traffic impacts	TCPs will be prepared for each work site. The TCP will graphically show the required traffic control at the work site, which will include, for example, lengths of merge/diverge tapers, location of traffic cones, traffic controllers, warning signage and speed limit sign locations, as required. Each TCP will be prepared by a suitably qualified technician in accordance with the *Traffic control at work sites manual* (Roads and Maritime, 2018) and will comply with the requirements of AS1743.3 *Roads Signs - Specifications*.	Detailed design and construction
TT4	Road closures	In the event of road closures, diversion routes will be provided along with an assessment of the likely network performance of the proposed diversion. Where required, demand management measures will be considered in consultation with the relevant roads authorities to reduce traffic on key corridors affected by construction activities for the project by directing traffic to other appropriate roads. Diversion routes and demand management measures will be documented in the CTMP.	Detailed design and construction
TT5	Active travel impacts	Where feasible, reasonable and safe, impacts on active transport (walking and cycling) modes and routes will be minimised by maintaining access around work sites or providing diversion routes.	Construction
TT6	Vehicle access	Vehicle access to residential and business properties will be maintained at all times, where possible. Where restricting access to properties is required to enable construction works, vehicle access will be restored as soon as possible. Where access to a property cannot be maintained, affected owners/occupants will be informed and feasible and reasonable solutions for access to their specific location discussed.	Construction
TT7	Emergency access	Access for emergency services vehicles will be maintained at all times.	Construction
TT8	Community and stakeholder consultation	TransGrid will engage with relevant stakeholders including Roads and Maritime, Transport for NSW (TfNSW), Transport Management Centre (TMC), public transport service providers (e.g. Sydney Trains, Transdev, State Transit Authority), waste collection agencies, local councils and local residents and businesses regarding potential traffic and access impacts and management options, in accordance with the CCF. TransGrid will work with TfNSW and bus operators to ensure that sufficient lead time and comprehensive public notification is provided, regarding changes to bus stops and services and that alternative arrangements are in place to minimise disruption during road changes. Consultation regarding the potential overlap of construction works for the project and other adjacent projects will be undertaken during detailed design to ensure that the works are coordinated, where possible.	Detailed design and construction
TT9	Impacts to bus routes	All diversions of bus routes will be agreed with TfNSW and bus operators prior to the traffic management approach being finalised; and will consider acceptable routes based on the turning paths of these vehicles.	Detailed design and construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
TT10	Construction laydown areas	The construction laydown areas will undergo a detailed design to ensure that access/egress is possible for the nominated construction design vehicle, and to ensure that impacts to the road network are mitigated and managed. This design will be presented within the CTMP for the project.	Detailed design and construction
TT11	Parking	Workers will be encouraged to travel to the work sites using public/active transport where possible. However, some on-road parking may be required at work sites. The CTMP will detail measures to minimise parking impacts to surrounding receivers as far as possible (e.g. not parking near schools/child care centres during drop off and pick up times or not parking close to sensitive land uses with high on-road parking demand, such as hospitals).	Construction
Noise and vibration			
NV1	CNVMP	A CNVMP will be developed as part of the CEMP for the project and will include reasonable and feasible safeguards to manage the noise emissions from construction and manage any complaints which may be received. The CNVMP will include the following: • identification of nearby residences and other sensitive land uses; • description of approved hours of work; • description and identification of all construction activities, including construction work sites, equipment and duration; • description of work practices (generic and specific) which will be applied to minimise noise and vibration; • a complaints handling process; • noise and vibration monitoring procedures; • overview of community consultation/notification required (see NV2); and • the Out-of-hours Protocol developed for the project.	Construction
NV2	Community consultation/ notification	Residents and other sensitive receivers impacted by noise and/or vibration from the proposed works which is expected to exceed the NML (as defined in Table 5-2 and Table 5-3 of **Appendix E**) and/or vibration criteria (as summarised in Table 5-6 and Table 5-7 of **Appendix E**) will be notified at least seven days prior to the commencement of the particular activity. The information provided to the residents and other sensitive receivers impacted will include: • programmed times and locations of construction work; • the hours of proposed works; • construction noise and vibration impact predictions; and • construction noise and vibration mitigation measures to be implemented. Community consultation regarding construction noise and vibration is further detailed in the CCF in **Appendix C**.	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
NV3	Site inductions	All project personnel, contractors and subcontractors will undergo an environmental induction. The induction will at least include: • all project specific and relevant standard noise and vibration mitigation measures; • relevant licence and approval conditions; • permissible hours of work; • any limitations on high noise generating activities (e.g. use of jack hammering, rock breaking, piling rigs and diamond saws); • locations of nearest sensitive receivers; • construction employee parking areas; • designated loading/unloading areas and procedures; • site opening/closing times (including deliveries); • behavioural practices such as limiting the use of loud stereos/radios on-site and not dropping materials from height or metal items; • public complaints handling procedures; and • environmental incident management procedures.	Construction
NV4	Out-of-hours protocol	Where feasible and reasonable, construction will be carried out during standard construction hours. However, given that some works will be required to be undertaken outside of standard construction hours, an 'Out-of-hours Protocol' will be prepared as part of the CNVMP. This will evaluate the potential noise impacts of specific out-of-hours works and recommend appropriate mitigations measures such as: • community consultation with highly noise affected receivers; • procedures to determine negotiated outcomes in consultation with affected receivers (e.g. construction scheduling during sensitive periods such as exams where construction is in the vicinity of schools); • specific mitigation measures such as respite periods; and • a monitoring program.	Construction
NV5	Respite periods for works during standard construction hours	Respite periods during standard construction hours, will be identified in consultation with affected receivers. Respite options will be considered when sensitive receivers are within the minimum working distances for vibration intensive works or are highly noise affected receivers (experiencing noise levels above 75 dB(A)). Respite options will include consideration of amendments to work schedules. Vibration intensive or high noise generating equipment will be used in continuous blocks, not exceeding three hours each, with a minimum respite period of one hour between each block.	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
NV6	Respite periods for works outside of standard construction hours	The need to consider respite periods will be triggered where the $L_{Aeq(15min)}$ noise levels exceed 75 dB(A) at the same receiver after midnight for more than three consecutive nights. Where this level is exceeded, respite periods will be considered in accordance with the Out-of-hours Protocol (refer to NV4).	Construction
NV7	Construction hours and scheduling	Where feasible and reasonable, construction will be carried out during standard construction hours. Where required to be completed outside of standard construction hours, in proximity to sensitive receivers, works generating high noise and/or vibration levels (including the use of rock breakers and diamond saws) will be scheduled during less sensitive time periods.	Construction
NV8	Noise monitoring	A noise monitoring program will be implemented for the duration of the works in accordance with the CNVMP and will focus on the use of high noise generating plant (e.g. jack hammering, rock breaking, piling rigs and diamond saws) and works outside of standard construction hours.	Construction
NV9	Equipment selection and placement	Equipment selection will consider potential noise and vibration impacts and quieter equipment and/or construction methods will be used where feasible and reasonable. Plant and equipment will: • have an operating sound power level of no more than those listed in the Construction Noise and Vibration Impact Assessment in **Appendix E**; • be maintained and operated in an efficient manner, in accordance with manufacturer's specifications, to reduce the potential for adverse noise and vibration impacts; • be fitted with non-tonal reversing beepers (or an equivalent mechanism); • be throttled down or shut down when not in use; • minimise noise through: - use of residential grade mufflers; - use of damped hammers such as "City" Model Rammer Hammers; and - silencing air parking brakes. High noise generating plant will: • be located so that the offset distance between the plant and adjacent sensitive receivers is maximised as far as possible; and • be directed away from sensitive receivers, where possible to do so.	Detailed design and construction
NV10	Construction traffic	Potential noise impacts from construction vehicles will be minimised through the following: • traffic flow, parking and loading/unloading areas will be planned to minimise reversing movements within the work sites and at construction laydown areas; • loading and unloading of materials/deliveries will occur as far as possible from sensitive receivers;	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
		• shielding loading/unloading areas if close to sensitive receivers, where feasible (i.e. breaking the line of site between the area and the receiver); • fitting delivery vehicles with straps rather than chains for unloading, wherever possible; • selecting construction laydown area access points and roads as far away as possible from sensitive receivers; • locating delivery and haulage routes away from sensitive receivers, where possible; • scheduling deliveries during less sensitive times, where possible; • limiting the speed of vehicles; • restricting the use of engine compression brakes; and • maximising the storage capacity of construction laydown areas to reduce the need for truck movements during sensitive times (between midnight and 7:00 am).	
NV11	Steel road plates	The use of road plates will be minimised, where possible. Where required to be used, the plates will be installed in a manner that minimises the potential for displacement by traffic loading and minimises any height difference with the adjacent road surface in order to reduce the potential for impact noise generation from tyres traversing the plates.	Construction
NV12	Stationary noise sources	Low noise emitting plant and equipment (such as those with built-in shielding and mufflers) will be used wherever possible. Noise generating plant at work sites (such as compressors and generators) will be directed away from and situated furthest away from sensitive receivers, where practicable. Machinery that is not in use will be switched off.	Construction
NV13	Shield sensitive receivers	Structures will be used to shield residential receivers from noise such as use of hoarding/noise curtains, where practicable, at construction laydown areas and special crossing work sites.	Construction
NV14	Building condition surveys and vibration monitoring	If vibration intensive equipment is to be used within the minimum working distances for cosmetic damage, then it is recommended that a different construction method with lower source vibration levels is used where feasible and reasonable. Where work within the minimum working distances for cosmetic damage is planned to occur: • attended vibration measurements will be undertaken at the work site when work commences, to determine site specific minimum working distances. As a precaution, where practicable, these measurements will be made at distances outside the minimum working distances to ensure no structural damage occurs and will provide detailed information regarding the transmission of vibration to allow site specific safe working distances to be determined; and • for listed heritage items and houses within Heritage Conservation Areas (HCAs), building conditions surveys will be undertaken. The survey will document the structural condition of these buildings/structures before construction commences and after construction is complete to identify any impacts on historical	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
		buildings/structures as a result of the project construction. Building condition surveys will be scheduled in consultation with property owners. Vibration intensive work will not proceed within the minimum working distances (recommended or site specific) unless a permanent vibration monitoring system is installed to warn operators when vibration levels are approaching the peak particle velocity objectives as outlined in DIN 4150. For work scheduled to occur near a building, within the minimum working distance for human comfort but outside the minimum working distance for cosmetic damage, the affected receivers will be notified.	
Air quality			
AQ1	General dust and odour impacts	An Air Quality Management Plan (AQMP) will be prepared for the project as part of the project's CEMP. The AQMP will identify the measures to be undertaken during construction of the project and document the complaints management process.	Construction
AQ2	Dry surfaces	Regularly water all exposed surfaces at construction laydown areas (excluding stockpiles) or special crossing work sites when conditions are dry and dusty, through the use of water sprays, sprinkler systems, a water cart or other suitable methods. Frequency would be determined by how quickly the surface dries out again, with higher frequency watering required on hot, dry, windy days.	Construction
AQ3	Adverse weather	On days where forecast weather conditions (e.g. high winds) may result in high dust emissions, dust generating work activities may need to be rescheduled or modified. The forecast weather conditions will be included in daily tool box talks and construction planning.	Construction
AQ4	Stockpiles	Spoil stockpiles will be covered.	Construction
AQ5	Drop heights	Minimise drop heights from excavators when placing spoil into trucks or onto stockpiles to reduce the potential for dust generation.	Construction
AQ6	Exposed surfaces	Progressively rehabilitate exposed areas at work sites to limit dust generation.	Construction
AQ7	Generation of dust from vehicles and plant	Ensure that all vehicles transporting soils, rock or other materials are covered when entering or exiting the work site.	Construction
AQ8	Generation of dust from vehicles and plant	Vehicles and plant will be free of excessive soil, where required, to reduce soil tracking onto public roadways.	Construction
AQ9	Generation of dust from vehicles and plant	Provide stabilised site access (where existing site is unsealed), and access points as required.	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
AQ10	Generation of dust from vehicles and plant	Construction vehicles and mobile plant will use designated haulage and access routes, where practicable, and traffic speeds at work sites will be restricted to limit the generation of dust from vehicle movements.	Construction
AQ11	Migration of dust off-site	If dust is seen to be migrating off-site, the source of the dust will be identified. Additional management and mitigation measures implemented (such as rescheduling the works or water spraying), where required.	Construction
AQ12	Landfill gas	Site-specific landfill gas management plans will be prepared for works at locations with landfill gas (including Camdenville Park and Sydney Park) prior to any trenching and excavation. Further site investigations will be undertaken within the project area closest to Arlington Oval and Marrickville Park and where the project traverses Henson Park, in accordance with the *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW EPA, 2012), to assess the presence and risk of landfill gas. If landfill gas is detected, a site-specific landfill gas management plan will be developed for any excavation works in these areas (also refer to CT9). The plans will be prepared by a suitably qualified landfill gas management specialist. The management plans will include mitigation measures to prevent human health exposure and explosive risks posed by landfill gas and nuisance odours from exposed leachate or landfill wastes. The plans will detail the type and frequency of monitoring required during the works and will outline the triggers that could stop works or require a step up in controls. Controls may include the use of odour suppressant mists and foams and other measures deemed suitable for the local conditions of the site.	Detailed design and construction
AQ13	Plant exhaust emissions	Construction vehicles and mobile plant will be maintained in good working condition. Engines will be switched off when not in use.	Construction
Electric and magnetic fields			
EMF1	Generation of magnetic fields	A revised EMF calculation will be undertaken once the final cable details are known to ensure consistency with the initial assessment undertaken and to confirm that magnetic field levels for the project are still below the ICNIRP reference levels for human exposure.	Detailed design
EMF2	Generation of magnetic fields	The project will operate within the limits set in the *International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to EMF* (ICNIRP, 2010).	Operation
EMF3	Verification of magnetic fields	Within six months of operations commencing, magnetic field levels will be measured at selected locations near receptors along the transmission cable route to verify that levels are below the ICNIRP reference levels.	Operation

