

30 Summary of environmental management measures

This chapter collates the environmental management measures for the project that were identified through the impact assessment process in **Chapter 9** to **Chapter 26**. All measures listed in **Table 30-1** would be incorporated into the Construction Environmental Management Plan (CEMP) and / or the operational framework for the project.

Table 30-1 Summary of environmental management measures

Impact	No.	Environmental management measure	Timing
Traffic and transport			
Construction			
General	TT01	A Construction Traffic Management and Safety Plan (CTMSP) would be prepared as part of the CEMP. The CTMSP would include the guidelines, general requirements and principles of traffic management to be implemented during construction, including: • Signage requirements (eg temporary speed restrictions, changes to the road environment, traffic management controls) • Lane possession and approval process during periods of online construction (eg line marking and temporary barriers) • Traffic control devices such as traffic signals • A local and regional communications strategy, including methods to provide advanced notice of any major or prolonged impacts (eg leaflets and local media), and real-time information regarding current impacts (eg variable message signs, radio traffic news) • Details of both the general approach to be used for access and egress to construction compounds and the specific controls required at specific locations • Any specific provisions required to manage potential impacts to sensitive users, such as schools, child care centres and health facilities. The CTMSP would be prepared in accordance with Austroads <i>Guide to Road Design</i> (with appropriate Roads and Maritime supplements), the RTA <i>Traffic Control at Work Sites</i> manual and AS1742.3: <i>Manual of uniform traffic control devices – Part 3: Traffic control for works on roads</i>, and any other relevant standard, guide or manual.	Pre-construction
Impacts to road network performance	TT02	Construction methods and staging would be designed to minimise road closures, subject to other project constraints, and ensure that disruptions to existing traffic are minimised as much as feasible and reasonable.	Construction

Impact	No.	Environmental management measure	Timing
(delays) and safety	TT03	Construction works would be carried out offline, where possible. Where offline construction is not practical, and for tie-ins between online and offline sections of the project, construction sequencing and any temporary works identified would aim to minimise user delay while providing sufficient flexibility for the selected contractor to safely and efficiently construct the project	Construction
	TT04	Works that would significantly reduce the performance of the road network would be scheduled for periods of typically lower traffic volumes where feasible and reasonable.	Construction
	TT05	Work areas would be isolated from general traffic using temporary safety barriers where possible.	Construction
	TT06	Temporary closed-circuit television (CCTV) and Variable Message Signs (VMS) would be provided at the outset of construction to link with the existing Transport Management Centre (TMC) network to facilitate monitoring and management of traffic impacts	Construction
	TT07	Traffic volume data would be analysed to identify capacity requirements, assess the potential impact of lane occupancies on traffic flows, plan lane occupancies to minimise the work area, and identify the best time to minimise inconvenience to road users. Restrictions and obstructions would be limited, road capacities maximised and peak traffic periods avoided where possible	Construction
	TT08	Impacts on pedestrian paths and cycle lanes would be minimised, and alternatives provided during construction where practical and safe to do so	Construction
	TT09	Impacts to bus stops would be identified and alternative locations and access would be provided. This would be undertaken in consultation with Transport for NSW and the relevant bus service provider	Construction
	TT10	Local road closures would be managed and adequate property access maintained. This would be undertaken in consultation with Roads and Maritime, local councils and property owners likely to be impacted	Construction
	TT11	A spoil management plan would be prepared with subsequent monitoring of heavy vehicle and haulage routes to ensure compliance and minimise impact on local roads off the arterial road network	Construction
	TT12	A road dilapidation report(s) would be prepared identifying existing conditions of local roads and mechanisms to repair damage to the road network caused by heavy vehicle movements associated with the project.	Construction
	TT13	Road occupancy licences would be obtained where required.	Construction
Impacts to emergency services	TT14	The CTSMP would be developed in consultation with local emergency services and procedures would be implemented to maintain priority access and a safe environment for emergency vehicles to travel through construction areas. The CTSMP would include measures to keep emergency services informed of the staging and progress of construction works.	Construction

Impact	No.	Environmental management measure	Timing
Operation			
Impacts to road safety	OpTT01	A road safety audit would be undertaken by a qualified auditor(s) as part of the detailed design, and again immediately prior to project opening, to examine the design from a road safety perspective and identify potential safety issues. This process would be undertaken in accordance with the Roads and Maritime Accident Reduction Guide Part 2: Road Safety Audits (RTA, 2005a).	Detailed design and prior to operation
Impacts to road network performance	OpTT02	An operational traffic review would be conducted 12 months following the commencement of operation to confirm the operational traffic impacts of the project on surrounding arterial roads and major intersections. The operational traffic review would be undertaken by a suitably qualified traffic specialist that is independent of the design and traffic studies undertaken as part of the environmental impact statement. The operational traffic review would include an assessment of the level of service at major intersections on local roads around the St Peters interchange, the King Georges Road interchange and changes in traffic levels on parallel arterial roads, such as Stoney Creek Road.	Operation
Air quality			
Construction			
General	AQ01	Develop and implement a Construction Air Quality Management Plan in consultation with the NSW EPA. Any measures that are required will differ depending on the activities occurring, and so will need to be tailored for each individual site.	Pre-construction
	AQ02	Carry out regular site inspections to monitor compliance with the Construction Air Quality Management Plan, record inspection results.	Construction
	AQ03	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	Pre-construction
	AQ04	Display the name and contact details of person(s) accountable for air quality and dust issues at the boundaries of each construction area. This may be the environment manager/engineer or the site manager. Display the head or regional office contact information.	Construction
Dust management	AQ05	Plan site layout so that machinery and dust causing activities are located away from receivers, as far as is possible.	Construction
	AQ06	Erect solid screens or barriers around dusty activities or the site boundary.	Construction
	AQ07	Ensure, where reasonable and feasible, that appropriate control methods are implemented to minimise dust emissions from the project site.	Construction
	AQ08	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site, cover as soon as practicable.	Construction
	AQ09	Impose and signpost a maximum-speed-limit of 20 km/h on surfaced and unsurfaced haul roads and in work areas.	Construction

Impact	No.	Environmental management measure	Timing
	AQ11	Where practicable, only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, (e.g. suitable local exhaust ventilation systems).	Construction
	AQ12	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	Construction
	AQ13	Where possible, use enclosed chutes and conveyors and covered skips.	Construction
	AQ14	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	Construction
	AQ15	Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using appropriate cleaning methods.	Construction
	AQ16	Avoid scabbling (roughening of concrete surfaces) if possible.	Construction
Stockpile management	AQ17	Stockpiles would be located outside overland flowpaths, and where left exposed and undisturbed for longer than 28 days, would be finished and contoured to minimise loss of material in flood or rainfall events. Materials which require stockpiling for longer than 28 days would be stabilised by compaction, covering with anchored fabrics, or seeded with sterile grass where appropriate.	Construction
	AQ18	Where a stockpile, eg sand or fine aggregate, has the potential to generate dust, control measures would be implemented. These would include wetting the stockpile, covering the stockpile or contouring the stockpile.	Construction
	AQ19	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	Construction
	AQ20	For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.	Construction
Tracking of material on roads	AQ21	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site.	Construction
	AQ22	Avoid dry sweeping of large areas.	Construction
	AQ23	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	Construction
	AQ24	Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	Construction
	AQ25	Record all inspections of haul routes and any subsequent action in a site log book.	Construction
	AQ26	Where reasonable and feasible, haul roads will be maintained with water carts and graders, and the condition of the roads will be monitored.	Construction
	AQ27	Implement site exit controls (e.g. wheel washing system and rumble grids) to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable.	Construction

Impact	No.	Environmental management measure	Timing
Emissions management	AQ28	Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	Construction
	AQ29	Access gates to be located at least 10 metres from receivers where possible.	Construction
	AQ30	Ensure all construction vehicles comply with their relevant emission standards.	Construction
	AQ31	Ensure that, where practicable, engine idling is minimised when stationary.	Construction
	AQ32	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	Construction
	AQ33	Promote and encourage sustainable travel (public transport, cycling, walking, and car-sharing).	Construction
Demolition	AQ34	No bonfires and burning of waste materials.	Construction
	AQ35	Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).	Construction
	AQ36	Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground and may be more useful for covering larger areas.	Construction
	AQ37	Minimise explosive blasting where possible during demolition, using appropriate manual or mechanical alternatives.	Construction
	AQ38	Bag and remove any biological debris or other hazardous materials such as asbestos, damp down such material before demolition.	Construction
Earthworks	AQ39	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	Construction
	AQ40	Use hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.	Construction
	AQ41	Where possible, only remove any cover for exposed areas in small areas during work and not all at once.	Construction
Cumulative impacts	AQ42	Regular communication with other high risk construction ancillary facilities within 500 metres of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.	Construction
	AQ43	Undertake regular on-site and off-site inspection, where receivers are nearby, to monitor dust, record inspection results.	Construction
Complaints management	AQ44	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.	Construction
	AQ45	Make complaints available to the Secretary upon request.	Construction

Impact	No.	Environmental management measure	Timing
	AQ46	Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.	Construction
Operation			
Air Quality	N / A	Environmental management measures that are available for improving tunnel-related air quality are categorised as follows: • Tunnel design • Ventilation design and control • Air treatment systems • Emission controls and other measures • Monitoring. Refer to Section 10.10.2 for detailed discussion of these categories.	Operation
Human health			
Construction			
Moving house as a result of property acquisition	HH1	Affected households would be provided access to a free counselling service; WestConnex Assist, to support them in the land acquisition process and relocation.	Pre-construction
Noise and vibration			
Construction			
General	NV1	A construction noise and vibration management plan(s) will be prepared and implemented consistent with the requirements of the <i>Interim Construction Noise Guideline</i> (DECC, 2009), and will include the following: • Identification of nearby residences and other sensitive land uses • Description of approved hours of work • Description and identification of construction activities, including work areas, equipment and duration • Description of what work practices (generic and specific) will be applied to minimise noise and vibration • A complaints handling process • Noise and vibration monitoring procedures • Overview of community consultation required for identified high impact works.	Pre-construction
Construction noise	NV2	Induction and training will be provided to relevant staff and subcontractors outlining their responsibilities with regard to noise.	Construction
	NV3	Noisy activities that cannot be undertaken during standard construction hours will be scheduled as early as possible during the evening and/or night time periods.	Construction

Impact	No.	Environmental management measure	Timing
	NV4	Permanent noise barriers will be scheduled for completion as early as possible in order to minimise construction noise.	Construction
	NV5	Property treatments identified for the operational phase of the project will be considered for installation before or early in the construction period, where they would improve noise levels.	Construction
	NV6	Acoustic sheds will be erected at the Kingsgrove North (C1), Bexley Road North (C4) and Bexley Road South (C5) construction compounds, to mitigate noise generated by tunnelling support activities. The noise attenuation requirements for these acoustic sheds will be reviewed and confirmed during detailed design.	Pre-construction
	NV7	Temporary acoustic hoardings will be installed at the Kingsgrove North (C1), Commercial Road (C3), Bexley Road North (C4), Bexley Road South (C5), Bexley Road East (C6), Arncliffe (C7), Canal Road (C8) and Campbell Road (C9) construction compounds. The design and location of acoustic hoardings will be confirmed during detailed design.	Pre-construction
	NV8	When working adjacent to schools, particularly noisy activities will be scheduled outside normal school hours, where practicable.	Construction
	NV9	Where feasible and reasonable, equipment with directional noise emissions will be oriented away from sensitive receivers.	Construction
	NV10	Verification checks on the noise emissions of plant and machinery will be conducted.	Construction
	NV11	Ongoing noise monitoring will be undertaken during construction at sensitive receivers during critical periods to identify and assist in managing high risk noise events.	Construction
	NV12	Reversing of equipment will be minimised to prevent nuisance caused by reversing alarms. Use of non-tonal reversing alarms ('quackers') will be implemented to further reduce the nuisance caused by reversing alarms.	Construction
	NV13	Loading and unloading will be carried out away from sensitive receivers, where practicable.	Construction
	NV14	Deliveries will be carried out during standard construction hours where feasible and reasonable.	Construction
	NV15	Additional noise mitigation measures during out of hours works will be determined on a case-by-case basis using individual receiver predictions, and may consist of offers of alternative accommodation, monitoring, individual briefings, letter box drops, project specific respite offers, phone calls and specific notifications.	Construction
	NV16	Respite periods (eg one hour respite for every three hours of continuous construction activity) will be scheduled for high noise impact works where appropriate.	Construction
Construction traffic noise	NV17	Truck drivers will be advised of designated vehicle routes, parking and queuing locations, acceptable delivery hours and other relevant practices (ie minimising the use of engine brakes, and no extended periods of engine idling).	Construction
	NV18	Deliveries and spoil removal will be planned to avoid queuing of trucks around construction compounds.	Construction

Impact	No.	Environmental management measure	Timing
Construction vibration	NV19	Before the start of tunnelling or other vibration intensive works at each site, condition surveys will be undertaken on properties and structures within the preferred project corridor (the zone on the surface equal to 50 metres from the outer edge of the tunnels) and within 50 metres of surface works.	Construction
	NV20	The safe working distances will be complied with where feasible and reasonable. This will include the consideration of smaller equipment when working close to existing structures.	Construction
	NV21	If vibration intensive works are required within the safe working distances, vibration monitoring or attended vibration trials will be undertaken at the outset of these works to ensure that levels are within relevant criteria.	Construction
	NV22	Building condition surveys of potentially affected structures will be completed both before and after the works to identify existing damage and any damage due to the works.	Pre-construction and post construction
Ground borne noise	NV23	Vibration intensive construction works will be confined to the less sensitive daytime period (9.00 am to 12.00 pm and 2.00 pm to 5.00 pm) as far as reasonably practicable.	Construction
	NV24	A detailed ground-borne noise assessment will be undertaken following further geotechnical investigations. This will include developing the vibration site law for the project.	Construction
Blasting	NV25	Noise and vibration mitigation methods specific to blasting will be incorporated into the construction noise and vibration management plans where required.	Construction
	NV26	Blasting with the potential to generate an impact at the surface will be restricted to standard daytime hours (except where approved by the relevant authority). Blasting would occur between 9:00am and 5:00pm, up to five days per week (Monday to Friday) and on Saturdays (9:00 am to 1:00pm). Blasts would be limited to one single detonation in any one day per receiver group, unless otherwise agreed by the NSW EPA through consultation on the Construction Noise and Vibration Management Plan.	Construction
	NV27	Site investigations will be conducted prior to production blasting to define suitable blast sizes to comply with project blasting noise and vibration criteria.	Construction
	NV28	Dilapidation studies of nearby receiver buildings will be undertaken where the potential for exceedances of the blasting criteria is identified.	Pre-construction
	NV29	Where the predicted levels exceed the noise or vibration criteria for blasting, alternative construction methods, such as penetrating cone fracture, will be utilised.	Construction
Consultation with impacted receivers	NV30	Community consultation protocols for sensitive receivers likely to be impacted by construction activities such as blasting, vibration and noise will be prepared and implemented.	Pre-construction and construction
Operation			
Road traffic noise	OpNV01	At locations where residual impacts remain after all feasible and reasonable approaches have been exhausted, noise mitigation in the form of acoustic treatment of existing individual dwellings will be considered.	Operation

Impact	No.	Environmental management measure	Timing
	OpNV02	Operational traffic noise will be monitored at sensitive receivers between six months and one year after opening. If the traffic noise levels are above the predicted levels, consideration of additional feasible and reasonable mitigation measures will be undertaken.	Operation
Operational fixed facilities	OpNV03	Operational fixed facilities will be designed to meet project specific noise criteria derived in accordance with the <i>NSW Industrial Noise Policy</i> .	Pre-construction
Land use and property			
Construction			
Temporary acquisition	LP01	The relevant property owners would be consulted in relation to the acquisition of properties required to facilitate construction of the project. Acquisition would be undertaken consistently with the principles in the Land Acquisition Information Guide (Roads and Maritime, 2014b) and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> (NSW).	Construction
Property access	LP02	Prior to any impact to access, alternative arrangements would be negotiated with the affected parties in order to enable continued access and to minimise disruption as much as reasonably possible.	Pre-construction and construction
	LP03	Affected property owners and community facilities would be provided with advanced notification of relevant project schedules, construction works and changes to access arrangements.	Construction
	LP04	Community updates would be provided on changes to the local road network within the project area during construction.	Construction
	LP05	Appropriate signage would be provided advising of walking track closures and alternative walking routes.	Construction
Settlement	LP06	A Settlement Monitoring Plan would be prepared that would provide details on: • Location of monitoring points • Duration of monitoring • Data collection and review • Roles and responsibilities for review of data • Triggers and actions for corrective actions.	Construction
	LP07	Building condition surveys would be undertaken on properties and structures within the preferred project corridor (the zone on the surface equal to 50 metres from the outer edge of the tunnels) and within 50 metres of surface.	Construction
	LP08	Services in locations where differential / angular settlement is anticipated would be identified. A monitoring plan, triggers and actions would be agreed with the utilities owner prior to potential impacts occurring.	Construction
	LP09	A monitoring program, undertaken as part of the Settlement Management Plan, would be undertaken to ensure that settlement has stabilised before monitoring is completed.	Construction

Impact	No.	Environmental management measure	Timing
Operation			
Permanent acquisition	OpLP01	Land acquisition for the project would be undertaken consistently with the principles in the Land Acquisition Information Guide (Roads and Maritime, 2014b) and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> (NSW).	Detailed design / preconstruction
Loss of land use and property access	OpLP02	Property accesses that are affected as a result of the project would be reinstated in consultation with the affected landowners including relocation if required.	Detailed design / construction
Visual impacts and urban design			
Construction			
Landscaping	V01	Existing vegetation around the perimeter of the construction compounds would be retained where feasible and reasonable, particularly: - Vegetation surrounding the Bexley Road East construction compound, particularly along the boundary between residential properties and the compound along the northern and eastern boundaries - Mature trees along the north-west (Marsh Street) and south-west boundaries of the Arncliffe construction compound site - Mature trees and vegetation along the boundary of Sydney Park along Campbell Road and Barwon Park Road.	Pre- construction
	V02	Landscape planting would use fast growing species where reasonable and feasible. This would soften views of construction sites, particularly for compounds located within public recreational spaces.	Construction
	V03	Revegetation and landscaping would be undertaken progressively.	Construction
Visual amenity	V04	Temporary noise barriers would be erected early within the site establishment phase where required to minimise noise impacts and provide visual screening.	Pre-construction / construction
	V05	Temporary noise barriers would be designed to include painted surface and project information / logo to deter graffiti and reduce the scale of noise barriers, particularly adjacent to residential areas or public open space.	Detailed design
	V06	Site hoardings and fencing would be regularly maintained, including the prompt removal of graffiti.	Construction
	V07	Acoustic sheds would be designed to minimise noise impacts and provide visual screening to be visually recessive, such as the use of mid toned colours and materials to minimise the intrusiveness and potential glare of the sheds.	Detailed design
Sydney Airport lighting	V08	During detailed design, the Roads and Maritime would liaise with the Civil Aviation Safety Authority to assess the potential for impacts of night lighting from the construction of the project on Sydney Airport operations. Mitigation measures would then be developed as required.	Detailed design

Impact	No.	Environmental management measure	Timing
Lighting	V09	Cut-off or and directed lighting would be used within and outside of construction compounds with lighting location and direction considered to ensure glare and light spill are minimised.	Detailed design
	V10	The lighting design for shared paths located within the M5 Linear Park impacted by the project or located adjacent to compounds would be designed to minimise light spill to adjoining residential properties while maintaining a safe night time environment for path users (eg lighting position below the height of the fence line).	Detailed design
	V11	A signage strategy would be developed during detailed design for temporary wayfinding and safety. Potentially affected receivers would be consulted on the final signage in relation to the location and associated impacts.	Detailed design
Signage	V12	Elements within construction sites would be located to minimise visual impacts as far as feasible and reasonable, for example, locating equipment back from site boundaries.	Detailed design / construction
Visual amenity	V13	Opportunities would be investigated to maximise the separation distances as far as reasonable and feasible: - Between the Kingsgrove North construction compound to the adjoining residential areas to reduce shading and visual impacts - Between the Bexley Road North and Bexley Road East construction compounds and adjoining residential areas to reduce shading and visual impacts.	Detailed design
	V14	Opportunities would be investigated to provide an alternative southern cycle route for the length of the existing shared path impacted by the western surface works.	Detailed design
Operation			
Visual amenity	OpV01	Vegetated batters would be limited to 1:3 and 1:4 where possible in order to maximise the impact of vegetation on these batters and minimise maintenance.	Detailed design
	OpV02	Chain link fencing for sites would only be used where these would not be viewed by sensitive receivers, such as residents and users of recreational space. At these locations, high quality fencing suitable for parks and public spaces would be considered.	Detailed design
	OpV03	Where large areas of hardstand are or structures are designed, such as carparks, consideration of shade trees within these spaces would be considered where reasonable and feasible to soften views and provide shade and visual amenity.	Detailed design / post construction
	OpV04	Pedestrian and shared paths would be aligned away from residential property boundaries where public open space adjoins residential boundaries.	Detailed design
Landscaping	OpV05	Planting areas would be maximised, where feasible, between public open space and infrastructure, and would include taller screening vegetation (at the Bexley Road South motorway operations complex (MOC2) between the built form and the M5 Linear Park shared path for example).	Detailed design