No.	Impact/issue	Environmental management and mitigation measures	Timing
Hazards and risks			
HR1	General	General hazard and risk management measures for construction of different project components (such as underground cables, special crossings and construction laydown areas) will be included within the CEMP, including: • details of the environmental hazards and risks associated with different construction activities; • procedures to comply with legislative and industry standard requirements; • Work Method Statements; • emergency procedures for unplanned events; and • training for relevant personnel (including subcontractors) and site inductions.	Construction
HR2	Traffic hazards during construction	Traffic hazards will be managed through the preparation and implementation of a CTMP. The CTMP will manage access to residences/businesses, the closure of lanes and roads and detours for pedestrians and cyclists. The CTMP will also include measures to make the public aware of changes in road conditions such as erecting warning signs and having traffic controllers on-site. Refer to additional measures in TT1 to TT10.	Construction
HR3	Disruption of rail network	Construction and maintenance of the cable bridges within heavy rail and light rail corridors will be undertaken during rail possessions planned by the relevant rail network authority or as otherwise agreed with the rail authority.	Construction and operation
HR4	Transportation of hazardous materials	Hazardous materials will be transported, stored and used in accordance with: • *Work Health and Safety Act 2011* (NSW); • *Dangerous Goods (Road and Rail Transport) Act 2008* (NSW); • Australian Code for the Transport of Dangerous Goods by Road and Rail (National Transport Commission, 2017); and • relevant Australian Standards. Safety Data Sheets will accompany all dangerous goods transported to work sites.	Construction and operation
HR5	Spills and leaks of hazardous materials	Hazardous material procedures (including procedures for storage, transport and disposal of hazardous materials, spill prevention and management, and the refuelling and maintenance of vehicles/equipment) will be developed and implemented as part of the CEMP, to minimise potential for impacts associated with chemical spills and leaks. Any captured water which is not of a suitable quality for discharge will be disposed of at an appropriately licenced waste facility.	Construction and operation
HR6	Unauthorised access	All work sites and construction laydown areas will include some form of delineation, barrier/perimeter fencing and signage notifying unauthorised persons not to enter and of the potential hazards at the site.	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
HR7	Underground utilities	Minimise public safety risks such as flooding and fire/explosions from damaging underground utilities by: • undertaking Dial-Before-You-Dig (DBYD) enquiries and consulting with relevant service infrastructure providers, prior to commencement of construction; • undertaking service and utility identification works; • employing non-destructive excavation methods to expose buried services prior to excavation where works are required in close proximity to the utility and there is a high risk of striking that utility; and • protecting utilities prior to any excavation works being undertaken in proximity to the utility where required.	Construction
HR8	Bushfire risks	Restrict hot works (such as welding or other activities generating heat or sparks) on days of declared catastrophic fire danger at the Sydney South substation.	Construction
HR9	Electrical safety	During construction, appropriate warning in the form of surface markers and subsurface tape will be installed along the transmission cable route to warn third parties conducting excavations in the area of the presence of the cable circuit. The cable circuit will also be registered on DBYD prior to construction commencing.	Construction
HR10	Emergency response	If required, the site-specific Emergency Response Manual for the Rookwood Road, Beaconsfield West and Sydney South substations will be updated to reflect the changed conditions and additional requirements that may arise as a result of the project.	Operation
HR11	Hazards during operation	Maintenance crews will undertake maintenance and repair work in accordance with the requirements of TransGrid's existing Environmental Management System.	Operation
HR12	Subsidence and/or frac-out during underboring	The risk of subsidence and/or frac-out will be minimised during underboring by: • designing the depth of the underbore around local geotechnical conditions; • appointing a suitably qualified and experienced drilling contractor; and • ensuring contingency plans are in place to deal with drilling fluid in the event of a frac-out.	Detailed design
HR13	Frac-out during underboring	Modelling of underbores would be undertaken to determine the risk of frac-out. This would include a geotechnical evaluation and construction risk assessment. Proposed construction methods would be evaluated to determine the lowest risk method.	Detailed design
HR14	Subsidence during underboring	For all rail underbores, a geotechnical settlement analysis is required by the rail authority. This analysis determines the risk of settlement based on the depth of cover of the underbore and the cross sectional area.	Detailed design
Visual amenity			
LV1	Design of construction laydown areas and work sites	Fencing around construction laydown areas and work sites and hoardings (where required) will take into consideration the landscape character of the local environment and proximity of sensitive receptors in selecting suitable materials and designs. Fencing around laydown areas within HCAs and public open space will prevent visibility of the internal works area.	Detailed design and construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
LV2	Night lighting at construction laydown areas	Night lighting at construction laydown areas will be minimised adjacent to residential properties. Where lighting is required, and a construction laydown area is positioned close to residences, lighting will be directed away from residential properties to avoid light spill into adjacent properties at night.	Detailed design and construction
LV3	Cable bridge design	Design principles for the final cable bridge designs will include integration of the structures into the surrounding landscape while meeting safety, technical and operational requirements. Bridges will be designed to reduce visual prominence, including surface treatment which avoids reflective materials.	Detailed design
LV4	Landscaping and rehabilitation	Ground stabilisation, landscaping and rehabilitation at cable bridge crossings will be undertaken once installation of the cable bridge is complete and will be monitored for a period of at least six months.	Construction and operation
LV5	Tree removal and replanting	The project will avoid the removal of trees wherever feasible and reasonable. Where avoidance is not possible, a tree replanting strategy/landscape plan will be developed in consultation with the relevant council. To mitigate the visual impact of tree removal, similar species of trees will be replanted, where feasible. Where this is not possible, suitable trees for specific local conditions will be determined. The suitability of the replacement trees will be confirmed by a qualified arborist, in consultation with TransGrid's cable specialists. Trees will be removed at the time of construction if trenching activities impact tree roots to a point where the tree is no longer viable (as determined by the project arborist). No trees will be removed within the parklands of Sydney Park in Alexandria, along Constitution Road in Dulwich Hill and at the Johnson Park Bushcare site in Dulwich Hill (this is consistent with BD9).	Construction and operation
LV6	Sydney Park impacts	The final transmission cable circuit will follow Barwon Park Road and existing stormwater infrastructure wherever possible to avoid impacting established trees within or adjacent to Sydney Park.	Detailed design and construction
Biodiversity			
BD1	Relocation of resident fauna	Pre-clearance survey of trees to be removed will be undertaken by a suitably qualified ecologist to identify/locate active nests in use by native animals. The removal of nest trees will be supervised by a qualified ecologist/licensed wildlife handler. Any fauna that will not disperse independently will be captured and relocated to a suitable location nearby. Prior to any disturbance by construction works, pre-clearance surveys of stormwater culverts and pipes that may be suitable habitat for roosting bats will be undertaken to identify bats for relocation.	Construction
BD2	Critical life-cycle events (e.g. breeding or nursing)	If active bird nests are identified during the pre-clearance survey, avoidance of vegetation clearing works during late winter/early spring breeding/nesting period will be considered.	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
BD3	Grey-headed Flying-fox habitat	Replanting with potential Grey-headed Flying-fox habitat vegetation will be undertaken within the project area where feasible, and in consultation with local councils.	Construction
BD4	Construction footprint	No temporary facilities i.e. site offices/toilets/equipment storage will be placed outside of the designated construction laydown areas or work sites. Access tracks to work sites outside of a road reserve will be clearly demarcated.	Construction
BD5	Temporary fencing	Work sites outside of the road reserve will be delineated with temporary fencing/barriers along the perimeter to avoid encroachment into vegetated areas.	Construction
BD6	Sedimentation of waterways	Appropriate controls will be utilised to manage exposed soil surfaces and stockpiles to reduce sediment discharge into waterways, in accordance with the Blue Book (Landcom, 2004). All works within proximity to drainage lines will have adequate sediment and erosion controls. Revegetation of disturbed areas will commence as soon as practicable to reduce the risk of erosion.	Construction
BD7	Dust generation	Dust suppression measures, as outlined in an AQMP, will be implemented during construction works to limit dust at work sites. Revegetation of disturbed areas will commence as soon as practicable to reduce areas likely to create dust.	Construction
BD8	Spread of weeds and pathogens	Vehicles, machinery and waste associated with construction will remain within work sites and laydown areas and will not impinge on areas of retained vegetation. Weeds (listed under the NSW *Biosecurity Act 2015*) present within construction laydown areas or work sites will be managed in accordance with the regional priority objectives of the Greater Sydney Regional Strategic Management Plan 2017 – 2022.	Construction
BD9	Construction staff training	All construction personnel will undertake an environmental induction that will include items such as: • potential or actual presence of threatened species or habitats; • site environmental procedures (vegetation management, sediment and erosion control, exclusion fencing and the prevention of the spread of weeds); • response to environmental emergencies (chemical spills, fire, and injured fauna); and • key environmental project personnel.	Construction
BD10	Tree removal and replanting	The project will avoid the removal of trees[4] wherever feasible and reasonable. Where avoidance is not possible, a tree replanting strategy/landscape plan will be developed in consultation with the relevant council. Similar species of trees will be replanted, where feasible. Where this is not possible, suitable trees for specific local conditions will be determined. The suitability of the replacement trees will be confirmed by a qualified arborist, in consultation with TransGrid's cable specialists.	Construction and operation

No.	Impact/issue	Environmental management and mitigation measures	Timing
		Trees will be removed at the time of construction if trenching activities impact tree roots to a point where the tree is no longer viable (as determined by the project arborist). No trees will be removed within the parklands of Sydney Park in Alexandria, along Constitution Road in Dulwich Hill and at the Johnson Park Bushcare site in Dulwich Hill.	
BD11	Cable monitoring for tree impacts	Where cable monitoring systems identify a potential impact of tree roots on the operating transmission cable, a qualified arborist will be called on to investigate further. If there is potential for damage to the cables, the tree will need to be removed. Removal will be limited to only trees that are affecting the transmission cable.	Operation
BD12	Tree retention	The following will be considered during the detailed design phase to retain trees wherever possible: • review the alignment of the transmission cable circuit to avoid impacting the structural root zone (SRZ) or more than 10% of the tree protection zone (TPZ) where possible, with priority consideration given to heritage areas and high retention value trees; and • locate construction facilities and infrastructure (e.g. site offices, plant/equipment storage) outside of tree protection zones.	Detailed design
B13	Tree protection	The following tree protection measures will be implemented: • all tree pruning must be in accordance with the AS 4373-2007 Pruning of Amenity Trees (Standards Australia 2007) and the Code of Practice for the Amenity Tree Industry (NSW WorkCover, 1998); • all tree work on retained trees is to be carried out by an arborist with a minimum AQF Level 3 qualification in Arboriculture; • trunk, branch and/ or ground protection measures for high retention value trees that extend into or are located in the roadway, will comply with AS 4970-2009 Protection of trees on development sites (Standards Australia, 2009a); and • ground protection will be used within the TPZ and SRZ, where possible, to prevent root damage caused by compaction of the soil and the loss of water infiltration and oxygen to the trees root system. Ground protection may include a permeable membrane such as geotextile fabric beneath a layer of mulch, crushed rock or rumble boards. The location and distribution of roots of trees to be retained will be determined through low or non-destructive excavation methods such as hydro-vacuum excavation (sucker truck), air spade and manual excavation, where required, immediately prior to excavation works commencing.	Construction
BD14	Tree monitoring	A qualified arborist will be consulted in the event there is a change to the condition of high retention value trees in the project area due to construction activity. A qualified arborist will inspect high retention value trees within the project area for any damage once construction is completed and tree protection measures have been removed.	Construction and operation

No.	Impact/issue	Environmental management and mitigation measures	Timing
BD15	Cable installation in key fish habitat	DPI Water's *Controlled activities on waterfront land – Guidelines for laying pipes and cables in watercourses on waterfront land* (DPI, 2012) will be used to inform the cable installation at the Cooks River.	Detailed design
BD16	Protection of water quality in the Cooks River	The following water quality measures will be implemented: • water collected during construction (e.g. during dewatering or surface water inflows to the trench or pits) will be discharged or disposed of in accordance with the *Protection of the Environment Operations Act 1997 and the ANZECC Water Quality Guidelines (2000) for 95% protection level for marine ecosystems;* • the water discharge point will be at a stable point on the bank or across riparian vegetation to allow slowing of water before travelling further downstream. Where feasible, the velocity of downstream flows will not exceed natural seasonal flow velocities. Sediment and erosion mitigation measures will be implemented in accordance with ESCPs; and • contaminated water captured during construction will be disposed of at an appropriately licensed facility.	Detailed design and construction
BD17	Habitat restoration and weed control at the Cooks River	If vegetation is removed along the Cooks River, rehabilitation and revegetation will be undertaken (where not constrained by permanent operational infrastructure) to maintain the connectivity of riparian corridors along the river. Weed control will also be implemented within the project area at the Cooks River to maintain restored areas as weed free.	Construction
BD18	Offset for mangrove removal	Should any Grey Mangrove at the Cooks River (which constitutes key fish habitat) require removal due to the project, this will be offset in accordance with DPI Fisheries requirements under the *Policy and guidelines for fish habitat conservation and management* (DPI, 2013), to ensure no net loss of key fish habitat	Construction
Aboriginal heritage			
AH1	Impacts to areas of Aboriginal archaeological sensitivity and/or impacts to Aboriginal sites	If impacts to the area of potential Aboriginal archaeological sensitivity at Mildura Reserve, Campsie cannot be avoided, a program of archaeological test excavation will be required to determine the presence or absence of subsurface Aboriginal objects. The methodology for investigating and managing areas of Aboriginal archaeological sensitivity and known Aboriginal sites/objects will be detailed in an Aboriginal Cultural Heritage Management Plan (ACHMP) for the project. The ACHMP will be prepared in consultation with Registered Aboriginal Parties (RAPs) and Department of Planning, Industry and Environment (DPIE). Subject to ACHMP approval by DPIE, this document will guide the management of Aboriginal cultural heritage within the project area throughout the life of the project.	Construction
AH2	Site inductions	Prior to the commencement of works, all construction personnel will undergo an Aboriginal heritage induction which identifies the general nature of Aboriginal sites and objects, the location of areas of archaeological sensitivity, requirements of the ACHMP (if relevant), procedure for unexpected finds, personnel responsibilities, and safeguards to be implemented to protect and avoid impacts to Aboriginal sites, if discovered.	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
AH3	Unexpected Aboriginal objects or human remains	If unexpected Aboriginal objects or human remains are uncovered in the project area during construction, TransGrid's Unexpected Finds Protocol will be initiated. This includes[5]: 1. All ground surface disturbance in the area of finds should cease immediately when the finds are uncovered and relevant personnel will be notified; 2. If the find is suspected to be human skeletal material, the NSW Police will be contact immediately; 3. If there is substantial doubt regarding an Aboriginal origin for the finds, then a qualified opinion from an archaeologist will be sought as soon as possible; 4. If a qualified opinion cannot be gained or the identification is positive, immediately notify the following authorities or personnel of the discovery: a. OEH (Environment Line: 131 555); b. Relevant Aboriginal Community Representatives 5. Immediately notify the following authorities or personnel of the discovery: a. OEH (Environment Line: 131 555); b. Relevant Aboriginal Community Representatives. 6. Facilitate, in co-operation with the appropriate authorities and relevant Aboriginal community representatives: a. the recording and assessment of the finds; b. fulfilling any legal constraints arising from the find(s). This will include complying with OEH directions; and c. the development and conduct of appropriate management strategies. Strategies will depend on consultation with stakeholders and the assessment of the significance of the find(s). Where the find(s) are determined to be Aboriginal Objects, any re-commencement of construction related ground surface disturbance will only resume in the area of the find(s) following the preparation of an ACHMP for the project, if one does not already exist.	Construction
Non-Aboriginal heritage			
NAH1	Impact on Alexandra Canal and Potts Hill Reservoirs 1 and 2	Works in the vicinity of Alexandra Canal at Beaconsfield West substation and the Potts Hill Reservoirs 1 and 2 will be managed by the Cultural Heritage Management Plan (CHMP) (refer to NAH6) to ensure that there are no direct impacts on the canal walls or the reservoirs.	Construction

[5] As per Appendix E – Unexpected Finds Protocol, TransGrid Aboriginal Heritage Due Diligence Assessment (Document ref: D2018/05672)