Impact	No.	Environmental management measure	Timing
Landscape and urban design (general)	OpV06	A final urban design and landscape plan would be prepared in consultation with the New M5 Urban Design Review Panel, local councils within the project corridor and the local community. The Plan shall include (but not limited to): • The architectural treatment of the ventilation facilities, which would be informed by the functional requirements and the design principles detailed in the New M5 Urban Design Report. • Landscape plans and final plant species for the western surface works, Bexley Road motorway operations complex, Arncliffe motorway operations complex, the St Peters interchange and local road upgrades • The artwork strategy for the Kindilan underpass • Consideration of the outcomes of the Safety in Design review of the project.	Detailed design
Landscape and urban design at Kingsgrove	OpV07	The design of the noise attenuation at the western surface works would be confirmed during detailed design and in consultation with the local community. This may consist of noise mounds and barriers (or a combination of both) and with consideration to the provision of accessible open space at Beverly Grove Park and a landscaped outlook.	Detailed design
Landscape and urban design at Bexley	OpV08	Landscaping at the Bexley Road motorway operations complex would consider opportunities to complement the existing topography of the built site as well as the adjacent Wolli Creek bushland.	Detailed design
Landscape and urban design at Arncliffe	OpV09	Reasonable and feasible measures to use landscaping to screen or filter views of the Arncliffe motorway operations complex from residential areas to the west would be implemented.	Detailed design
Landscape and urban design at St Peters	OpV10	Opportunities to maximise the green canopy throughout the local road upgrades at Peters with tree planting in medians where safety barriers and / or speed limits permit would be explored during detailed design, and implemented where reasonable and feasible.	Detailed design
Sydney Airport lighting	OpV11	During detailed design, the Roads and Maritime would liaise with the Civil Aviation Safety Authority to assess the potential for impacts of night lighting from the operation of the project on Sydney Airport operations. Mitigation measures would then be developed as required.	Detailed design
Lighting	OpV12	Lighting design within motorway operations complexes, roadways, and on elevated pedestrian bridges would minimise the impacts of lighting to surrounding areas (particularly residential areas), for example through the use of cut-off, directed lighting and landscaping to minimise light spill and glare. This includes consideration of residences along Campbell Road.	Detailed design

Impact	No.	Environmental management measure	Timing
Social and economic			
Construction			
Accessibility	SEO1	A community involvement plan would be implemented to provide timely, regular and transparent information about changes to access and traffic conditions, details of future work programs and general construction progress throughout the construction phase of the project. Information would be provided in a variety of ways including letter box drops, media releases, internet site, signage and a hotline.	Construction
Property acquisition	SEO2	Acquisition would be undertaken consistently with the principles in the Land Acquisition Information Guide (Roads and Maritime, 2014b) and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> (NSW).	Pre-construction and construction
Business impacts	SEO3	A toll free number and website would be maintained to enable business owners and/or operators to receive prompt responses to their concerns, access information and view assistance measures in place during construction related work.	Construction
	SEO4	A business impact risk register would be maintained to identify and manage the specific impacts associated with construction related works for individual businesses.	Construction
	SEO5	The business stakeholder forum would be continued during detailed design and throughout construction to address business concerns. Further information about consultation can be found in Chapter 7 (Consultation)	Construction
Soils and water quality			
Construction			
Water quality	SW01	The control and mitigation of potential surface water quality impacts during construction would be defined in a Soil and Water Management Plan prepared as part of the overall CEMP.	Pre-construction/ construction
	SW02	The Soil and Water Management Plan would be developed to incorporate controls and measures in accordance with The Blue Book. The plan would be continually updated to suit the changing needs as the project works progress. The plan would be developed in consultation with the Environment Protection Authority and DPI - Water and document the types of measures that would be put in place to minimise the risk of soil erosion or polluted discharges reaching the receiving environments.	Pre-construction/ construction
	SW03	An Erosion and Sedimentation Management Plan would be prepared as outlined in the Erosion and Sedimentation Risk Assessment Procedure (RTA, 2004).	Pre-construction/ construction

Impact	No.	Environmental management measure	Timing
	SW04	The Soil and Water Management Plan would include: • Construction traffic restricted to delineated access tracks, and maintained until construction complete • Appropriate sediment and erosion controls to be implemented prior to soil disturbance • Stormwater management to avoid flow over exposed soils which may result in erosion and impacts to water quality • Stockpiles located outside the 20 year ARI flood extent where feasible. Otherwise, appropriate management control measures such as bunding would be implemented • Staging of surface works to minimise area of exposed surfaces, with re-vegetation and / or stabilisation of disturbed areas to occur as soon as feasible • Site compounds sealed or hard stand to minimise erosion where possible • Wheel wash or rumble grid systems installed at exit points to minimise dirt on roads • A soil conservation specialist would be contracted to supervise construction in high risk areas in accordance with the Erosion and Sedimentation Management Procedure (RTA, 2008c) • All water generated during construction would be captured, tested (and treated if required) prior to reuse or discharge under a site specific arrangement, depending on the quality of water generated. This would target compliance with the Water Quality Reference Criteria. At the St Peters interchange site this would include transfer of some water to the leachate treatment plant. Varying levels of groundwater quality would also require a variation to treatment approaches • Contaminated sediments and potential acid sulfate soils would be segregated and disposed of (with or without prior treatment as appropriate) at a licensed facility or treated onsite • Stockpiles would be located outside of riparian corridors.	Pre-construction/ construction
	SW05	The water quality and outflow velocities of the water treatment plants at the following compounds would be in accordance with the project's Water Quality Reference Criteria and the project's Environment Protection Licence: Kingsgrove North construction compound (C1), Commercial Road construction compound (C3), Bexley Road South construction compound (C5), Arncliffe construction compound (C7), Canal Road construction compound (C8).	Construction

Impact	No.	Environmental management measure	Timing
	SW06	The project specific water quality monitoring program would continue to collect to at least 12 months of data or to the commencement of construction (whichever is sooner) to represent pre-construction conditions for the project. Monitoring would continue during construction of the project as identified in Appendix A of the Technical working paper: Surface water (Appendix N). The details of this monitoring program would be contained in the Soil and Water Management Plan, and would include the following: • Sampling locations to include upstream (control) and downstream measurement locations • Samples taken twice a month, once in dry conditions and once in wet conditions where possible • In-situ monitoring of: – pH – Reduction Oxidation Potential – Dissolved Oxygen – Temperature – Conductivity – Turbidity – Colour – Odour • Analytical sampling of the following potential constituents of concern: – Total Recoverable Hydrocarbons – Benzene, Toluene, Ethylbenzene, Xylene and Naphthalene – Nutrients including: Total Nitrogen, Total Kjeldahl Nitrogen, Nitrogen Oxide, Nitrite, Nitrate, Total Phosphorous and Reactive Phosphorous – Heavy metals (Arsenic, Cadmium, Copper, Chromium, Lead, Mercury, Nickel, Zinc) – Manganese – Ferrous Iron and Total Iron.	Pre-construction/ construction
	SW07	Water quality monitoring of the breeding ponds for Green and Golden Bell Frog near Marsh Street, Arncliffe would occur during construction by a suitably qualified scientist as part of the Green and Golden Bell Frog Plan of Management.	Construction
Water reuse	SW08	Opportunities for reuse of treated water generated at the Arncliffe motorway operations complex would be considered during detailed design.	Detailed design
Acid sulfate soils	SW09	An Acid Sulfate Soil Management Plan would be prepared as a sub-plan to the Construction Environment Management Plan to outline the requirements for the management of potential acid sulfate soils.	Pre-construction/ construction

Impact	No.	Environmental management measure	Timing
	SW10	Further contamination investigation would be conducted in areas with medium or high acid sulfate soils potential during the detailed design stage as part of early works. Management of acid sulphate soils during the project would be undertaken as per the management measures outlined in Section 17.4 .	Detailed design / pre-construction
Contamination	SW11	During landfill closure activities, surface water management measures would be implemented in accordance with The Blue Book to isolate and capture potentially contaminated water. Any such water would be transferred to the leachate treatment plant for treatment prior to discharge to sewer under a trade waste agreement with Sydney Water.	Construction
Contaminated runoff and spills	SW12	The following measures would be in place to manage spills of contaminated fluids: • Areas would be allocated for the storage of fuels, chemicals and other hazardous materials • Facilities would be secured and bunded to levels dictated by Environment Protection Authority guidelines • Spills or contaminated runoff would be captured and treated and / or disposed of at a licensed facility • Re-fuelling, wash down and preparation of construction materials would be undertaken in bunded areas to mitigate risks in relation to spills or leaks of fuels / oils or other hazardous onsite construction material • The application of good practice in the storage and handling of dangerous and hazardous goods would provide appropriate practical responses to manage impacts on occupational health and safety and minimise the risk of a spill occurring • Potential discharges from construction sites would be managed through the installation of basins (primarily designed for sediment capture but with capacity to contain the nominated spill volume) constructed in accordance with The Blue Book • Captured contaminants resulting from spills or leaks would be treated and disposed of at a licensed facility • Any soil which has been contaminated with fuel, oils or other chemicals would be disposed as contaminated soil by a waste subcontractor.	Construction
Geomorphology	SW13	Construction work activities within and / or adjacent to waterways would be minimised as much as feasibly possible to minimise disturbance to those waterways and waterfront land.	Construction
	SW14	Alignment of drainage and discharge outlet infrastructure would direct flows downstream to minimise alterations and erosion of the channel beds and banks.	Detailed design/ construction
	SW15	Drainage and discharge outlet infrastructure would include energy dissipation and erosion scour protection as appropriate.	Detailed design/ construction
	SW16	Disturbed floodplain environments adjacent to watercourses (including waterfront land) and / or along overland drainage lines would be stabilised and vegetation managed in accordance with the <i>Guidelines for Controlled Activities on Waterfront Land</i> (DPI, 2012a).	Construction

Impact	No.	Environmental management measure	Timing
Operation			
Surface runoff Surface runoff	OpSW01	Suitable stormwater treatment devices would be identified during detailed design, including an operational water treatment plant, with the aim of meeting the targets of the Botany Bay and Catchment Water Quality Improvement Plan (SMCMA, 2011). Where space is available, water quality basins would be installed. In the case where space is unavailable, treatment would include the use of proprietary stormwater treatment devices. The design of treatment trains would be informed by an assessment of the sensitivity of the receiving environments and supported by MUSIC modelling.	Detailed design/ operation
	OpSW02	The treatment capacity lost in decommissioning pond WQP – 3 would be provided by new or upgraded stormwater treatment devices.	Detailed design/ operation
Water quality monitoring	OpSW03	Operational water quality monitoring would be conducted for 12 months post-construction or as otherwise required by the conditions of approval. This would include upstream (control) and downstream monitoring locations. The details of this monitoring program would be contained in the Soil and Water Management Plan, and would include the following: • Sampling locations to include upstream (control) and downstream measurement locations • Samples taken twice a month, once in dry conditions and once in wet conditions where possible • In-situ monitoring of: – pH – Reduction Oxidation Potential – Dissolved Oxygen – Temperature – Conductivity – Turbidity – Colour – Odour • Analytical sampling of the following potential constituents of concern: – Total Recoverable Hydrocarbons – Benzene, Toluene, Ethylbenzene, Xylene and Naphthalene – Nutrients including: Total Nitrogen, Total Kjeldahl Nitrogen, Nitrogen Oxide, Nitrite, Nitrate, Total Phosphorous and Reactive Phosphorous – Heavy metals (Arsenic, Cadmium, Copper, Chromium, Lead, Mercury, Nickel, Zinc) – Manganese – Ferrous Iron and Total Iron.	Operation
New discharge outlets	OpSW04	New discharge outlets into Alexandra Canal would be designed with sufficient energy dissipation or scour protection to limit the impact on contaminated sediments and reduce the possibilities of contaminated sediments being subject to scour or resuspension.	Detailed design/ operation