No.	Impact/issue	Environmental management and mitigation measures	Timing
NAH2	Removal of street trees/plantings at the intersection of Seventh Avenue and Fifth Avenue (Canterbury LEP 2012 Item 55)	The project will avoid impacts to heritage listed street plantings on Fifth Avenue wherever feasible and reasonable. During construction, manual excavation and monitoring by an arborist, with exclusion fencing used to protect trees from indirect impacts if there are works in their immediate vicinity will be considered. If tree removal cannot be avoided, a tree replanting strategy will be discussed and agreed with the relevant local council, in consideration of the Canterbury Bankstown Tree Management Manual (Canterbury Bankstown Council, 2015).	Detailed design and construction
NAH3	Impacts on the Brick Paving (Marrickville LEP 2011 Item 98)	The design of the final transmission cable route will avoid the footpath that includes the brick paving that is immediately adjacent to the transmission cable route.	Detailed design and construction
NAH4	Impact on heritage values of the HCAs from tree removal	Removal of street trees identified as providing contributory heritage values within HCAs will be avoided where possible. If tree removal cannot be avoided, a tree replanting strategy will be developed in consultation with the relevant local council.	Construction
NAH5	Damage to heritage structures from vibration	Minimum working distances will be enforced when working in proximity to heritage structures. This includes: • hand held jack hammers will be used, if needed, at least one metre away from the location of a heritage item; • hydraulic hammers up to 300 kilograms only be used if greater than four metres away from the location of a heritage item; • hydraulic hammers up to 900 kilograms will only be used if greater than 12 metres away from the location of a heritage item; and • hydraulic hammers up to 1,600 kilograms will only be used if greater than 34 metres away from the location of a heritage item. If minimum working distances cannot be maintained during construction, a CHMP will be developed that includes building condition surveys and/or vibration monitoring as per environmental management measure NV14.	Construction
NAH6	General construction impacts	A CHMP will be produced for the project as part of the CEMP, to manage any impacts on identified heritage items. The CHMP will: • guide appropriate responses to identified heritage constraints during construction; • define limits to machinery use and construction activity in proximity to heritage structures to avoid vibration impacts;	Detailed design and construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
		• detail where and when monitoring will be undertaken to ensure no vibration or other indirect impacts on identified heritage items; • define any protectionary fencing required to delineate safe working areas and/or no-go areas in relation to heritage protection; and • include maps showing the location and curtilage of heritage items. A toolbox presentation or project induction will be held with all staff and contractors prior to the commencement of works to make them aware of their responsibilities with regard to avoiding heritage impacts. Once the final design is known, the relevant local councils within the project area will be informed of any anticipated impacts to heritage items.	
NAH7	Unexpected finds	In the event that unexpected historic finds are identified during construction, all works will immediately cease at that area. Unexpected finds may include artefact scatters (including glass, animal bone, ceramic, brick and metal), building foundations and earthworks of unknown origin. The following procedure guides the management of unexpected and previously unidentified finds during the course of project works: • all work in the area will cease immediately; • alert the Environmental Specialist to the find; • if necessary, protect the area with fencing; • engage a suitably qualified archaeologist to undertake an assessment of the find/s; • if it is determined the relic is likely to be significant, a Section 146 notification form will be sent with a short letter report to the Heritage Council notifying them of the discovery; • an assessment will be undertaken using the guidelines *Assessing Significance for Historical Archaeological Sites and 'Relics'* (NSW Heritage Branch, 2009); • on the advice of the archaeologist, if necessary, prepare an Impact Assessment with Research Design and Methodology to submit to the Heritage Division along with a Section 140 excavation permit to undertake archaeological works; • undertake the archaeological mitigation in accordance with the prepared documents and any permit/exception issued by the Heritage Division; and • once the site has been mitigated to the satisfaction of the archaeologist and the Heritage Division, works may resume in the area.	Construction
Soils and contamination			
CT1	Assessment of excavation areas	Soil investigations will be undertaken prior to construction along the project area to: • assess the presence of contamination and risks posed to project workers and the environment, so that appropriate controls can be implemented during construction;	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
		• chemically classify the soil *in-situ,* for potential re-use or off-site disposal to licensed landfill or re-use facility in accordance with the applicable land use criteria, Waste Classification Guidelines (NSW EPA, 2014a) or applicable Resource Recovery exemption and order; and • assess for the presence of acid sulfate soils and liming rates, so Acid Sulfate Soils Management Plans (ASSMPs) can be prepared and waste classified in accordance with Waste Classification Guidelines (NSW EPA, 2014a). A Sampling Analysis Quality Plan (SAQP) will be prepared for soil investigation in accordance with the NEPM (ASC NEPM, 2013). The SAQP will detail: • data quality objectives (DQOs) and data quality indicators (DQIs); • justification of the number, density and location of sampling locations based on the potential for contamination, excavation extent and quantities requiring off-site disposal; • analytical suite and schedule, including contaminants of concern identified; • assessment criteria for on-site reuse or off-site disposal (waste classification); and • sampling and laboratory methodologies, field and laboratory quality assurance and control. Following the completion of the soil investigations a report will be prepared for each construction precinct providing conclusions on waste classification and recommendations for health and environmental controls during construction. The reports will provide clear commentary on the classification of the waste in accordance with the Waste Classification Guidelines (NSW EPA, 2014a).	
CT2	Assessment of imported Virgin Excavated Natural Material (VENM)	Prior to the backfilling of trenches during construction with VENM, the VENM source(s) will be identified and assessed against the definition of VENM in the Waste Classification Guidelines (NSW EPA, 2014a) and *Protection of the Environment Operations Act 1997* (POEO Act). The VENM source(s) will be assessed by an appropriately qualified contaminated land consultant, which will entail: • identifying whether the current and past activities at the source site that had potential to contaminate the land, whether actual acid sulfate soils (AASS) or potential acid sulfate soils (PASS) is present and that the site is not within an area mapped as containing naturally occurring asbestos; and • undertaking chemical assessment to ascertain that the material is not contaminated. The NSW EPA VENM certificate will be completed and signed by the consultant (or supplier) and provided to TransGrid prior to importation and use of the VENM. The VENM will also be inspected at the work site to check the imported VENM is from the same source assessed.	Construction
CT3	Construction laydown areas	Limited baseline soil investigations and site inspections will be undertaken for each construction laydown area to manage identified risks during construction. The investigations will include limited sampling to identify and assess contamination in surface soil. A baseline report will be prepared for each construction laydown area. Where contamination is identified, a site-specific management plan will be implemented prior to construction to	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
		inform the management of asbestos or chemical contamination in soil while the construction laydown area is in use. Following demobilisation of the construction laydown area a post–construction report will be prepared for each construction laydown area. The post-construction report will compare to the baseline report and confirm whether or not conditions are the same and if remedial works are required to clean up contamination from the project works within the construction laydown areas.	
CT4	Contaminated soil management during construction	Protocols for the management of contaminated soil during construction will be included in the CEMP for all construction works and will: • detail requirements for safety controls including the following where required: - air monitoring; - exclusion zones and decontamination; - excavation ventilation; - dust suppression and containment; - odour suppression and monitoring; - personnel protective equipment; - training and supervision; • detail requirements for environmental controls including the following: - sediment and erosion control; - management of surface water runoff around the excavation areas and prevention of surface water entering excavations; - stockpile management and separation; and - materials tracking and records. Sediment and erosion mitigation measures will be implemented in accordance with ESCPs.	Construction
CT5	Spoil waste management and transport	Spoil which has been assessed as not suitable for reuse or cannot be reused will be classified in accordance with the Waste Classification Guidelines (NSW EPA, 2014a). The spoil will be transported to an appropriate waste disposal facility licensed to receive such waste. Approval will be obtained from the respective landfill facility prior to transport and will require an estimate of the likely volume of waste to be disposed. The following material handling requirements will be implemented for trucks transporting materials off-site: • a licensed transporter will be used to transport material to an appropriately licensed NSW EPA waste facility; • all truck loads will be filled to the correct level and not over filled; • trucks carrying waste materials will be covered prior to exiting the work site and will remain covered until authorised to unload at the destination (NSW EPA licensed waste facility);	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
		• trucks will be fitted with seals to ensure that the movement of potentially saturated materials is undertaken appropriately. The integrity of the seals will be inspected and tested prior to commencement of each day's haulage works; • in the event that materials are tracked or spilt outside of the construction zone, soil will be immediately cleaned up in a way that prevents contamination of land, the stormwater or waterways; and • all truckloads and landfill waste tickets/dockets will be tracked and a register completed to reconcile and check spoil has been lawfully disposed. Temporary spoil stockpiles may be stored at select construction laydown areas. As all spoil will be classified in-situ prior to excavation, the stockpiled material will already be classified in accordance with the NSW EPA guidelines. Stockpiles will be kept separate based on their classification. All stockpiles will be tracked in accordance with protocols within the CEMP for material tracking. Stockpiles will be managed with appropriate sediment and erosion controls as outlined in an ESCP.	
CT6	Asbestos management	An Asbestos Management Plan (AMP) will be developed for areas identified during pre-construction investigations as containing Asbestos Containing Materials (ACM), areas suspected of containing ACM and to address unexpected finds of ACM during construction. Specifically, protocols will be stipulated for separation, monitoring, validation and clearance of asbestos. The AMP and associated Standard Work Procedures will satisfy the requirements of: • Work Health and Safety Regulation 2011; • the Safe Work Australia Asbestos Codes of Practice and Guidance Notes: - Code of Practice: How to Manage and Control Asbestos in the Workplace; - Code of Practice: How to Safely Remove Asbestos; and - Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibre, 2nd Edition [NOHSC: 3003 (2005)]. An Occupational Hygienist (Hygienist) will be on-site for the duration of the excavation works where ACM has been identified from pre-construction or where unexpected finds of ACM are encountered. The Hygienist will: • undertake air monitoring for asbestos during excavation; • provide on-site visual inspection, identification of asbestos impacted material and clearance of non-asbestos impacted surfaces; and • supervise works to ensure compliance with the AMP and NSW regulatory requirements for asbestos containing material management and disposal. In the event that friable asbestos is detected, a suitably licensed Asbestos Removal Contractor (licensed to undertake friable asbestos (Class A) removal) will be required to undertake and oversee all the asbestos removal and disposal works outlined in the AMP.	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
		All persons performing the works will be required to undertake a suitable risk assessment and develop a Safe Work Method Statement (SWMS) for all of their work activities prior to commencing work in ACM impacted areas. Identified ACM will be segregated, managed and disposed of as Special Waste and transported and disposed in accordance with Protection of the Environment Operations (Waste) Regulation (2014). Where more than 100 kg of asbestos waste or more than 10 square metres of asbestos sheeting is transported the NSW EPA online tool WasteLocate will be used. The handling and disposal of asbestos waste will be tracked and recorded.	
CT7	Acid sulfate soils	ASSMPs will be prepared in accordance with the ASSMAC (1998) guidelines based on the results of the pre-construction investigations for locations within Precinct 2, 3, 4 and 5. The ASSMPs will incorporate the following procedures: • soil will be treated with lime in accordance with the ASSMP where PASS is not able to be loaded and transported to a landfill licensed to receive untreated PASS within 24 hours of excavation or if AASS are identified and excavated; • exposure of PASS material within an excavated trench or excavation site will be minimised to reduce the potential for oxidation and acid leachate generation; • excavation will be done under dry conditions, where possible using a truck and shovel (tracked excavator) operation and the water table will be lowered within excavation areas, as part of excavation dewatering; • excavated fill will be monitored for colour and leachate quality; • no PASS material will be placed and left at the surface untreated; • soil will be placed into an appropriately bunded treatment area (pads) and treated with a neutralising agent (e.g. lime). Leachate water from the PASS material will be managed and treated to ensure no acid is released to the environment; • leachate generated during the ASS treatment operations will be captured. Any water potentially affected by leachate collecting within the excavation will be treated with hydrated lime or equivalent prior to discharge. Water potentially affected by leachate accumulating within the work site will not be discharged until it meets acceptable water quality standards or collected and disposed at a licensed liquid waste treatment facility; and • PASS materials will be kept separate from non-PASS materials at all times to reduce the volume of material requiring treatment. Acid is transported by water; therefore, excavation works in PASS will be conducted during dry periods (where practical) to minimise the risk of overflow associated with sudden or heavy rain and to allow better control of treated waters for discharge.	Construction
CT8	Unexpected finds	An unexpected finds procedure will be included in the CEMP. An unexpected find is potential contamination that was not previously identified during this PSI or pre-construction investigations. Project workers will be trained in identifying the following:	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
		• soil that appears to be contaminated based on visual and olfactory (odour) observations; • ACM (i.e. either bonded or friable asbestos); • groundwater that appears to be contaminated based on visual and olfactory (odour) observations (including potential hydrocarbon sheens on the water surface, free phase liquids such as petroleum fuel, discolouration etc.); • drums or underground storage tanks (USTs); and • fill containing wastes (e.g. slag, refuse, demolition materials). In the event of an unexpected find: • excavation works will temporarily be suspended at the location of the unexpected find, the environment manager contacted and the area of concern appropriately isolated; • the area will be inspected by a contaminated land consultant and if required, appropriate sampling and analysis will be undertaken, the sampling works will be documented in a report; • the requirement for additional controls will be assessed by the consultant and implemented by the proponent; and • workplace health and safety and environmental protection requirements will be reviewed, depending on the type of unexpected finds encountered.	
CT9	Former landfill management	Site-specific management plans for former landfill sites will be required for excavation works in Sydney Park and Camdenville Park. A plan may also be required for Henson Park following the outcome of investigations (see CT1). The development of the plans will include consultation with the relevant councils. Approval will be sought from the NSW EPA in all areas where exhumation of landfill waste is required in accordance with Clause 110A of the *Protection of the Environment Operations Legislation Amendment (Waste) Regulation 2018 (Amendment Regulation).* Where there are existing environmental management plans, such as for Camdenville Park, site-specific mitigation measures outlined in these plans will be reviewed and implemented as required. The plan will be prepared by a contaminated land consultant and occupational hygienist. The plan will specify: • an excavation plan specifying areas classified as per in-situ waste classification and suitability for reuse; • trench ventilation during excavation to prevent the accumulation of landfill gases within the trench (also refer to AQ12); • ambient and in-trench monitoring for landfill gases (methane, carbon dioxide, hydrogen sulfide and carbon dioxide), ammonia and volatile organic compounds; • action levels for evacuation of the work zone where health and lower explosive limit (LEL) levels are exceeded and additional controls to allow work to re-commence once implemented;	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
		• exclusion zone around the work area on either side of the trench, including fully fenced security chain mesh fences with bracing, where required; • geotechnical considerations for the base of the trench to mitigate the risk of subsidence of the installed cable; • final capping layer above the concrete cable conduit casing as per the Environmental Guidelines Solid Waste Landfills (NSW EPA, 2016), unless otherwise specified or agreed by with City of Sydney Council and Inner West Council: - compacted clay layer at least 600 mm thick, with an in situ saturated hydraulic conductivity of less than 1 x 10–9 metres/s (where subsurface waste either side of the trench is less than; - a revegetating layer from the top of the capping layer to the surface comprising clean soils with 200 mm of topsoil (in landscaped areas); and • the construction of joint bays, link boxes and sensor pits within former landfill areas will be designed to prevent the accumulation of landfill gases. Inner West Council and City of Sydney Council will be consulted on the design, monitoring and location of the pits within Sydney Park, Camdenville Park, and Henson Park (if required).	
CT10	Sydney Park	TransGrid will undertake additional investigations at Sydney Park on leachate and methane risks prior to or during construction and will report these findings to the City of Sydney.	Detailed design and construction
CT11	Drilling slurry	TransGrid will investigate and adopt good practice measures for the management of drilling slurry during horizontal directional drilling, where used, taking into consideration the volume of slurry that will be generated.	Detailed design and construction
Surface water and flooding			
WQ1	Water quality, soil erosion and sediment control (CSWMP)	A CSWMP will be prepared as part of the overall CEMP to document the measures required to mitigate and manage potential impacts on soils, surface water and groundwater during construction. The CSWMP will include the following sub-plans and measures: • ESCPs (see WQ2); • where wheel washing is required, wheel wash wastewater will be collected (e.g. through temporary containment and directing to sediment basins or tanks) and disposed of appropriately; • water collected during construction (e.g. during dewatering or surface water inflows to the trench or pits) would be discharged or disposed of in accordance with the *Protection of the Environment Operations Act, 1997 and the ANZECC Water Quality Guidelines (2000) for 95% protection level for marine ecosystems.* Contaminated water captured during construction would be disposed of at an appropriately licensed facility; and	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
		• where works are within the riparian zone (40 metres from the top of the watercourse bank) the *Controlled Activities on Waterfront Land Guidelines* (DPI, 2012) would be reviewed and relevant measure included into the CSWMP where appropriate. Procedures and protocols to manage potentially contaminated fill, soil, bedrock, acid sulfate soils and extracted groundwater will be detailed in the CEMP in accordance with conditions outlined in the Preliminary Site Investigation report (refer to **Appendix K**) and the *NSW Acid Sulfate Soils Manual* (Stone *et al*, 1998).	
WQ2	Water quality, soil erosion and sedimentation (ESCP)	ESCPs will be prepared as part of the CEMP for transmission cable route work sites, substations and construction laydown areas, in accordance with the Blue Book (Landcom, 2004). ESCPs will be implemented in advance of site disturbance and updated as required as the construction progresses and the work site locations change. Measures in the ESCPs will include: • construction traffic to be restricted to access tracks, where existing roads cannot be utilised (e.g. through Sydney Park). These access tracks will be clearly delineated and maintained until construction is complete; • where possible, clean water will be prevented from entering excavations by diverting runoff away from earthworks activities; • the extent of ground disturbance and exposed soil will be minimised to the greatest extent practicable to minimise the potential for erosion; • disturbed ground and exposed soils, such as inside trenches or at construction laydown areas, will be temporarily stabilised (e.g. with geotextile) prior to extended periods of site inactivity and permanently stabilised as soon as possible to minimise the potential for erosion; • stormwater flows will be managed to avoid flow over exposed soils which may result in erosion and impacts to water quality. Inside the excavation this may require the use of trench stops; and • rainfall forecasts will be monitored daily during construction and works rescheduled if necessary and as determined by the contractor, to reduce risk of erosion and sedimentation and to minimise the impact of heavy rainfall and flood events.	Construction
WQ3	Water quality – spills and leaks	The following measures will be documented in the CSWMP and implemented to mitigate and manage spills and leaks: • areas will be allocated for the storage of fuels, chemicals and other hazardous materials. These areas will be as far away as feasible and reasonable from watercourses, located where flooding during a 20 year Average Recurrence Interval (ARI) event is unlikely, and on an impervious bunded area; • the storage and handling of dangerous goods will be in accordance with relevant guidelines and standards such as the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005); • fuel and liquid storage at construction laydown areas will be secured and stored in accordance with the NSW EPA guidelines (Department of Environment and Climate Change NSW, 2007b);	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
		• appropriate spill containment and prevention measures will be applied to fuel and liquid storage, where feasible and reasonable; • accidental spills or leaks will be managed through the use of spill containment measures including spill kits. Any contaminated material will be disposed of to an appropriately licenced facility; • re-fuelling of construction plant and equipment will be undertaken using appropriate spill containment measures to mitigate pollution risks from accidental spills or leaks; • refuelling activities will be undertaken at least 100 metres from the nearest watercourse; • a spill response kit will be available on-site at all work sites at all times; • where bulk fuel or other liquid substances are to be brought to a work site, a container specifically designed for that purpose will be used; • underboring sites will have appropriate stormwater diversions, as well as downstream pollution and sediment control measures to both prevent stormwater entering the excavation as well as to assist with containing any loss of drilling fluid; and • flows of drilling fluid will be visually monitored in accordance with the CSWMP.	
FF1	Flooding and water flows (FMS)	A Flood Mitigation Strategy (FMS) will be prepared in accordance with the *Floodplain Development Manual* (DIPNR, 2005) for work within flood prone or flood affected land within the project area to demonstrate that the existing flooding characteristics will not be exacerbated. The FMS will be prepared by a suitably qualified and experienced person in consultation with directly affected landowners, DPI-Water, DPIE, Sydney Water and relevant councils. The FMS will be prepared during detailed design and prior to construction. The FMS will identify design and mitigation measures that will: • be considered by the contractor in the development of site-specific flood management plans, including the need to protect plant, staff, materials and earthworks activities from flooding (also refer to FF3); • avoid or reduce impacts at adjacent properties; and • not significantly alter surface water flows during construction and operation. The FMS will limit flooding characteristics to the following levels, or else provide alternative flood mitigation solutions consistent with the intent of these limits: • a maximum increase in inundation time of one hour in a 100 year ARI rainfall event; • a maximum increase of 10 millimetres in inundation at properties where floor levels are currently exceeded in a 100 year ARI rainfall event; • a maximum increase of 50 millimetres in inundation at properties where floor levels would not be exceeded in a 100 year ARI rainfall event; and • no inundation of floor levels which are currently not inundated in a 100 year ARI rainfall event.	Detail design

No.	Impact/issue	Environmental management and mitigation measures	Timing
FF2	Flooding and water flows at Cooks River	The FMS will outline specific measures for the construction of the proposed cable bridge over the Cooks River to minimise impacts associated with impeding surface water flows. This will include: • where possible, construction will take place outside of the floodplain; • construction will not be undertaken during flooding events; • temporary mobile plant will be used during construction that can be quickly removed in the event of a flood; • the crossing will be designed to be elevated above the 100 year ARI floodplain extent (as identified in the FMS), subject to consultation with Sydney Water and the relevant road authority; and • if abutments or piers are required within the floodplain and within an area with significant depth or velocity during flood events, or are likely to affect an overland flow path, then a quantitative flood impact assessment will be prepared for the crossing to meet the requirements of mitigation measure FF1. If these requirements cannot be met, design changes for this crossing may be required. These changes will be discussed with the relevant authorities, where necessary.	Detail design and construction
FF3	Flooding and water flows during construction	Flood Management Plans (FMPs) will be developed as part of the CSWMP for works within flood prone or flood affected land within the project area. Measures to be detailed in the FMPs to manage potential flood and water flow impacts would include: • the construction of the project will be staged to limit the extent and duration of temporary works in a floodplain; • work inside ephemeral watercourses including, but not limited to the Coxs Creek and other urban drainage network assets, will not be undertaken during or immediately following runoff generating rainfall events when stormwater flows in these watercourses are expected; and • flood emergency response procedures will be documented within the FMPs to make sure construction equipment and materials are removed from floodplain areas at the completion of each work activity or in the event a weather warning is issued for impending flood producing rain.	Construction
FF4	Camdenville Park flood detention basin	Design of the transmission cable route through Camdenville Park will consider the integrity and functionality of the existing flood detention basin.	Detail design
Groundwater			
GW1	Groundwater interception	A Groundwater Management Strategy will be prepared that will outline the requirement for drilling and installation of monitoring wells and baseline groundwater level and quality monitoring. This additional information will be collected prior to or during detailed design in locations where it is likely that the watertable may be intersected. This data will be used to confirm whether groundwater control measures or dewatering will be required. Where it is likely that groundwater will be intersected, estimates of groundwater inflows will be predicted to	Detailed design

No.	Impact/issue	Environmental management and mitigation measures	Timing
		assess if a groundwater extraction license would be required (that is if 3 ML/year of groundwater discharge was to be exceeded). Outcomes from the GMS will inform the Construction Environmental Management Plan (CEMP). The CEMP, where necessary: • measures to stabilise the excavation, such as installation of temporary shoring in trenches (e.g. sheet piling); • localised temporary dewatering measures to maintain dry working conditions; • measures to maintain groundwater flow conditions to minimise disruption to down-gradient receptors; and • measures to minimise groundwater drawdown to reduce any ground settlement impacts.	
GW2	Aquifer interference	Detailed hydrogeological information (e.g. bore data) will be used to inform the most suitable underboring construction method at select special crossings that will minimise the need for dewatering. Where an aquifer is to be completely penetrated at the underboring special crossings, appropriate controls (such as drainage blankets) will be installed beneath the infrastructure to ensure groundwater flow is maintained to minimise disruption to groundwater flow paths.	Detailed design
GW3	Intersection of contaminated groundwater	In areas where contaminated groundwater is identified, measures will be implemented to ensure that the backfill within the excavation does not create a more permeable pathway for migration of contamination.	Detailed design and construction
GW4	Dewatering	A CSWMP will be prepared as part of the CEMP to document the measures required to mitigate and manage potential impacts on groundwater during construction. The CSWMP would include the following measures: • water collected during dewatering of excavations would be discharged or disposed of in accordance with the *Protection of the Environment Operations Act 1997* and the *ANZECC Water Quality Guidelines* (2000) for 95% protection level for marine ecosystems; and • contaminated groundwater captured during construction will be disposed of at an appropriately licenced facility.	Construction
Waste management			
WM1	Waste minimisation	The following waste minimisation strategies will be implemented: • use of recycled materials (i.e. recycled content for asphalt and concrete including the use of fly ash) wherever feasible; • use of wastewater or recycled water to reduce potable water demand for construction activities; and • use of modular, precast/prefabricated structures, where feasible.	Detailed design and construction
WM2	General	Waste will be managed in accordance with the waste hierarchy established in the *Waste Avoidance and Resource Recovery Act 2007* (WARR Act). This will include the:	Construction and operation

No.	Impact/issue	Environmental management and mitigation measures	Timing
		• classification of waste during construction in accordance with the current guidelines; • segregation of waste at construction laydown areas and substations (within appropriate bins) for ease of recycling/reuse; • procurement of materials on an as needed basis to avoid waste due to over-ordering; and • investigating opportunities to reuse materials where feasible.	
WM3	Construction waste	Waste will be managed (classified, handled and stored) in accordance with relevant state legislation and government policies (including the NSW EPA *Waste Classification Guidelines*). All waste to be disposed off-site will be directed to a waste management facility that is lawfully permitted to accept that type of waste. Records of waste tracking and disposal will be maintained.	Construction and operation
WM4	Spoil management	The Waste Management Plan developed for the project as part of the CEMP will outline the requirements for spoil management. The plan will identify: • spoil generation activities; • spoil generation location; • spoil management hierarchy; • on-site management, including stockpile sites; • spoil reuse options • spoil disposal locations; • spoil transport modes and routes; and • material tracking requirements.	Detailed design and construction
WM5	Asbestos waste	The disturbance, movement and disposal of asbestos containing materials will be carried out in accordance with the Work Health and Safety Regulation 2011 and other relevant guidelines. The handling and disposal of asbestos waste will be tracked in accordance with the Asbestos Management Plan (refer to CT6).	Construction
WM6	Construction wastewater	Wastewater not used on-site will be disposed off-site or discharged into the local stormwater system in accordance with the requirements of the POEO Act.	Construction
WM7	Spoil reuse	Reasonable and feasible options will be investigated to reuse spoil (where it can be achieved safely) in accordance with the POEO Act and WARR Act.	Detailed design and construction
WM8	Concrete recycling	Opportunities to recycle concrete (i.e. from excavation of concrete roads) will be investigated.	Detailed design and construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
Land use and property			
LP1	Property use	Agreements will be negotiated with relevant landowners for the temporary use of property during construction and permanent easements over private property during operation.	Detailed design and construction
LP2	Traffic and access disruptions	Affected landowners/occupants will be provided with advance notification of project construction schedules and changes to access arrangements or traffic disruptions.	Construction
LP3	Vehicle access	Vehicle access to residential and business properties will be maintained at all times, where possible. Where restricting access to properties is required to enable construction works, vehicle access will be restored as soon as possible. Where access to a property cannot be maintained, affected owners/occupants will be informed and feasible and reasonable solutions for access to their specific location discussed.	Construction
LP4	Temporary land use change	Construction laydown areas will be reinstated to their pre-existing condition as soon as practicable following the completion of construction, in consultation with the relevant landowner.	Construction and operation
LP5	Identification of utilities	Further surveys (including pot holing) will be undertaken to confirm the locations of major utilities identified in DBYD. Thermal resistivity assessments will be undertaken to determine the potential for reduced trench widths in order to minimise the need for utility relocation or support/protection measures.	Detailed design
LP6	Disruption of services or relocation of utilities	Where services need to be disrupted or utilities relocated, relevant stakeholders will be consulted and affected communities notified.	Detailed design and construction
LP7	Utility damage	Where works are to be carried out in close proximity to utilities, consultation will be undertaken with the relevant utility provider to determine safety and network integrity requirements.	Construction
Social and economic			
SE1	Community consultation	Implementation of the project CCF (refer to **Appendix C**).	Detailed design and construction
SE2	Social infrastructure	Construction laydown areas within private and public reserves and parks will be planned to minimise impacts on existing recreational and sporting infrastructure, including playground equipment, with construction laydown areas located in areas of open space, where possible. Establishment and use of the laydown areas will consider public safety and maintain safe access to recreational areas.	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
		Private and public reserves and parks proposed for the construction laydown areas will be returned to their original or improved condition following construction (or as otherwise agreed with the relevant authority). Access to community facilities along the transmission cable route and in proximity to construction laydown areas will be maintained at all times unless an alternative solution has been negotiated with the landowner/occupier. Access to areas of reserves and parks not utilised for construction laydown areas will be maintained throughout construction.	
SE3	Access and transport	Opportunities to enhance pedestrian and cyclist connectivity within the local study area, including design of cable bridges to accommodate pedestrian and cyclist movements will be investigated during detailed design, in consultation with relevant stakeholders. The construction workforce will be encouraged to travel to and from work sites via public transport or use car-pooling to reduce impacts on local parking. Temporary relocation of bus stop facilities will be undertaken in consultation with the relevant road authority, bus operators and TfNSW. The relocated bus stops will be reinstated at their original location as construction works are completed in each location. Vehicle access to residential and business properties will be maintained at all times, where possible. Where restricting access to properties is required to enable construction works, vehicle access will be restored as soon as possible. Where access to a property cannot be maintained, affected owners/occupants will be informed and feasible and reasonable solutions for access to their specific location discussed.	Detailed design and construction
SE4	Business impacts	Vehicle access to business properties will be maintained at all times, where possible. Where restricting access to properties is required to enable construction works, vehicle access will be restored as soon as possible. Where access to a property cannot be maintained, consultation will be undertaken with affected landowners/occupants, in accordance with the CCF, to identify appropriate timeframes for restricting access, or to negotiate alternative solutions. Construction activities undertaken in proximity to businesses will maintain visibility of business frontage, associated signage and access points, where possible. Business impacts resulting from changes to amenity or access will be managed in line with mitigation measures identified for other relevant environmental issues.	Construction
SE5	Utilities impacts	Consultation and construction planning with relevant utility/service providers (including councils, TfNSW, Sydney Trains, ARTC and Roads and Maritime) and measures such as searches of DBYD will be undertaken to minimise the potential for damage or disruption to utilities and services.	Detailed design and construction
SE6	EMF impacts	Information about potential EMF levels and the relevant health guidelines will continue to be provided to stakeholders in proximity to the cable route as part of community consultation undertaken for the project.	Construction

No.	Impact/issue	Environmental management and mitigation measures	Timing
SE7	Sydney Park impacts	Construction works within Sydney Park will be undertaken in stages and appropriate diversions for access provided to minimise disruption to park users and the City of Sydney.	Construction
Cumulative impacts			
CE1	General	TransGrid explore project refinements and opportunities (including construction scheduling) to further minimise impacts on the environment and communities.	Detailed design
CE2	General	Key stakeholders, including relevant government agencies, councils and developers (including project proponents), will be kept informed of construction progress and scheduling in an effort to minimise community impacts. The frequency and method of this communication will be outlined in the project CEMP and CCF.	Construction
CE3	General	TransGrid will review the environmental impacts of the project before the start of construction and periodically during construction to identify further opportunities to reduce cumulative impacts. Any potential changes to impacts or mitigation measures will be captured in the CEMP.	Detailed design and construction
CE4	General	Consultation and construction planning will be undertaken with relevant stakeholders, particularly proponents for other developments within proximity to the project.	Detailed design and construction

24.0 Project justification and conclusion

This chapter provides an evaluation of the project and outcomes of the environmental impact assessment, together with a discussion of the project's justification. This chapter also provides an assessment of the project against the principles of ecological sustainable development, a description of its benefits and consideration of the consistency of the project with the objects of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

24.1 Ecological sustainable development

Ecological sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

The EP&A Act recognises that ESD requires the effective integration of economic and environmental considerations into decision making processes. The four principles that assist in the achievement of ESD, as defined in Schedule 2 of the Environmental Planning and Assessment Regulations 2000, include the:

- precautionary principle;
- inter-generational equity;
- conservation of biological diversity and ecological integrity; and
- improved valuation and pricing and incentive mechanisms.