Impact	No.	Environmental management measure	Timing
Existing drainage outlets	OpSW05	Where existing drainage lines are to be subject to increased inflow, an assessment of their discharge characteristics would be made. If necessary, energy dissipation or scour protection would be added to prevent contaminated sediments from being subject to scour or resuspended. This would be undertaken during detailed design.	Detailed design/operation
Mitigation for spills	OpSW06	The assessment of risk of spills on the motorway would be undertaken during detailed design. If warranted, spill containment would be provided.	Detailed design/operation
Operational water treatment plant	OpSW07	The operational water treatment plant would be designed to meet the Water Quality Reference Criteria outlined in Appendix A of the Technical working paper: Surface water (Appendix N). Monitoring of the Cooks River would be undertaken during initial operation of the project to ensure discharge meets these criteria.	Detailed design/operation
Geomorphology Geomorphology	OpSW08	Suitably designed scour and erosion control measures would be included in the detailed design.	Detailed design/operation
	OpSW09	Drainage and discharge infrastructure where space is available would incorporate measures, as appropriate, to trap and remove sediments in line with the outcomes of the stormwater pollution reduction targets from the Botany Bay and Catchment Water Quality Improvement Plan (SMCMA, 2011). This would reduce the risk of any impacts to the geomorphic condition of receiving waters.	Detailed design/operation
Contamination			
Construction			
Landfill closure	CM01	The closure and ongoing management of the Alexandria Landfill would be undertaken in line with the LCMP (see Section 17.3.4 and Section 5.9.1) and remedial action plan. This includes a landfill closure, environmental management and monitoring framework.	Pre-construction and construction
Landfill closure	CM02	A site specific management plan would be prepared for the Alexandria Landfill to manage the excavation of parts of the landfill during construction. The management plans, amongst other requirements would detail mitigation measures to: • Contain and treat landfill gas emissions from excavations • Treat offensive odours produced by leachate and landfill gas • Contain, extract and treat leachate within excavations • Protect workers and off-site receptors from exposure to potential biological, chemical and physical hazards encountered during the exhumation of landfill waste. • Manage asbestos contaminated wastes	Pre-construction
Disturbance and mobilisation of contaminated material	CM03	Potentially contaminated areas directly affected by the project would be investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the CLM Act. This includes further investigations in areas of potential contamination identified in the construction footprint.	Pre-construction

Impact	No.	Environmental management measure	Timing
General	CM04	An unexpected finds and hazardous materials procedure would be implemented to manage any potentially contaminated materials that may be encountered during site preparation and / or construction works.	Pre-construction
General	CM05	Waste management plans, as part of the CEMP, would include procedures for handling and storing potentially contaminated spoil and undertaking waste assessment and classification for off-site disposal to appropriately licenced waste facilities. See Chapter 24 (Resource use and waste minimisation) for more information.	Pre-construction
Asbestos	CM06	Site specific asbestos management plans would be developed where relevant. Refer to Chapter 24 (Resource use and waste minimisation) for further information on asbestos management.	Pre-construction
Hazardous materials	CM07	A hazardous materials assessment would be carried out prior to and during the demolition of buildings. Demolition works would be undertaken in accordance with the relevant Australian Standards and relevant NSW WorkCover Codes of Practice, including the <i>Work Health and Safety Regulation 2011</i> .	Pre-construction, construction
Dangerous goods	CM08	A dangerous goods search of the WorkCover NSW records for licenced dangerous good would be undertaken prior to construction.	Pre-construction
Explosive ordnance	CM09	An explosive ordnance due diligence assessment would be completed at the identified former ammunition site (Project area 3), located between Flatrock Road, Bexley Road and Wolli Creek.	Pre-construction
General	CM10	In the event of encountering unexpected finds of contamination (i.e. the observation of offensive odours, soil discoloration, buried waste or potential asbestos containing materials) during construction, work in the area would cease until an appropriately qualified environmental consultant can advise on the need for further assessment, remediation or other action, as deemed appropriate. Further assessment and management of contamination, if required, would be undertaken in accordance with section 105 of the CLM Act.	Construction
Contamination	CM11	Appropriate mitigation measures to minimise sediment mobilisation as a result of construction activities at the location of the new stormwater infrastructure at Alexandra Canal would be detailed in the CEMP in accordance with the requirements of the Remediation Order in consultation with NSW EPA and Sydney Water.	Pre-construction and construction
Contamination	CM12	Appropriate mitigation measures including stockpiling and management of potentially contaminated material would be undertaken at construction compounds to prevent movement of material into receiving waters.	Construction
General	CM13	Plant, equipment and supplies would be managed to prevent spills and leaks. See Chapter 26 (Hazard and risk) for more information.	Construction
General	CM14	Tunnel washing water and waste would be appropriately contained, treated and disposed of. Refer to Chapter 24 (Resource use and waste minimisation) for more information.	Construction
Contamination	CM15	Further <i>in situ</i> testing of soils in areas of known potential contamination to determine waste classification.	Construction

Impact	No.	Environmental management measure	Timing
Operation			
General	OpCM1	The ongoing management of the Alexandria Landfill will be undertaken in line with the LCMP (see Section 17.3.4 and Section 5.9.1)	Pre-construction, construction and post construction
Contamination	OpCM2	Procedures to address spills, leaks and tunnel washing would be developed and implemented during operation of the project	Operation
Scour protection	OpCM3	Measures to minimise sediment mobilisation during operation would be incorporated into the design of stormwater outlets at the location of the new stormwater infrastructure at Alexandra Canal. The design of the outlets, including discharge velocities and scour protection measures, would be confirmed during detailed design and supported by appropriate drainage modelling. The detailed design of the outlets would be provided to Sydney Water and NSW EPA for approval in accordance with the requirements of the Remediation Order.	Detailed design
Flooding and drainage			
Construction			
Flood Management Strategy	FD01	A Flood Management Strategy would be prepared by a suitable qualified and experienced person in consultation with directly affected landowners, DPI-Water, OEH and the relevant local councils. It would include but not be limited to: • Identification of flood risks to the project and adjoining areas, including consideration of local drainage catchment assessments and climate change implications on rainfall, drainage and tidal characteristics • Design and mitigation measures to protect proposed operations and not worsen existing flooding characteristics during construction and operation, including soil erosion and scouring • Drainage system upgrades • Preparation of a flood / emergency management plan.	Pre-construction
Flood Management Strategy	FD02	The Flood Management Strategy would be peer reviewed and confirmed as meeting the requirements of this management measure by a suitably qualified and experienced independent hydrological engineer. It would be submitted to the Secretary of DP&E and the relevant local councils prior to construction works commencing in the vicinity of flood prone land and overland flow paths for the waterways and catchments in the vicinity of the project area, or as otherwise agreed by the Secretary of DP&E.	Pre-construction
Flooding design	FD03	The 100 year ARI flood level is to be adopted in the assessment of measures which are required to mitigate any adverse impacts attributable to the project. Changes in flood behaviour under PMF conditions would also be assessed in order to identify impacts on critical infrastructure and significant changes in flood hazards as a result of the project.	Detailed design
Hydraulic assessment	FD04	A detailed hydraulic assessment into the impacts the project would have on flooding behaviour and relevant mitigation measures would be undertaken.	Detailed design

Impact	No.	Environmental management measure	Timing
Flooding design	FD05	Works within the floodplain would be designed to minimise adverse impacts on surrounding developments for flooding up to the 100 year ARI flood. Assessment would also be undertaken of the impacts during flooding in excess of the 100 year ARI flood up to the PMF in the context of impacts to critical infrastructure and flood hazards.	Detailed design
Survey	FD06	A floor level survey would be undertaken in affected areas to determine whether the project would increase floor damages in adjacent developments (ie in properties where there is a potential for increases in peak flood levels for events up to the 100 year ARI flood).	Detailed design
Flood management	FD07	Flood management plans would be developed as part of the CEMP prior to construction to guide the detailed design of temporary ancillary facilities, including construction compounds, to minimise the potential impacts of flooding on the project.	Pre-construction
Flooding in existing residential development	FD08	Around 8,000 cubic metres of the projected 12,000 cubic metres of lost floodplain storage due to the operation of the Arncliffe motorway operations complex (MOC3) would be required to be recaptured. Floor level surveys would be undertaken to determine whether the project would result in the above-floor inundation of the following potentially affected properties. Further design development would be undertaken during detailed design to confirm the extent of works required to mitigate the impact of the project on flooding conditions at these existing residential developments.	Detailed design / construction
Flooding in existing commercial / industrial development	FD09	Detailed design would aim to reduce the impact of the project on flooding conditions for the following two potentially affected properties. This would include consideration of whether the project would result in above-floor inundation of these properties.	Detailed design / construction
Flooding in existing commercial / industrial development	FD10	The potential to reduce impacts of the project on flooding for the properties located on the western overbank of the Alexandra Canal would be considered during detailed design. This would also include consideration of whether the project would result in above-floor inundation of these properties.	Detailed design / construction
Flooding in TransGrid's Beaconsfield West substation	FD11	Further design development would be undertaken to mitigate the impact of the project on flooding conditions in the TransGrid site. This would include further refinement of design of the relief drain, as well as the western approach to the Campbell Road bridge.	Detailed design / construction
Hydrology and flooding	FD12	Existing transverse drainage structures would be left in place during construction where transverse drainage structures are to be upgraded or replaced. If this is not feasible, temporary drainage would be adopted.	Detailed design / pre-construction