The principles of ESD have been considered during the development of the project. The following sections describe how the project has applied the principles of ESD.

24.1.1 Precautionary principle

The precautionary principle deals with certainty in decision-making. If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

The assessment of potential environmental impacts as detailed in this Environmental Impact Statement (EIS) indicates that there would be no threats of serious or irreversible environmental damage as a result of the construction and operation of the project. Where potential environmental impacts have been identified, mitigation measures have been proposed to minimise and manage environmental impacts during construction and operation.

This EIS documents the examination and evaluation of environmental impacts associated with the project and has been carried out using the best available technical information. The requirement to assess the potential impacts of a project is designed to identify and address uncertainty about the effects of the project. The EIS itself is therefore precautionary in nature.

As part of the EIS, technical assessments were undertaken for relevant environmental aspects. The precautionary principle has been applied within the technical assessments by adopting conservative assumptions i.e. worst case scenarios, as described below:

- traffic and transport assessment – the assumptions for the construction traffic assessment included a non-kerbside trenching arrangement and maximum sizes for work sites. This results in a number of diversions being identified as well as changes to traffic flow;
- noise and vibration assessment – the assumptions for the construction noise assessment included adjacent work sites with concurrent operation of plant and modelling of the highest noise generating construction scenarios, including works outside of standard construction hours (including night-time). These assumptions result in a large number of noise management level exceedances at residential receptors;
- air quality impact assessment – the assumptions for the construction dust assessment included the construction of two adjacent 600-800 metre sections of trench, stockpiling at two adjacent construction laydown areas and excavation at underboring sites;

- electric and magnetic fields (EMF) assessment – an assessment of the magnetic fields to be generated during operation of the transmission cable circuit was predicted where they would be the highest, which would be directly above the trench, joint bay or cable bridge;
- biodiversity assessment – assumes that all vegetation within the project area (around 10 hectares) would be cleared, including around 7.6 hectares of mangroves comprising Key Fish Habitat;
- landscape character and visual impact assessment – the assumptions for the assessment of visual amenity during construction include that street tree removal would be required throughout the project area;
- contamination assessment – assumes that landfill gas would be encountered during trenching and excavation near Arlington Oval and Marrickville Park; and through Henson Park, Camdenville Park, and Sydney Park; and
- surface water and flooding assessment – assumes the design of the proposed cable bridge at the Cooks River would change existing flow paths and flood storage at key locations along the river.

As there is a degree of conservatism built into these assessments, the actual impacts from the project are expected to be, in at least some cases, less than those presented in the EIS.

24.1.2 Inter-generational equity

Inter-generational equity requires the present generation to ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

The project would provide a secure electricity supply for both current and projected electricity supply requirements, and thus caters for the electricity needs of both current and future generations.

Through the design of the project and the proposed implementation of mitigation measures, intergenerational social equity impacts have been addressed. Examples of matters that are relevant to inter-generational equity are:

- the project has been and will continue to be designed to reduce the overall risk from an environmental, engineering and cost perspective;
- a project-specific Community Partnerships Program would be implemented during project delivery to identify opportunities to improve community facilities and provide a positive project legacy. The Community Partnerships Program would be targeted around the project area and would be aligned with community values and needs identified during consultation; and
- the implementation of the proposed environmental management measures and project commitments aims to avoid or minimise potential adverse impacts that the project would have on the surrounding environment and communities.

As a result, this project would provide benefits for both current and future generations and is in the public interest.

24.1.3 Conservation of biological diversity and ecological integrity

Conservation of biological diversity and ecological integrity have been considered during the route selection, design and assessment processes with the aim of identifying, avoiding, minimising and mitigating impacts. The conservation of biological diversity and ecological integrity is a fundamental consideration of the project, as evidenced through the consideration of environmental impacts in the EIS.

The design avoids impacts to areas of high ecological value as far as practical. For example:

- areas of cleared land containing no biodiversity values have been utilised where possible (road reserves and weedy/mown grassland);
- locating temporary construction laydown areas and work sites in areas where there are no biodiversity values and minimal vegetation clearing is required;

- removal of street trees will be avoided through realignment of the transmission cable circuit, wherever feasible and reasonable, to preserve habitat for threatened species such as Grey-headed Flying-fox; and
- construction method options such as underboring have been investigated at special crossings to minimise potential ecological impacts, particularly at the Cooks River.

This EIS provides a detailed biodiversity assessment (refer to **Chapter 13 Biodiversity**) which identifies impacts to biodiversity values and provides a range of mitigation measures to further manage these potential impacts.

24.1.4 Improved valuation and pricing of environmental resources

Resources should be included in the valuation of assets and services and should be valued and priced based on the value of a full life-cycle of those resources.

The value of the environment has been considered during the route selection process, development of the design, evaluation of options and preparation of the EIS.

In addition, the costs associated with the planning and design of measures to avoid/minimise adverse environmental impacts and the costs to implement them have been built into the overall project costs. Ongoing and detailed design of the project, together with specific construction management plans, would represent further commitment to the recognition of the value of protecting environmental resources.

One of TransGrid's adopted principles for the project requires that the project avoid the removal of trees wherever feasible and reasonable and that where avoidance is not possible, a tree replanting strategy/landscape plan be agreed with the relevant council.

The project has demonstrated that environmental resources have been valued by the extent of environmental assessments, the route selection process, consideration of options, and the development of environmental management measures.

24.1.5 Compatibility with the principles of ESD

The project has considered and applied the principles of ESD into each stage of the project from planning and route selection through to environmental assessment and will continue to apply these principles during design development, construction and operation.

24.2 Objects of the Environmental Planning and Assessment Act 1979 (NSW)

Consideration has been given to the consistency of the project with the objects of the EP&A Act outlined in **Table 24-1**.

Table 24-1 Objects of the Environmental Planning and Assessment Act 1979

Objects of the EP&A Act	Comment
(a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,	The project has considered impacts to the community during design development and has also assessed potential socio-economic impacts (refer to **Chapter 21 Social and economic**). The preferred transmission cable route between Rookwood Road substation and Beaconsfield West substation has aimed to minimise environmental and land use constraints and avoid sensitive areas (e.g. avoidance of threatened and endangered ecological communities). The project will avoid the removal of trees wherever feasible and reasonable, by investigating opportunities to retain trees during detailed design and construction. In addition, opportunities to enhance pedestrian and cyclist access would be further explored during detailed design and in consultation with relevant stakeholders.

Objects of the EP&A Act	Comment
	Environmental management and mitigation measures have been proposed to manage and/or mitigate potential environmental, social and economic impacts of the project, where they cannot be avoided.
(b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	The principles of ecological sustainable development have been considered during the development of the project as described in **Section 24.1**.
(c) to promote the orderly and economic use and development of land,	The project would promote the orderly and economic use and development of land within the project area by improving the electricity infrastructure. Impacts on land use and development have been reduced by locating the majority of the transmission cable route within road reserves and utilising existing substations. Where the transmission cable route extends beyond the road reserve, easements would be required which would assist in promoting orderly development in these locations.
(d) to promote the delivery and maintenance of affordable housing,	The project would not impact on the promotion of the delivery and maintenance of affordable housing.
(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	The selection of the preferred route option considered environmental constraints such as the presence of threatened and endangered ecological communities and known threatened flora and fauna habitat within the project area. The project has also been located and designed in a way which avoids and minimises impacts on vegetation, habitat and biodiversity in accordance with the Biodiversity Assessment Method 2017. A biodiversity assessment was undertaken which assessed the potential impacts of the project on threatened species/habitats and other native animals and plants as well as key fish habitat (refer to **Chapter 13 Biodiversity**). While impacts related to the removal of urban exotic and native vegetation, including mangroves (which affects the habitat of threatened species) were identified, these can be managed through implementation of mitigation measures, and through offsetting. No significant impacts to threatened ecological communities or threatened species were identified.
(f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	The project has assessed the potential impacts on Aboriginal and Non-Aboriginal heritage (refer to **Chapter 14 Aboriginal heritage** and **Chapter 15 Non-Aboriginal heritage** respectively). Aboriginal heritage impacts are not expected as a result of the project, however one area of potential archaeological sensitivity has been identified at the Cooks River that would require further investigation during detailed design (refer to Options 2 and 3 described in **Chapter 4 Project description**). Management measures including an unexpected finds process have been proposed to manage potential impacts to Aboriginal heritage. Potential non-Aboriginal heritage impacts have been identified and would be mostly minor and limited to impacting the curtilage of some heritage items and heritage

Objects of the EP&A Act	Comment
	conservation areas only. Management measures have been proposed to avoid, reduce or minimise identified impacts to heritage values, as well as to ensure any unexpected finds are managed appropriately.
(g) to promote good design and amenity of the built environment,	The construction stage of the project would have temporary amenity impacts associated with visual amenity, noise and dust. These impacts would be managed by the mitigation measures proposed and would be short-term in duration. The operation of the project would be mostly underground or within existing substations with the exception of cable bridges. The cable bridges would be visible but would be designed to be integrated into the existing landscape, while meeting safety, technical and operational requirements.
(h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,	The project does not involve the construction or maintenance of permanent buildings. Health and safety of workers and occupants of the substations would be managed in accordance with TransGrid's existing management systems.
(i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	TransGrid is seeking approval for the project from the NSW Minister for Planning and Public Spaces under Division 5.2, Part 5 of the EP&A Act. The following government stakeholder groups have been consulted during development of the project and EIS: • elected government officials; • councils in the local government areas of Sydney, Canterbury-Bankstown, Inner West and Strathfield; and • government departments and agencies including Roads and Maritime Services, NSW Environment Protection Authority, WaterNSW, Transport for NSW; Greater Sydney Commission, Sydney Coordination Office, NSW Department of Education and Australian Rail Track Corporation.
(j) to provide increased opportunity for community participation in environmental planning and assessment.	Community and stakeholder consultation has been continuous throughout the development of the project, with ongoing consultation planned for future project stages, should the project be approved. Consultation has been undertaken in a variety of forms, including meetings, briefings, information sessions, newsletters and print advertisements. This EIS will be placed on public exhibition by the NSW Department of Planning, Industry and Environment in late 2019 for a minimum of 30 calendar days. During this period, stakeholders and the community will be able to review the EIS and are invited to make submissions. This process provides further opportunity for community participation in the environmental planning and assessment process. **Chapter 6 Consultation** provides further information on the consultation activities undertaken for the EIS.

24.3 Project justification

The project is needed to address existing issues in the electricity supply network of the inner Sydney area. A reliable, affordable and sustainable electricity supply is essential for our way of life and a secure electricity network is critical to support the growth of Sydney. The inner Sydney area is one of the most critical parts of the NSW electricity network. However, parts of the transmission and distribution networks which supply electricity to the inner Sydney area are ageing and approaching the

end of their serviceable lives. As such, these assets are unable to operate at full capacity and there are plans to retire some assets. Furthermore, rapid development in the inner Sydney area has been spurring an increase in the demand for energy. Analysis undertaken by TransGrid and Ausgrid shows a significant forecast increase in unserved energy[1] (loss of supply) to the inner Sydney area due to an increase in the probability of cable failure of some assets and an increasing customer demand.

To address this concern, TransGrid and Ausgrid initiated the Powering Sydney's Future program to secure an ongoing, reliable electricity supply to the inner Sydney area and to address the forecast shortfall in network capacity, by investigating and delivering solutions that are economically viable, minimise community and environmental impacts, and consider engineering and program constraints.

Several alternative options were considered, including both network and non-network solutions. The preferred network option identified was the Rookwood Road substation to Beaconsfield West substation connection (the project). A detailed route selection study was subsequently completed with consideration of environmental, land use and engineering constraints, infrastructure mode considerations (e.g. underground, overhead, tunnels or a combination of these), cost considerations, and avoidance of other sensitive areas. Non-network solutions will also be implemented to defer the network build by one year from when it would need to be commissioned without this support (i.e. from 2021/2022).

The project would serve to provide continuity and reliability benefits to consumers within the inner Sydney area including additional security for periods of peak demand. By providing additional security and reliability, the project would further reduce the risk of a network failure. The project would provide an indirect economic benefit, by contributing to securing Sydney's electricity supply for the future. Both electricity network and land use planning for the Greater Sydney area recognise the need for infrastructure to cater for both increased employment and population growth in the inner Sydney area.

A project-specific Community Partnerships Program would be implemented during project delivery to identify opportunities to improve community facilities and provide a positive project legacy. The Community Partnerships Program would be targeted around the project area and would be aligned with community values and needs identified during consultation.

The environmental impacts of the project have been assessed, including impacts on traffic, noise, biodiversity, land use and property, air quality, visual amenity, surface water and flooding, social and economic, and heritage aspects. The results from the environmental impact assessments indicate that there would be some adverse environmental impacts. In particular, the traffic and transport assessment identified that a number of potential diversions and changes to traffic flow would be required during construction, which may impact on the journey times of road users. In addition, residential and non-residential receivers were identified as being likely to be impacted by construction noise from the project.

Works at some locations would be required to occur outside of standard construction hours for safety and traffic management reasons or to meet the requirements of government agencies. While this would reduce potential traffic impacts, it would result in construction noise impacts to residential receivers at night-time.

The majority of potential impacts identified were for the construction stage of the project. These impacts are short-term (up to two years) and in most cases the impacts would be reduced during operation.

A suite of management measures have been proposed to manage these potential impacts, including the preparation of an Out-of-hours protocol to detail specific procedures including consultation with affected receivers for works conducted outside of standard construction hours. Management measures would be documented in a Construction Environmental Management Plan and would aim to avoid, minimise or mitigate potential impacts of the project.

[1] Unserved energy is the electricity demanded by consumers but not able to be supplied.

24.4 Conclusion

This EIS provides a comprehensive assessment of the project, including assessment of various environmental issues and the identification of project benefits and potential environmental impacts.

Environmental management objectives have been identified which aim to avoid, minimise and mitigate potential impacts. A number of commitments have been made in the EIS to manage the environmental impacts identified during construction and operation of the project.

The project has been designed, to the extent feasible, to minimise impacts and address the issues and concerns raised by the community and stakeholders.

This EIS has concluded that the project should proceed because it would:

- provide continuity and reliability benefits to electricity consumers within inner Sydney (including the CBD);
- provide additional security for periods of peak demand and therefore reduce the risk of network failure;
- provide local employment opportunities and result in positive economic benefits;
- have a manageable short-term construction impact on the environment and surrounding residences and businesses; and
- have a manageable impact on the environment and community during construction and operation.

This EIS has identified a range of issues which would be addressed further during detailed design and construction planning.

On the basis of the findings detailed in the assessments within this EIS and with the implementation of the proposed management measures, the project is considered justified.

25.0 References, Glossary and Abbreviations

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25.2 Glossary

Term	Definition
A-Weighted decibels [dB(A)]	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Aboriginal archaeological site	The present spatial extent of visible Aboriginal archaeological material(s) at a given location.
Aboriginal cultural heritage	The tangible (objects) and intangible (dreaming stories, song lines and places) cultural practices and traditions, associated with past and present day Aboriginal communities.
Aboriginal Heritage Information Management System (AHIMS)	A register of NSW Aboriginal heritage information maintained by the NSW Office of Environment and Heritage.
Aboriginal object	Any deposit, object or material evidence (not being a handicraft made for sale), including Aboriginal remains, relating to the Aboriginal habitation of NSW.
Aboriginal place	Any place declared to be an Aboriginal place under section 94 of the National Parks and Wildlife Act 1974 (NSW).
Acid sulfate soils	Naturally occurring soils, sediments or organic substrates (eg peat) that are formed under waterlogged conditions. These soils contain iron sulfide minerals (predominantly as the mineral pyrite) or their oxidation products. In an undisturbed state below the water table, acid sulfate soils are benign. However, if the soils are drained, excavated or exposed to air by a lowering of the water table, the sulfides react with oxygen to form sulfuric acid.
Adit	A passageway or tunnel connection.
Airborne noise	Airborne noise is sound transmitted through the air/atmosphere, e.g. conversation between people.
Alignment	The geometric layout (e.g. of a road) in plan (horizontal) and elevation (vertical).
Alternating current	An electric current that reverses its direction (of the flow of electrons) many times a second at regular intervals and is typically used in power supplies.
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.
Amenity	The quality of a place, its appearance, feel and sound, and the way its community experiences the place. Amenity contributes to a community's identity and its sense of place.
Archaeological potential	The likelihood of undetected surface and/or subsurface archaeological materials existing at a location.
Artefact	Any object which has been physically modified by humans.
Assessment background level (ABL)	The overall background level for each day, evening and night period for each day of the noise monitoring.
Australian Energy Market Operator (AEMO)	The AEMO is responsible for operating Australia's largest gas and electricity markets and produces national plans as part of its role as national transmission planner.

Term	Definition
Australian height datum (AHD)	The standard reference level used to express the relative height of various features. A height given in metres AHD is the height above mean sea level.
Average recurrence interval (ARI)	An indicator used to describe the frequency of floods. The average period in years between the occurrences of floods of a particular magnitude or greater. In a long period of say 1,000 years, a flood equivalent to or greater than a 100 year ARI event would occur 10 times. The 100 year ARI flood has a one per cent chance (i.e. a one in-100 chance) of occurrence in any one year. Floods generated by runoff from the study catchments are referred to in terms of their ARI, for example the 100 year ARI flood.
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L_{90} sound pressure level is used to quantify background noise.
Bore	Constructed connection between the surface and a groundwater source, that enables groundwater to be transferred to the surface either naturally or through artificial means.
Busbar	A series of elevated metallic bars within an electrical substation which comprises a system of electrical conductors on which power is concentrated for high capacity distribution.
Cable bridges	A purpose built bridge made typically of reinforced concrete structures, through which the transmission cables are integrated for support and protection.
Cable circuit	A series of three phase alternating current transmission cables which make up an electrical circuit to carry an electrical current. A single circuit transmission cable typically comprises a minimum of three cables per circuit.
Capacity (of a road)	The nominal maximum number of vehicles which has a reasonable expectation of passing over a given section of lane or roadway in one direction, during a given time period under prevailing roadway conditions.
Catchment	The land area draining through the main stream, as well as tributary streams, to a particular site.
Community	A group of people living in a specific geographical area or with mutual interests that could be affected by the project.
Conduit	A protective tube or pipe system for individual electric cables. Sometimes referred to as a ‘duct’.
Construction	Includes all physical work required to construct the project and also includes construction planning such as the development of construction management plans.
Connectivity	The measure of the degree to which an area(s) of native vegetation is linked with other areas of vegetation.
Construction laydown areas	Areas required for temporarily storing materials, plant and equipment and providing space for other ancillary facilities, such as project offices, during construction. Some construction laydown areas would be used for stockpiling.
Cumulative impacts	Impacts that, when considered together, have different and/or more substantial impacts than a single impact assessed on its own.
Critically endangered ecological community (CEEC)	A threatened ecological community with a ‘critically endangered’ listing status under environmental legislation.

Term	Definition	
Daytime	The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and public holidays.	
Decibel (dB)	The measurement unit of sound.	
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. The average healthy human ear can detect a change in noise level of 1 dB. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume or 'loudness'. Examples of decibel levels of common sounds are as follows:	
	30 dB(A) 40 dB(A) 60 dB(A) 70 dB(A) 75 dB(A) 90 dB(A) 100 dB(A) 110 dB(A) 115dB(A) 120 dB(A)	A quiet country park Whisper in a library Open plan office space Inside a car on a freeway On a footpath beside a busy road Outboard motor Heavy truck pass-by Jackhammer/subway train Rock concert 747 aeroplane take off at 250 metres away
Deposited dust/dust soiling	Dust that has fallen out of suspension in the air and which has settled onto a surface.	
Derating	Refers to operating electrical cables at less than their optimal capacity. Usually involves converting the cables to a lower voltage.	
Detailed design	The stage of the project following concept design where the design is refined, and plans, specifications and estimates are produced, suitable for construction.	
Detour	An alternative route, using existing roads, made available to traffic.	
Deviation	An alteration to the alignment of a portion of linear infrastructure such as a road or pipeline.	
Directional drilling	The drilling of a horizontal bore to tunnel under existing infrastructure (such as watercourses, rail lines, major roadways) to facilitate the laying of cables. This is an alternative method to excavation and trenching or cable bridges.	
Discharge	The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per section (m^3/s). Discharge is different from the speed or velocity of flow, which is a measure of how fast the water is moving (e.g. metres per second (m/s)).	
Dust	Solid particles that are suspended in air or have settled out onto a surface after having been suspended in air. The terms dust and particulate matter (PM) are often used interchangeably, although in some contexts, one term tends to be used in preference to the other. In this report the term 'dust' has been used to include the particles that give rise to soiling, and to human health and ecological effects.	
Earthworks	All operations involved in loosening, excavating, placing, shaping and compacting soil or rock.	
Easement	A 'right of way' around infrastructure that allows access to authorised personnel for inspections, repairs and maintenance. The establishment of an easement also restricts certain activities on the land that could endanger members of the public or impact on the safe operation of the infrastructure.	

Term	Definition
Ecological community	An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat.
Egress	Exit.
Electrical conductivity	The measure of a material's ability to accommodate the transport of an electric charge.
Electric and magnetic fields (EMF)	Electric and magnetic fields (EMF) are part of the natural environment and are present in the earth's core and the atmosphere. These fields are also produced wherever electricity or electrical equipment is used.
Embankment	An artificially raised structure (usually an earthen or gravel wall) used especially to hold back water (to prevent flooding) or to carry a roadway/rail line (across low-lying or wet areas).
Emission	The discharge of a substance into the environment.
Endangered ecological community (EEC)	A threatened ecological community with an 'endangered' listing status under environmental legislation.
Equivalent continuous sound level [L_{eq}] and A-weighted equivalent continuous [$L_{Aeq(15min)}$]	The constant sound level which, when occurring over the same period of time, would result in the receptor experiencing the same amount of sound energy. The ICNG defines $L_{Aeq(15min)}$ as 'the A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as industry, road, rail and the community.
Erosion	A natural process where wind or water detaches a soil particle and provides energy to move the particle.
Eutrophication	When a body of water becomes overly enriched with minerals or nutrients which induces an excessive growth of plants and algae.
Evening	The period from 1800 to 2200 h Monday to Sunday and public holidays.
Fill	The material placed in an embankment.
Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.
Flood prone land	Land susceptible to flooding by the probable maximum flood. Also known as flood liable land.
Floodplain	Area of land which is inundated by floods up to and including the probable maximum flood event (ie flood prone land).
Frac-out	A release of drill slurry at a fracture zone which has occurred on the surface through the building up of pressure in the bore.
Frequency	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Geomorphology	Physical features of the earth's surface and their relation to its geological structures.
Geotechnical investigation	Below ground investigation including soil and groundwater sampling and testing.

Term	Definition
Greater Sydney region	The area generally from Penrith in the west to the east coast and from Hornsby in the north to Campbelltown in the south.
Hazard	A source of potential harm that can cause injury/loss of human life and/or damage to the environment or property.
Heavy vehicle	A vehicle what has a gross vehicle mass (GVM) or aggregate trailer mass (ATM) of more than 4.5 tonnes.
Heritage artefact	Any object which has been physically modified by humans.
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.
Infiltration	The downward movement of water into soil and rock. It is largely governed by the structural condition of the soil, the nature of the soil surface (including presence of vegetation) and the antecedent moisture content of the soil.
Ingress	Enter.
inner Sydney	Includes the Sydney Central Business District (CBD) and eastern suburbs.
Insulation (electrical)	Material designed to prevent the flow of electric current.
Joint bay	An enlarged section of excavated trench in which cables are joined together.
Key stakeholders	Government departments/agencies, local councils, utility and service providers.
L_{10}	The sound pressure level exceeded for 10 per cent of the measurement period. For 10 per cent of the measurement period it was louder than the L_{10}.
L_{90}	The sound pressure level exceeded for 90 per cent of the measurement period. For 90 per cent of the measurement period it was louder than the L_{90}.
L_{eq}	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
L_{max}	The maximum sound pressure level measured over the measurement period.
L_{min}	The minimum sound pressure level measured over the measurement period.
Landscape character	Landscape character is the distinct, recognisable and consistent pattern of elements in the landscape. It is these patterns that give each area its 'sense of place', making one landscape different from another.
Landscape character impact (rating)	The landscape character impact rating defines the effects of a project on a landscape character zone. It is measured as a combination of sensitivity of landscape and the magnitude of change due to the project.
Landscape Character Zone (LCZ)	Landscape Character Zones (LCZs) are identified as sharing broadly the same characteristics or spatial qualities. These may include planning designations, topographical qualities, natural drainage qualities, ecological characteristics/land cover, parks and open space, cultural and recreational characteristics, architecture and built form, spatial qualities, or infrastructure.