Impact	No.	Environmental management measure	Timing
Hydrology and flooding	FD13	Detailed flood modelling to understand the effects of likely rainfall events would be undertaken. Construction layouts would be finalised accordingly.	Pre-construction
Hydrology and flooding	FD14	Tunnel dive shafts would be protected against flooding either through locating openings outside of flood prone areas or constructing temporary bunding and / or appropriate temporary drainage. Stockpiles would be located outside the 20 year ARI flood extent where possible. Where construction compounds are located in the 20 year ARI flood extent, a contingency plan to manage flooding would be prepared and implemented.	Detailed design / pre-construction
Hydrology and flooding	FD15	Further detailed assessment of flooding impacts for proposed construction compounds and relevant management measures would be undertaken during detailed design. Contingency plans to manage flooding would be prepared and implemented for high risk temporary facilities proposed including fuel storages, water treatment plants and substations, as well as for the following construction compounds (located either wholly or partially within the 20 year ARI flood extent): • Kingsgrove South construction compound (C2) • Commercial Road construction compound (C3) • Bexley Road North construction compound (C4) • Bexley Road South construction compound (C5) • Arncliffe construction compound (C7) • Alexandra Canal bridge construction compound (C12) • Gardeners Road bridge construction compound (C13). For these sites, suitable procedures for flood warning, emergency management, site evacuation and planning would be developed.	Detailed design / pre-construction
Hydrology and flooding	FD16	The following measures would be implemented to manage flooding risks on construction sites: • Temporary bunding around parts of the site that would be adversely affected by floodwaters • Temporary drains / detention areas within the site • Use of carparks to provide detention • Elevation of site buildings where necessary to get floor levels above expected flood levels • Use of erosion and sediment fences around noise barriers to provide bunding to some parts of the sites while directing overland flows through less sensitive parts of sites, particularly at Kingsgrove and Arncliffe.	Detailed design / pre-construction
Hydrology and flooding	FD17	A drainage strategy would be determined during detailed design to manage the increased runoff within the catchment draining into Camdensville Park. This drainage strategy would be based on not increasing flows into the Eastern Channel for all events up to and including the 100 year ARI flood.	Detailed design / construction

Impact	No.	Environmental management measure	Timing
Potential impacts of future climate change on flooding	FD18	A more detailed assessment would be undertaken during detailed design to determine the climate change related flood risks to the project and to scope requirements for any management measures. The assessment would be undertaken in accordance with the <i>Practical Considerations of Climate Change – Floodplain Risk Management Guideline</i> (DECC, 2007)	Detailed design
Operation			
Bridges	OpFD01	Bridge crossings over the Alexandra canal would incorporate a suitable freeboard between the underside of the bridge structure and the peak 100 year ARI flood level.	Detailed design / operation
Flooding design	OPFD02	The project and associated arrangements would be designed to limit increases in peak discharges into the downstream drainage systems in accordance with local council requirements.	Detailed design
Drainage and localised flooding	OpFD03	The control and mitigation of potential localised flooding and drainage impacts during operation would include: • Drainage systems that are of insufficient capacity would be modified or upgraded to cater for increased flows • Where new drains connect with existing drainage networks a survey and condition assessment would be undertaken to inform detailed design • The efficiency of transverse drainage upgrades would be taken into account during detailed design • The effects a partial blockage of major hydraulic structures on flooding behaviour would be considered when determining finished road level and flood wall heights.	Detailed design / operation
Tunnel portals and ancillary facilities	OpFD04	Tunnel entries and associated flood protection barriers would be located above the PMF level or the 100 year ARI flood level plus 0.5 metres (whichever is greater). The same hydrological standard would be applied to tunnel ancillary facilities such as tunnel ventilation and water treatment plants where the ingress of floodwaters would also have the potential to flood the tunnels.	Detailed design / operations
Tunnel design	OpFD05	A suitable freeboard would be incorporated into the design of openings into the new road tunnels (eg at the location of the tunnel portals and ventilation shafts). These designs would take into account the impacts of a partial blockage of major hydraulic structures as well as climate change induced sea level rise on PMF event levels.	Detailed design / operation
Emergency response facilities	OpFD06	Emergency response facilities, including the motorway control centre, tunnel fire water tank and pump buildings and associated electrical substations would be locate above the PMF level or the 100 year ARI flood level plus 0.5 metres (whichever is greater).	Detailed design / operations
Groundwater			
Construction			
Disturbance of acid sulfate soils during excavation	GW01	An Acid Sulfate Soil Management Plan (ASSMP) would be prepared including the measures and monitoring to be undertaken where potential acid sulfate soils are expected. The plan would outline the type of treatment required for acid sulfate soils, bunding and requirement for treatment ponds.	Pre-Construction

Impact	No.	Environmental management measure	Timing
Intersection of saline soils and groundwater	GW02	A groundwater and soil salinity report would be prepared prior to the commencement of earthworks to assess the potential impacts to the local hydrogeological regime.	Pre-Construction
Failure of the leachate pumping system	GW03	Contingency measures to address leachate management at the Alexandria Landfill during construction and prior to the commissioning of the new leachate treatment plant would be explored during detailed design. Identified measures would be detailed in the CEMP and implemented during construction.	Construction
Migration of contaminated groundwater into the tunnels.	GW04	The tunnel construction program would be constructed in accordance with an overarching CEMP for the project which would include measures to manage contaminated groundwater issues. This may include removal of the source of the contamination by excavation and remediation of shallow impacted soils or engineering a solution to prevent the migration of contaminated groundwater into the tunnels.	Construction
Intersection of shallow perched groundwater within Alexandria Landfill or Botany Sands	GW05	Intersected shallow contaminated groundwater would be directed to the construction water treatment plant prior to discharge. Elsewhere, collection and treatment options would be considered and releases made under relevant discharge criteria.	Construction
Intersection of shallow contaminated groundwater during construction activities at Arncliffe	GW06	The intersection of shallow groundwater at the Arncliffe construction compound (C7) would be managed under CEMP(s) for the project. In the event that contaminated groundwater is intersected the approach would be to either remove the source of the contamination by excavation and remediation of shallow impacted soils or engineering a solution to prevent the migration of contaminated groundwater into the project tunnels.	Construction
Unsustainable release of groundwater resources	GW07	Treated waste water would be stored and re-used for project purposes wherever possible. Groundwater reuse would be in accordance with the policies of sustainable water use of the NSW Office of Water, such as dust suppression and earthworks	Construction
Excessive inflows during construction that may exceed the design inflow criterion of 1L/sec/km	GW08	Where saturated faults and fractures are intersected additional rock support would be installed in order to ensure tunnel stability. Appropriate waterproofing measure to reduce the inflow to an acceptable quantity will be applied as required. Measures can range from a spray-on membrane to grouting or installation of a sheet membrane	Construction

Impact	No.	Environmental management measure	Timing
Possible high groundwater inflows and sustained pressure heads (no drawdown) beneath the Cooks River and higher fracture permeability	GW09	Where higher than expected inflows are experienced as beneath the Cooks River and under other major surface water features, appropriate waterproofing measure to permanently reduce the inflow to an acceptable quantity will be applied as required. Measures can range from a spray- on membrane to grouting or installation of a sheet membrane depending on the inflow volume	Construction
Aggressive groundwater chemistry such as elevated sodium, chloride, ammonia, low pH conditions that are aggressive to concrete and steel	GW10	Building materials that are resistant to aggressive groundwater conditions would be selected.	Detailed design

Impact	No.	Environmental management measure	Timing
Spills and incidents relating to fuels, oils, lubricants and refuelling	GW11	The project works would be undertaken in accordance with a CEMP(s) for the project which would include the following management measures: • Stockpiles of fuels, hazardous liquids and chemicals would be stored in an impervious bunded area in accordance with Australian Standards and EPA guidelines • The storage of fuels and chemicals would be limited to locations more than 40 metres from any water course • Refuelling of vehicles and machinery would occur off-site where possible or in a designated re-fuelling area • Vehicles would be properly maintained to minimise the risk of fuel/oil leaks and routine inspections of construction equipment would be undertaken to identify any fuel/oil leaks • Emergency spill kits would be kept on-site and project personnel would be aware of the location of spill kits and trained in their use • Hazardous materials handling procedures would be documented and implemented • In the event of an incident resulting in impacts to human health or the environment, works would cease immediately and the EPA would be notified (if required) • Erosion and sediment control measures would be regularly inspected, and particularly following rainfall events. The controls would remain in place until construction works are completed and areas are stabilised.	Construction
Groundwater inflow into tunnels exceeding project requirements	GW12	A tunnelling procedure that details a methodology to determine when and what type of waterproofing is required to be installed during construction would be implemented during construction. Pre-excavation pressure grouting may also be used in locations identified that could produce substantial inflows to reduce groundwater inflows to an acceptable level. Post grouting (ie grouting undertaken post excavation) may also be required to further reduce groundwater inflows. Post grouting would occur within one month post excavation.	Construction
Construction of the tunnels could adversely impact surface and groundwater quality, resources and wetlands.	GW13	A groundwater monitoring program would be prepared and implemented to monitor groundwater impacts during construction. The program would be developed in consultation with the EPA, DPI (Fisheries), NSW DPI Water and relevant councils.	Construction

Impact	No.	Environmental management measure	Timing
Cracking creek beds, localised elevated inflows to tunnels from fractured rock beneath the creeks and potential surface environmental consequences from the increased flows	GW14	Where the project alignment passes close to watercourses and inflows are elevated, appropriate waterproofing measures to permanently reduce the inflow to an acceptable quantity would be applied as required	Construction
Impact to existing registered bores.	GW15	In the event that the drawdown in a water supply bore or irrigation bore exceeds two metres (in accordance with the Aquifer Interference Policy) measures would be taken to 'make good' the impact by restoring the water supply to pre-development levels. The measures taken would be dependent upon the location of the impacted bore and would be determined in consultation with the affected licence holder but could include, deepening the bore, providing a new bore or providing an alternative water supply.	Construction Operation
Ground settlement	GW16	A Settlement Monitoring Plan would be prepared that would provide details on: • Location of monitoring points • Duration of monitoring • Data collection and review • Roles and responsibilities for review of data • Triggers and actions for corrective actions.	Construction
	GW17	Building conditions surveys would be undertaken in the zone of influence of the tunnel settlement where the settlement is expected to have a potential impact. In the unlikely event that any damage occurs to a property, appropriate rectifications would be carried out.	Construction
	GW18	Services in locations where differential/ angular settlement is anticipated would be identified. A monitoring plan, triggers and actions would be agreed with the relevant utility owner prior to potential impacts occurring.	Construction
	GW19	A monitoring program, undertaken as part of the Settlement Management Plan, would be carried out prior to excavation until all relevant settlement has stabilised. Monitoring would be for a period of not less than six months after settlement has stabilised.	Construction