Term	Definition
Life-expired	Infrastructure that has reached the end of its serviceable life expectancy and needs to be removed (upgrades or refurbishment are not possible to extend its functionality).
Light vehicle	A vehicle up to a B99 in size. A B99 vehicle is the 99th percentile vehicle size.
Magnitude	The magnitude of change of landscape character or to views seen by receptors due to the project. The magnitude rating depends on factors such as the extent of loss, change or addition of any feature or element, change to the landscape itself or one nearby that affects its character, or the quality and extent of the concept design and potential mitigation measures, if adopted.
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000.
Night-time	The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and public holidays.
Patch size	An area of intact native vegetation that: a) occurs on the Route corridor and temporary lay down areas or biodiversity stewardship site, and b) includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤30 m for non-woody ecosystems). Patch size may extend onto adjoining land that is not part of the Route corridor and temporary lay down areas or stewardship site.
PM_{10}	Airborne particulate matter (such as airborne dust or silt) with equivalent aerodynamic diameter of 10 microns or less.
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of less than 2.5 µm.
Pollutant	Any measured concentration of solid or liquid matter that is not naturally present in the environment.
Potential Archaeological Deposit (PAD)	The hypothesised presence of archaeological deposit where there is uncertainty due to a lack of visibly eroding artefacts, lack of test excavation either locally or in analogous landforms in the region.
Pre-construction	All work prior to, and in respect of the state significant infrastructure, that is excluded from the definition of construction.
Probability	A statistical measure of the expected chance or likelihood of occurrence.
Project area	The project area comprises the overall potential area of direct disturbance by the project, which may be temporary (for construction) or permanent (for operational infrastructure) and extends below the ground surface. The project area includes the location of operational infrastructure and construction work sites for: • the transmission cable route (including the entire road reserve of roads traversed); • special crossings of infrastructure or watercourses; • substation sites requiring upgrades (noting that all works would be contained within the existing site boundaries); and • construction laydown areas.
Proponent	The person or organisation that proposes to carry out the project or activity. For the purpose of the project, the proponent is TransGrid.
Rating background level (RBL)	The overall background level for each day, evening and night period for the entire duration of noise monitoring.

Term	Definition
Reasonable and feasible	'Reasonable' relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community expectations and nature and extent of potential improvements. 'Feasible' relates to engineering considerations and what is practical to implement.
Riparian buffer	Riparian buffers applied to water bodies in accordance with the BAM.
Risk	The likelihood of an adverse event occurring.
Roadway	Any one part of the width of a road devoted particular to the use of vehicles, inclusive of shoulders and auxiliary lanes.
Road reserve	The area comprising roads, footpaths, nature strips and public transport infrastructure (including indented bus bays, bus shelters and bus stop signage).
Secretary's Environmental Assessment Requirements (SEARs)	Requirements and specifications for an environmental assessment prepared by the Secretary of the NSW Department of the Planning and Environment under section 5.16 of the NSW *Environmental Planning and Assessment Act 1979*.
Sediment	Material, both mineral and organic, that is being or has been moved from its site of origin by the action of wind, water or gravity and comes to rest either above or below water level.
Sensitive receiver/receptor	Includes residences, educational institutions (including preschools, schools, universities, TAFE colleges), health care facilities (including nursing homes, hospitals), religious facilities (including churches), child care centres, passive recreation areas (including outdoor grounds used for teaching), active recreation areas (including parks and sports grounds), commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, retail spaces and industrial premises).
Sensitivity	The sensitivity of a receptor/receiver or receiving environment is based on the extent to which they can accept change without adverse impacts.
Shuttle working conditions	A traffic scenario whereby part of the roadway is closed, and a single lane is used alternatively by traffic in each direction.
Signalised intersection	An intersection regulated by traffic lights, often installed at the intersection of major roads.
Sound power level	The total sound emitted by a source.
Sound pressure level	The amount of sound at a specified point.
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
state significant infrastructure (SSI)	Infrastructure projects for which approval is required under Division 5.2 of the NSW *Environmental Planning and Assessment Act 1979*.
Stone/lithic artefact	Any rock materials modified by human agency.
Switchbay	Part of a substation within which the switch and control equipment relating to a given circuit are contained.

Term	Definition
Threatened species	Critically Endangered, Endangered or Vulnerable threatened species as defined by Schedule 1 of the BC Act, or any additional threatened species listed under Part 13 of the EPBC Act as Critically Endangered, Endangered or Vulnerable.
Thrust boring	This is a jack and bore drilling method typically used for installing a steel or concrete pipe casing beneath an existing surface where there is risk of trench collapse. Typically used to cross under major infrastructure such as railways and highways.
Trackout	The transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network.
Traffic Control Plan (TCP)	A graphical plan showing road signs and devices arranged to warn road users and to guide traffic around, or if necessary, through a work site or temporary hazard.
Traffic management approach	An approach to managing impacts to traffic, for example, through lane and/or road closures and through guidance and control of moving traffic, including pedestrians, cyclists and all types of vehicles.
Traffic noise	The total noise resulting from road traffic. The L_{eq} sound pressure level is used to quantify traffic noise.
Transmission cable	An insulated wire that conducts an electrical current at voltages greater than 132 kV.
Two-way flow (either side of the work site)	A traffic management approach whereby part of the roadway is closed, and traffic flow is retained in both directions, either side of the work site.
Two-way flow (along one side of the work site)	A traffic management approach whereby part of the roadway is closed, and traffic flow is retained in both directions, along one side of the work site.
Underboring	This is a trenchless method for installing cables involving passing the conduits under infrastructure (such as a road or railway corridor) or a watercourse. Underboring could be via thrust boring (also known as micro tunnelling) or horizontal directional drilling.
Vibration intensive works	Works which use vibration intensive equipment such as jack hammers, piling rigs and rock breakers.
View	A sight or prospect from a particular location.
Visual impact (rating)	The visual impact rating defines the day to day visual effects of a project on receptors. It is measured as a combination of sensitivity of receptors and the magnitude of change to the view.
Warning tape	Tape that is buried directly above underground services to provide visual warning during subsequent excavation.
Waterway	Any flowing stream of water, whether natural or artificially regulated (not necessarily permanent).
Wetland	An area of land that is wet by surface water or ground water, or both, for long enough periods that the plants and animals in it are adapted to, and depend on, moist conditions for at least part of their life cycle. Wetlands may exhibit wet and dry phases and may be wet permanently, cyclically or intermittently with fresh, brackish or saline water.

Term	Definition
Work site	A specific section of the project area for carrying out project construction activities such as trenching and excavation, establishment of a joint bay, underboring or installing a cable bridge. The work site would be fenced off from public access and may include associated activities such as traffic management measures.

25.3 Abbreviations

Abbreviation	Definition
µm	Micrometres
dB	Decibels
dBA	A-weighted decibels
AASS	Actual Acid Sulfate Soils
ABL	Assessment Background Level
ABS	Australian Bureau of Statistics
ACHAR	Aboriginal Cultural Heritage Assessment Report
ACM	Asbestos containing material
ACT	Australian Capital Territory
ADI	Australian Defence Industries
AEMO	Australian Energy Market Operator
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AIMD	Active Implanted Medical Devices
AIP	Aquifer Interference Policy
AMP	Asbestos Management Plan
ANO	Authorised Network Operator
ANZECC	Australian and New Zealand Environment and Conservation Council
AQMP	Air Quality Management Plan
ARI	Average Recurrence Interval
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASC NEMP	*National Environment Protection (Assessment of Site Contamination) Measure*
ASL	Above sea level
ASS	Acid sulfate soil
ASSMAC	Acid Sulfate Soils Management Advisory Committee
ASSMP	Acid Sulfate Soil Management Plan
AVATG	Assessing Vibration: A Technical Guideline
BAM	Biodiversity Assessment Method
BC Act	NSW Biodiversity Conservation Act 2016
BDAR	Biodiversity Development Assessment Report
bgl	Below ground level
BoM	Bureau of Meteorology
BTEX	Benzene, toluene, ethylbenzene, xylenes
CBD	Central Business District
CCF	Community Consultation Framework

Abbreviation	Definition
CEMP	Construction Environmental Management Plan
CHL	Commonwealth Heritage List
CLM Act	Contaminated Land Management Act 1997
CNS	Construction Noise Strategy
CNVMP	Construction Noise and Vibration Management Plan
CRA	Colebee Release Area
CSM	Conceptual Site Model
CSWMP	Construction Soil and Water Management Plan
CTMP	Construction Traffic Management Plan
DBYD	Dial Before You Dig
DCPs	Development Control Plans
DEC	Department of Environment and Conservation
DECCW	Department of Environment, Climate Change and Water
DEFRA	UK Department for Environment, Food and Rural Affairs
DP	Deposited Plan
DPC	NSW Department of Premier and Cabinet
DPIE	NSW Department of Planning, Industry and Environment (previously DPE)
DIPNR	Department of Natural Resources
DIRAC	Department of Infrastructure and Regional Development and Cities
DQIs	Data Quality Indicators
DQOs	Data Quality Objectives
DoEE	Commonwealth Department of the Environment and Energy
DUAP	Department of Urban Affairs and Planning
EEC	Endangered Ecological Community
EHC	Environmentally Hazardous Chemicals Act 1985
EIS	Environmental Impact Statement
ELF	Extremely Low Frequency
EMF	Electric and Magnetic Field
ENA	Energy Networks Association
EPA	Environment Protection Authority (NSW)
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
EPL	Environment Protection Licence
ERP	Environmental risk and planning
ESA	Environmental Site Assessment
ESCP	Erosion and Sediment Control Plan
FMP	Flood Management Plan

Abbreviation	Definition
FMS	Flood Mitigation Strategy
FoV	Field of View
GDE	Groundwater Dependent Ecosystem
GIS	Geospatial information system
HCAs	Heritage Conservation Areas
HV	High Voltage
IAIA	International Association for Impact Assessment
IAQM	UK Institute of Air Quality Management
ICNG	Interim Construction Noise Guideline
ICNIRP	International Commission of Non-Ionizing Radiation Protection
IEEE	Institute of Electrical and Electronic Engineers
kV	kilovolt
LALC	Local Aboriginal Land Council
LCZs	Landscape Character Zones
LEPs	Local Environmental Plans
LFG	Landfill Gas
LGA	Local Government Area
LV	Low Voltage
PASS	Potential Acid Sulfate Soils
PMF	Probable Maximum Flood
mG	milliGauss
MNES	matters of national environmental significance
MRV	Medium Rigid Vehicles
MUS	Managing Urban Stormwater
MV	Medium Voltage
NCAs	Noise Catchment Areas
NEPC	National Environment Protection Council
NHL	National Heritage List
NMLs	Noise Management Levels
NPfI	Noise Policy for Industry
NSW	New South Wales
NPW Act	NSW National Parks and Wildlife Act 1974
NSW DEC	NSW Department of Environment and Conservation
NSW DPI	NSW Department of Primary Industries
NTNDP	National Transmission Network Development Plan
OCE	Odour Control Enclosure
OCPs	Organochlorine pesticides

Abbreviation	Definition
OEH	NSW Office of Environment and Heritage (now DPIE or DPC)
OLs	Observer Locations
OLS	Obstruction Limitation Surface
Ou	Odour Units
PAD	Potential Archaeological Deposit
PAHs	Polycyclic aromatic hydrocarbons
PANS-OPS	procedures for air navigation systems – aircraft operations
PCBs	Polychlorinated biphenyls
PFAS	Polyfluoralkyl Substances
PMF	Probable Maximum Flood
POEO	Protection of the Environment Operations Act 1997
PSI	preliminary site investigation
RAP	Registered Aboriginal Parties
RBL	Rating Background Level
REF	Review of Environmental Factors
RNE	Register of the National Estate
RNP	Road Noise Policy
ROL	Road Occupancy Licence
SAQP	Sampling, Analysis and Quality Plan
SCN	Sydney Cycleways Network
SEARs	Secretary's Environmental Assessment Requirements
SEIA	Social and Economic Impact Assessment
SEIFA	Socio-Economic Indexes for Areas
SEPP 55	State Environment Planning Policy No.55 – Remediation of Land
SMCMA	Sydney Metropolitan Catchment Management Authority
SRV	Small Rigid Vehicles
SSC	State suburb code
SSI	State Significant Infrastructure
SWMS	Safe Work Method Statement
TCP	Traffic Control Plan
TRH	Total recoverable hydrocarbon
TSP	Total Suspended Particulates
TWA	Time weighted average
UBD	Universal Business Directories
UK	United Kingdom
VDVs	Vibration Dose Values
WALs	Water Access Licences

Abbreviation	Definition
WARR Act	Waste Avoidance and Resource Recovery Act 2001
WHO	World health Organisation
WM Act	Water Management Act 2000
WMP	Waste Management Plan

TransGrid