Impact	No.	Environmental management measure	Timing
Operation			
On-going groundwater extraction and treatment during operation	OpGW01	An OEMP would be prepared and implemented to outline management measures for groundwater inflows, treatment and discharge and protocols for spillages or incidents. Monitoring parameters may include groundwater levels, groundwater quality including field parameters, laboratory analytes and sample frequency.	Operation
Build-up of precipitated iron (slimes) and silt and sand due to slaking of the sandstone.	OpGW02	The drainage system would be regularly maintained in accordance with the Operational Environmental Management Plan.	Operation
Impact on surface and groundwater quality, resources and wetlands as a result of operation	OpGW03	A groundwater quality monitoring program would be prepared and implemented to monitor groundwater impacts during tunnel operations. The program would be developed in consultation with the EPA, DPI (Fisheries), NSW DPI Water and relevant councils.	Operation
Failure of the leachate pumping system	OpGW04	Contingency measures to address leachate management in the event of pump failure would be explored during detailed design and implemented in the Landfill Closure Plan.	Operation
Non-Aboriginal heritage			
Construction			
General	NAH01	Protocols would be developed for anticipated categories of unexpected non-Aboriginal heritage finds, such as tram infrastructure, late 19th to early 20th refuse, and brick works. In the event of an unexpected cultural heritage find outside of these specific protocols, the <i>Standard Management Procedure – Unexpected Archaeological Finds</i> (Roads and Maritime, 2015a) would be followed. This would include notification to the NSW Heritage Division of OEH (highly effective).	Pre-construction and construction
	NAH02	Construction personnel would be made aware of non-Aboriginal heritage sites as part of the site induction. These sites would be identified on sensitive area plans and in the CEMP (highly effective).	Pre-construction and construction
	NAH03	As part of the construction heritage management plan, an overarching historical archaeological research design would be prepared prior to commencement of construction in consultation with the NSW Heritage Division of OEH. It would describe clear significance thresholds to possible archaeological items that may be uncovered during works and designate when monitoring, testing and / or salvage and excavation should occur in relation to the project works and timing. Post-excavation reporting, including artefact analysis and additional historical research (where necessary), would be required for any historical archaeological investigations undertaken (moderately effective).	Detailed design

Impact	No.	Environmental management measure	Timing
	NAH04	A construction heritage management plan would be prepared prior to construction in consultation with the NSW Heritage Division of OEH. The plan would detail how construction impacts on heritage would be minimised and managed including training and induction processes for construction personnel. Inductions are to cover built heritage, landscape and historical archaeological sites and their management, and provide heritage guidance on how to avoid / manage impacts. The induction would be prepared in consultation with a suitably qualified heritage specialist and historical archaeologist. As a minimum, the plan would include the following: • Induction protocols for staff and project personnel to undertake a cultural heritage induction, to assist them in understanding and complying with their legal obligations under the <i>Heritage Act 1977</i> • A list, plan and GIS layer showing the location of identified heritage items • A significance assessment and statement of significance for each item • Detail the mitigation measures identified and when the measures are to be implemented • Provide protocols and procedures to be enacted during construction to ensure the protection of items of heritage significance • An unexpected finds procedure in the event that further sites are identified during works • The separate procedure for the discovery of skeletal remains (highly effective).	Pre-construction
	NAH05	Impacts to built heritage, heritage landscapes and historical archaeological sites, will to the greatest extent practicable, be avoided and minimised. Where impacts are unavoidable, works shall be undertaken in accordance with the strategy outlined in the construction heritage management plan (moderately effective).	Pre-construction and construction
Removal of heritage listed structures	NAH06	In relation to the house at 82 Campbell Street and terrace group at 28-44 Campbell Street the following would be undertaken: • The buildings would be subject to a full archival recording following the <i>NSW Heritage Division guidelines How to Prepare an Archival Recording</i> (NSW Heritage Office, 2003) and <i>Photographic recording of heritage items using film or digital capture</i> (NSW Heritage Office, 2006) • Consideration should be given as to whether elements of the houses could be salvaged and used to maintain or restore other properties managed by Roads and Maritime (somewhat effective).	Detailed design

Impact	No.	Environmental management measure	Timing
	NAH07	In relation to Rudders Bond Store, the following would be undertaken: - The bond store would be subject to a full archival recording following the <i>NSW Heritage Division guidelines How to Prepare an Archival Recording</i> (NSW Heritage Office, 2003) and <i>Photographic recording of heritage items using film or digital capture</i> (NSW Heritage Office, 2006) - Consideration would be given as to whether the laminated timber columns could be salvaged and re-erected and clad elsewhere within the St Peters interchange or the local area. The cladding and brick walls are not considered to be of heritage significance and are not included within the reuse proposal - Investigate options for documenting the history of the Ralph Symonds company and presenting it to a national audience, in partnership with stakeholders such as the City of Sydney and Powerhouse Museum. The focus would be on their development of innovative timber construction methods during and after World War II (somewhat effective).	Detailed design / pre-construction
Change of use	NAH08	In relation to the Service Garage at 316 Princes Highway, the following would be undertaken: - An existing condition survey report and program of monitoring would be undertaken to identify early potential risks to the heritage item - A photographic archival recording is undertaken prior to the current use ceasing. The archival recording should conform to the guidelines provided in <i>How to prepare archival records</i> (NSW Heritage Office, 2003) and <i>Photographic recording of heritage items using film or digital capture</i> (NSW Heritage Office, 2006). The archival recording should be lodged with the relevant local libraries and the State Library of NSW. - The oral history should be prepared, which seeks to contact past and present employees as well as others with memories of the service station. The oral history should be lodged with the relevant local libraries and the State Library of NSW (somewhat effective).	Pre-construction
Potential for direct impacts due to vibration associated with surface construction	NAH09	Detailed mitigation and management measures would be developed for each heritage item directly impacted by the project with regard to vibration (surface and tunnelling) and settlement once final disturbance areas have been identified through detailed design. These mitigation and management measures would be included in the CEMP(s) for the project (highly effective).	Detailed design

Impact	No.	Environmental management measure	Timing
Potential for direct impacts due to vibration associated with surface construction	NAH10	Surface works would adhere to safe working distances, and an existing condition survey report and program of monitoring would be undertaken to identify early potential risks at the following non-Aboriginal heritage items: • Wolli Creek Culvert • St Peters Public School, including interiors • Terrace housing, including interiors (I273) • Waugh and Josephson industrial buildings, former, showroom, offices and workshops, including interiors • Town and Country Hotel, including interiors • Group of Victorian Filigree and Victorian Italianate terrace houses – Narara, including interiors • Terrace group I12 • Water Board pump house, including Interior and substructure • Industrial Building, 'Frank G Spurway' • Former Alexandria Spinning Mills (highly effective).	
Visual impacts, as well as vibration impacts to the Macdonaldtown Stormwater Channel #3	NAH11	An existing condition survey report and program of monitoring would be undertaken to identify early potential risks at the Macdonaldtown Stormwater Channel #3 (highly effective).	Pre-construction and construction
Acoustic impacts to non-Aboriginal heritage items	NAH12	The following non-Aboriginal heritage properties would be considered for at property acoustic treatment: • St Peters Public School, including interiors • Terrace group I12 (highly effective). Acoustic treatments would be confirmed during detailed design, and would consider the principles of <i>The Burra Charter (the Australia ICOMOS charter for places of Cultural Significance)</i> (ICOMOS (Australia), 2013).	Detailed design

Impact	No.	Environmental management measure	Timing
Impacts to the Goodsell Estate Heritage Conservation Area as a result of vibration, acquisition and modification, as well as visual impacts and impacts conservation area values.	NAH13	Management measures for the Goodsell Estate Heritage Conservation Area would include: • Landscaping, to mitigate the impacts of realigning and widening roads, as well as alterations to the existing stormwater detention basin • Surface works would adhere to safe working distances • An existing condition survey report and program of monitoring would be undertaken to identify early potential risks to relevant structures within the conversation area and within 50 metres of the main alignment tunnels (highly effective).	Pre-construction, construction and post-construction
Impacts to the Clemton Park Urban Conservation Area as a result of vibration, changes in heritage area conservation values, and visual impacts.	NAH14	Management measures for the Clemton Park Urban Conservation Area would include: • Surface works would adhere to safe working distances • An existing condition survey report and program of monitoring would be undertaken to identify early potential risks to relevant structures within the conservation area • Landscaping would provide screening of the Bexley Road South motorway operations complex from the Clemton Park Urban Conservation Area, once established (highly effective).	Pre-construction, construction and post-construction
Impacts to the Pallamanna Parade urban Conservation Area as a result of vibration, changes in heritage area conservation values, and visual impacts.	NAH15	Management measures for the Pallamanna Parade Urban Conservation Area would include: • Surface works would adhere to safe working distances • An existing condition survey report and program of monitoring would be undertaken to identify early potential risks to relevant structures within the conservation area • Landscaping would provide screening of the project from the Pallamanna Parade Urban Conservation Area, once established (highly effective).	Pre-construction, construction and post-construction

Impact	No.	Environmental management measure	Timing
Impacts to heritage values due to construction of stormwater discharge points	NAH16	The following management measures would be implemented with respect to Alexandra Canal: • Monitoring during works to ensure vibration is not impacting the Alexandra Canal walls • Preparation of an archival recording of the Canal, involving both scale drawings and photography, prior to the removal of sandstone blocks • Numbering of sandstone blocks so that those displaced by the discharge points can be replaced in their previous locations • Stockpiling displaced sandstone blocks for use in repairs of other sections of the Alexandra Canal • Installation of heritage interpretation regarding the Canal in accordance with an interpretation plan (moderately effective).	Detailed design and construction
Heritage interpretation	NAH17	An interpretation plan would be prepared and implemented for: • Alexandra Canal and the industrial heritage of the area. This shall include installation of a heritage interpretation regarding the Canal in accordance with an interpretation plan • The St Peters Brickpit geological site, including: – Integrate the geological interpretation into the Sydney Park brickworks in consultation with City of Sydney, as the industrial counterpart to the geological history to tell a more complete story of historical land use in the area – Integrate the geological / palaeontological discovery of the <i>Paraclytosaurus davdi</i> – Retain an exposed section of the fresh shales and siltstones, including features associated with deposition of the sedimentary rocks, and later formed fractures such as joints and faults, if safe to do so for both landform stability and ongoing access for interpretation (moderately effective).	Detailed design and construction
Impact to geological and palaeontological values	NAH18	An archival recording of the St Peters brickpit geological site would be undertaken prior to and during the construction (highly effective).	Pre-construction
	NAH19	An assessment and / or consultation with a palaeontologist to determine whether the project impact area has potential to contain further specimens of scientific interest (highly effective).	Pre-construction
Visual	NAH20	Approaches to appropriately manage impacts of the project to the individual contribution of views into and out from heritage properties and the long-term impact of construction would be detailed in a CEMP (highly effective). Individually tailored landscape treatments would be developed during detailed design to mitigate visual impacts at 2-34 Campbell Road, St Peters.	Pre-construction Detailed design
Impacts on archaeology	NAH21	The construction heritage management plan would include detailed procedures / strategies for the conservation and curation of any historical artefacts recovered during works (moderately effective).	Pre-construction and construction

Impact	No.	Environmental management measure	Timing
Urban design and landscaping	NAH22	Urban design and landscaping would be undertaken to manage visual impacts to the following additional non-Aboriginal heritage items: • Terrace housing (I273) • Southern Cross Hotel (I277) • Water Board pump house (I18) (highly effective).	Construction and post-construction
Biodiversity			
Construction			
General construction impacts	B01	A Flora and Fauna Management Plan will be developed before construction. The Plan will identify potential impacts to biodiversity and describe mitigation measures and environmental controls to be implemented during construction, including measures to protect biodiversity features which will be retained.	Construction
Vegetation clearance	B02	The removal of established vegetation will be minimised, where possible.	Construction
	B03	Pre-clearance activities will be carried out in accordance with <i>Guide 1 Pre-clearing process</i> of Roads and Maritime's <i>Biodiversity Guidelines</i> (RTA, 2011). Pre-clearing surveys will be undertaken by a suitably qualified ecologist to identify the presence of: • Hollow-bearing trees • Threatened flora and fauna.	Construction
	B04	Trees will be removed in accordance with <i>Guide 4 – Clearing of Vegetation and Removal of Bushrock</i> of Roads and Maritime's <i>Biodiversity Guidelines</i> (RTA, 2011).	Construction
	B05	Where vegetation clearance is required, exclusion zones will be established in accordance with <i>Guide 2 Exclusion Zones</i> of Roads and Maritime's <i>Biodiversity Guidelines</i> (RTA, 2011).	Construction
	B06	Where reasonable and feasible, mature and hollow-bearing trees will be retained. Where this is not reasonable and feasible, nest boxes will be installed to mitigate the impacts of removing hollow bearing trees in accordance with Table 8.1 of <i>Guide 8 – Nest boxes</i> of Roads and Maritime's <i>Biodiversity Guidelines</i> (RTA, 2011) at least one month prior to the commencement of construction	Construction
	B07	Locally indigenous species will be included as part of landscaping and rehabilitation works to promote native fauna habitat.	Construction
Impacts to native flora and fauna	B08	Should unexpected threatened flora or fauna be located at any time during construction, relevant works will cease in the area to prevent further harm to the individual. Should this occur, a suitably qualified ecologist will be engaged to advise on appropriate mitigation and management measures.	Construction
	B09	Any fauna handling would be undertaken by an appropriately licenced ecologist in accordance with <i>Guide 9 – Fauna handling</i> of Roads and Maritime's <i>Biodiversity Guidelines</i> (RTA, 2011).	Construction

Impact	No.	Environmental management measure	Timing
Impacts to the Green and Golden Bell Frog	B10	The Green and Golden Bell Frog Plan of Management Plan will be finalised and implemented to minimise and manage impacts to the Arncliffe key population. The Green and Golden Bell Frog Plan of Management Plan would be approved by the Commonwealth Department of the Environment and OEH, and would include: • Management measures to be implemented at the Arncliffe construction compound (C7) and RTA Ponds to minimise and manage impacts to the Green and Golden Bell Frog habitat and key population during construction. • Management measures relating to the enhancement of existing habitat at the Marsh Street Wetland • Supplementary management measures for consideration to mitigate and minimise impacts to the Green and Golden Bell Frog.	Construction
Impacts to hydrology and aquatic biodiversity	B11	Measures to mitigate potential water quality impacts during construction are outlined in Section 16.4 and Section 18.4 .	Construction
	B12	Works within or near aquatic habitats and riparian areas will be managed in accordance with <i>Roads and Maritime's Guide 10 – Aquatic habitats and riparian zones</i> .	Construction
	B13	Works within aquatic habitats or riparian zones would be undertaken to limit impacts on aquatic flora and fauna, and their habitats, and impacts on riparian areas. This would be undertaken in accordance with Guide 10 of the <i>Biodiversity Guidelines</i> .	Construction
	B14	Where possible, construction activities would minimise disturbance to waterways and riparian land	Construction
	B15	Stockpiles would be located outside riparian corridors.	Construction
Spread of weeds	B16	Weeds within the construction footprint will be actively managed prior to the clearance of vegetation. All weed material cleared from within the construction footprint of the project will be disposed of at a facility licensed to receive green waste.	Construction
	B17	Vegetation within the road reserve adjacent to areas to be cleared will be managed in accordance with <i>Guide 6 – Weed Management</i> and <i>Guide 10 – Aquatic Habitats and Riparian Zones</i> of <i>Roads and Maritime's Biodiversity Guidelines</i> (RTA, 2011) to reduce the introduction and spread of noxious weed species.	Construction
	B18	Landscaping and revegetation works will be undertaken using weed-free topsoil in accordance with the project's urban design concept plan.	Construction
Introduction and spread of pathogens	B19	A hygiene protocol will be implemented as part of the CEMP(s) for the project to prevent the spread and exacerbation of the Chytrid Fungus in accordance with <i>Guide 7 – Pathogen Management</i> of <i>Roads and Maritime's Biodiversity Guidelines</i> (RTA, 2011).	Construction
	B20	A risk assessment process will be used for each construction compound to determine the need to clean machinery prior to entering	Construction

Impact	No.	Environmental management measure	Timing
	B21	Pathogens will be identified as part of pre-clearing inspections. In the event that pathogens are identified within the construction footprint, appropriate mitigation measures will be identified by an ecologist and implemented as part of the CEMP(s) in accordance with <i>Guide 7 – Pathogen Management of Roads and Maritime's Biodiversity Guidelines</i> (RTA, 2011).	Construction
Operation			
General	OpB01	A management plan will be developed and implemented to identify and mitigate potential ongoing impacts to biodiversity, including procedures for: • Management of weeds • Management, maintenance and rehabilitation of riparian land disturbed by the project and riparian areas associated with the discharge of treated water • Maintenance of nest boxes	Operation
Greenhouse gas			
Construction			
Emission of greenhouse gases during construction	GHG1	Prepare a Greenhouse Gas Emissions Strategy and Management Plan for the project.	Detailed design
	GHG2	Undertake an updated greenhouse gas assessment based on detailed design.	Detailed design
	GHG3	The emissions intensity of significant construction materials specified in the design of the project would be assessed and, where feasible and in compliance with technical specifications, low emission construction materials would be used.	Detailed design
	GHG4	Where feasible, recycled content road construction materials such as recycled aggregates in road pavement and surfacing, or similar, would be used.	Detailed design
	GHG5	The fuel efficiency of construction plant and equipment would be assessed before selection and, where feasible and reasonable, equipment with the highest fuel efficiency or equipment that uses lower greenhouse gas intensive fuel such as biofuels (eg biodiesel, ethanol) would be used.	Pre-construction and construction
	GHG6	Project planning would be undertaken to ensure that the site vehicle movements and construction activities are efficient, to avoid double handling of materials and unnecessary fuel use where possible.	Detailed design
	GHG7	Locally produced goods and services would be procured where feasible and cost effective to reduce transport fuel emissions.	Detailed design and construction
	GHG8	At least six per cent of construction energy required for the project would be sourced where possible from an accredited GreenPower energy supplier	Pre-construction and construction
	GHG9	Where possible, and fit for purpose, spoil would be beneficially re-used within the project before off-site re-use or disposal options are investigated. A spoil management strategy would be developed for the project prior to the commencement of construction and would identify spoil disposal sites and the management of excess spoil.	Pre-construction and construction

Impact	No.	Environmental management measure	Timing
	GHG10	Waste would be diverted from landfill, including diversion of spoil, construction and demolition waste, and commercial and industrial waste, where reasonable and feasible. The management of waste would be considered as part of the preparation of the CEMP for the project, detailing the appropriate procedures for waste management.	Detailed design and construction
Operation			
Emission of greenhouse gases during operation	OpGHG 1	The main alignment tunnels would be designed to minimise fuel consumed by vehicles using the road, for example through the provision of a vertical alignment that allows consistent vehicle speeds to be maintained.	Detailed design
	OpGHG 2	A life cycle assessment would be undertaken as part of the detailed design in order to select mechanical and electrical systems with increased energy efficiencies, where reasonable and feasible, such as the tunnel ventilation system, tunnel lighting, water treatment systems and electronic toll and surveillance systems.	Detailed design
	OpGHG 3	Low carbon energy generation options would be investigated as part of the detailed design process in order to reduce the demand on mains electricity and generate renewable energy onsite, where feasible. At least six per cent of energy required for the project would be sourced from an accredited GreenPower energy supplier, where possible.	Detailed design
Aboriginal heritage			
Construction			
Impacts on culturally sensitive Aboriginal sites	AH 1	Vibration generating activities, including blasting would be conducted in a manner to ensure vibration levels do not exceed three millimetres per second at potential Aboriginal heritage site SR-OVRH-1.	Construction
Indirect impacts on sandstone rock overhang site	AH 2	Vibration monitoring would be carried out during vibration intensive works within 50 metres of SR-OVRH-1. The need for vibration monitoring would be informed by a preliminary screening of activities at this location to identify what activities have the potential for vibration at this location. The preliminary screening and works requiring monitoring would be contained within the CEMP.	Pre-construction and construction
Impacts on culturally sensitive Aboriginal sites	AH 3	A baseline condition assessment would be completed by a qualified structural engineer for Aboriginal site SR-OVR-1 before construction commences, followed by a condition assessment immediately following significant vibration and with recommendations for remediation measures if required.	Pre- construction and construction

Impact	No.	Environmental management measure	Timing
Unexpected discovery of Aboriginal objects (Project wide)	AH 4	If an Aboriginal object(s) is discovered during construction it would be managed in accordance with the <i>Standard Management Procedure: Unexpected Heritage Items</i> (Roads and Maritime Services, 2015), including: • Ceasing works in the vicinity of the object(s), where there is the potential to directly or indirectly impact on the object(s) • Notifying the construction Environmental Representative and OEH of the discovery • Engaging a qualified archaeologist to determine the nature, extent and scientific significance of the object(s) • Developing management recommendations in consultation with the qualified archaeologist, OEH and RAPs.	Construction
Unexpected discovery of Aboriginal objects (Alexandra Canal)	AH 5	In order to manage the potential discovery of an Aboriginal object(s) during pile installation adjacent to Alexandra Canal the following strategy would be implemented: • Geotechnical coring at each pile location by a geotechnical engineer to obtain intact sediment samples to a depth of around seven metres • Inspection of obtained sediment samples by a qualified archaeologist in consultation with the geotechnical engineer in order to characterise the soil profile and identify any Aboriginal archaeological materials Should Aboriginal archaeological material be present within one or more core samples, management would occur in accordance with the <i>Standard Management Procedure: Unexpected Heritage Items</i> (Roads and Maritime, 2015).	
Unexpected discovery of human remains	AH 6	If human remains are discovered during construction would be managed in accordance with the <i>Standard Management Procedure: Unexpected Heritage Items</i> (Roads and Maritime Services, 2015), including: • Ceasing works in the vicinity of the remains, with the potential to directly or indirectly impact on the remains • Notifying the construction Environmental Representative, OEH and NSW Police of the discovery • Following directions from the NSW Police and / or OEH, as relevant, depending on the nature of the remains and the outcomes of forensic investigations.	Construction

Impact	No.	Environmental management measure	Timing
Resource use and waste minimisation			
Construction			
Resource consumption	WM01	Construction energy consumption would be reduced through initiatives such as: • Use of roadheaders, which can excavate a more efficient shape for the road tunnel than tunnel boring machines, resulting in less spoil generation and less energy consumption for handling, management and transport of spoil • Local materials procurement where feasible and cost effective to reduce fuel consumption for transport • Selection of efficient construction plant and equipment where possible • Use of recycled materials where feasible • Efficient practices on site (for example, switching off engines when not in use) • Use of energy efficient or solar powered lighting for temporary construction facilities • Investigating the use of biofuel for construction vehicles.	Construction
	WM02	Where feasible and reasonable, construction material would be sourced from within the Sydney region.	Pre-construction and construction
	WM03	Unnecessary resource consumption would be avoided by making realistic predictions of the required quantities of resources such as construction materials	Construction
	WM04	Resource recovery would be applied to the management of construction waste and would include: • Recovery of resources for reuse-reusable materials generated by the project would be segregated for reuse either on-site or off-site where possible, including the reuse of the major waste streams (VENM and ENM) • Recovery of resources for recycling - recyclable resources (such as metals, plastics and other recyclable materials) generated during construction and demolition • Resources would be segregated for recycling • These materials would then be sent to an appropriate recycling facility for processing. • Recovery of resources for reprocessing -cleared vegetation would be mulched or chipped on-site and used for landscaping, in the absence of a higher beneficial use being identified.	Construction
	WM05	Where reasonable and feasible, Packaging Take Back arrangements would be implemented with suppliers.	Construction

Impact	No.	Environmental management measure	Timing
Management of waste	WM06	Wastes would be managed (classified, handled and stored) and reused / recycled / disposed of in accordance with relevant State legislation and government policies including the POEO Act, <i>Waste Avoidance and Resource Recovery Act 2001</i> , <i>Waste Avoidance and Resource Recovery Strategy 2014-2021</i> (EPA, 2014b), and the sustainable procurement objective of the <i>WestConnex sustainability strategy</i> (WestConnex Delivery Authority, 2015).	Construction
	WM07	A Construction Waste Reuse Recycling and Energy plan (CWRREMP) would be prepared as part of the CEMP detailing appropriate procedures for waste management. The Construction Waste Recycling Reuse Environment Management Plan would ensure waste disposal and energy use is minimised by tracking and reporting performance and applying corrective action as required.	Construction
	WM08	Wastes would be managed using the waste hierarchy principles of: • Avoidance of unnecessary resource consumption to reduce the quantity of waste being generated. • Recover resources for reuse on-site or off-site for the same or similar use, without reprocessing. • Recover resources through recycling and reprocessing so that waste can be processed into a similar non-waste product and reused. • Disposal of residual waste.	Construction
	WM09	Residual waste would be disposed of to a suitably licensed landfill or waste management facility where there are no other feasible and reasonable options for waste avoidance, reuse or recycling. Waste materials requiring removal from the site would be classified, handled and stored in accordance with the <i>Waste Classification Guidelines: Part 1 Classifying Waste</i> (EPA, 2014a) until collection by a contractor for disposal.	Pre-construction and construction
	WM10	Off-site reuse of waste would comply with relevant NSW Environment Protection Authority resource recovery exemptions and requirements.	Construction
	WM11	Asbestos handling and management would be undertaken in accordance with the project's Asbestos Management Plan and relevant legislation, policies and standards: • <i>Work Health and Safety Act 2011</i> • <i>Code of Practice for the Safe Removal of Asbestos 2nd Edition</i> (NOHSC, 2005a). • <i>Code of Practice for the Management and Control of Asbestos in Workplaces</i> (NOHSC, 2005b). • <i>Protection of the Environment Operations (Waste) Regulation 2014</i> – Part 7 Transportation and management of asbestos waste. • Australian Standard AS2601:1991 Demolition of Structures.	Pre-construction
	WM12	Measures would be implemented to manage stockpiles such as potentially locating stockpiles outside of overland flowpaths, riparian corridors and finished and contoured so as to minimise loss of material in flood or rainfall events. Stockpiles left exposed and undisturbed for longer than 28 days would be stabilised by compaction then either sprayed with suitable tackifier, covered with anchored fabrics, or seeded with sterile grass.	

Impact	No.	Environmental management measure	Timing
Excess spoil	WM13	A Spoil Management Strategy would be developed prior to the commencement of construction and implemented during construction. The strategy would identify spoil disposal sites and describe the management of spoil on-site and during off-site transport.	Pre-construction
	WM14	Where possible and fit for purpose, spoil would be beneficially reused within the project before off-site reuse or disposal options are pursued.	Construction
	WM15	Before being transported from construction sites, excavated spoil would be classified in accordance with the <i>Waste Classification Guidelines: Part 1 Classifying Waste</i> (EPA, 2014a) to ensure appropriate reuse or disposal.	Construction
Wastewater	WM16	Feasible and reasonable opportunities for wastewater reuse on-site or for construction purposes would be pursued (such as dust suppression both in the tunnels and for surface works).	Construction
	WM17	Wastewater not used on-site would be discharged into the local stormwater system in accordance with the requirements of an environment protection licence issued for the project.	Construction
Contaminated soil	WM18	An Unexpected Finds Protocol would be implemented in the event of encountering previously unidentified area(s) or types of contaminated material. Where this happens, all relevant work would cease in the vicinity of the discovery in accordance with a unsuitable spoil management contingency procedure which would be included as part of the Spoil Management Strategy for the project. Relevant works would not recommence until the need for and scope of remedial action(s), if required, is identified in accordance with the requirements of the <i>Contaminated Land Management Act 1997</i> .	Construction
Operation			
Management of waste	OPWM01	Wastes would be managed and disposed of in accordance with relevant State legislation and government policies including the POEO Act, <i>Waste Avoidance and Resource Recovery Act 2001</i> , <i>Waste Avoidance and Resource Recovery Strategy 2014-2021</i> (EPA, 2014b), and the sustainable procurement objective of the <i>WestConnex sustainability strategy</i> (WestConnex Delivery Authority, 2015).	Operation
Operational water requirements	OPWM02	Opportunities for reuse of wastewater would be considered in preference to discharge to the local stormwater system.	Detailed design and operation
	OPWM03	In order to reduce demand on local water supplies, options would be investigated for providing water required for operation of the deluge system from wastewater produced through the tunnel drainage system where it meets appropriate quality parameters.	Detailed design and operation

Impact	No.	Environmental management measure	Timing
Climate change and risk adaptation			
Operation			
Climate change impacts	CC01	The risk associated with future climate change on the project would be further considered during detailed design.	Pre-construction
	CC02	Implement adaptation measures to address high and extreme rated risks identified in the subsequent detailed climate change risk assessment.	Pre-construction
	CC03	Where extreme, high or medium risks have been identified in this assessment or subsequent climate change risk assessments, a review of the existing design policies, specifications or practices would be undertaken to consider the impacts of climate change.	Pre-construction
Hazard and risks			
Construction			
General	HR01	Site-specific hazard and risk management measures would be included within the CEMP, which may include items such as: • Details of the hazards and risk associated with construction activities for both surface and subsurface works • Procedures to comply with legislative and industry standard requirements • Contingency plans, as required.	Pre-construction / construction
Storage of dangerous goods and hazardous substances	HR02	Storage of dangerous goods and hazardous materials would occur in accordance with suppliers' instructions and relevant Australian Standards and may include bulk storage tanks, chemical storage cabinets / containers or impervious bunds.	Construction
	HR03	Storage, handling and use of dangerous goods and hazardous substances would be in accordance with the <i>Work Health and Safety Act 2011</i> and the <i>Storage and Handling of Dangerous Goods Code of Practice</i> (WorkCover NSW, 2005).	Construction
	HR04	Secure, bunded areas would be provided around storage areas for oils, fuels and other hazardous liquids.	Construction
	HR05	Bunds would be provided around activities such as vehicle refuelling, servicing, maintenance or wash-down, where there is a potential for spills and contamination.	Construction
	HR06	Material Safety Data Sheets would be obtained for dangerous goods and hazardous substances stored onsite prior to their arrival.	Construction
Transportation of dangerous goods and hazardous substances	HR07	Transport of dangerous goods and hazardous substances would be conducted in accordance with relevant legislation and codes, including the <i>Dangerous Goods (Road and Rail Transport) Regulation 2014</i> and the Australian Code for the <i>Transport of Dangerous Goods by Road and Rail</i> (National Transport Commission, 2008).	Construction

Impact	No.	Environmental management measure	Timing
Aviation Measures	HR08	The project would be constructed in line with Civil Aviation Safety Authority requirements, to the satisfaction of the Secretary of the Commonwealth Department of Infrastructure and Regional Development.	Construction
Aviation Measures - lighting	HR09	The project would be constructed in accordance with the requirements of the Civil Aviation Safety Authority and the <i>Sydney Airport Master Plan 2033</i> , with respect to lighting used during construction.	Construction
Operation			
Fire and life safety	OpHR01	The fire and safety systems and measures adopted for the project would be equivalent to or exceed the fire safety measures recommended by NFPA502 (American), PIARC (European), AS4825 (Australian) and Roads and Maritime standards.	Detailed Design
Storage of dangerous goods and hazardous substances	OpHR02	Storage of dangerous goods and hazardous materials would occur in accordance with supplier's instructions and relevant Australian standards and may include bulk storage tanks, chemical storage cabinets / containers or impervious bunds.	Operation
	OpHR03	Storage, handling and use of dangerous goods and hazardous substances would be in accordance with the <i>Work Health and Safety Act 2011</i> and the <i>Storage and Handling of Dangerous Goods Code of Practice</i> (WorkCover NSW, 2005).	Operation
	OpHR04	Secure, bunded areas would be provided around storage areas for oils, fuels and other hazardous liquids. Impervious bunds would be of sufficient capacity to contain at least 110 per cent of the volume of the largest stored container.	Operation
	OpHR05	Bunds would be provided around activities such as vehicle refuelling, servicing, maintenance or wash-down, where there is a potential for spills and contamination.	Operation
	OpHR06	Material Safety Data Sheets would be obtained for dangerous goods and hazardous substances stored onsite prior to their arrival.	Operation
Transportation of dangerous goods and hazardous substances	OpHR07	The transport of dangerous goods and hazardous substances would be prohibited through the main alignment tunnels and on and off-ramp tunnels.	Operation
Incident response	OpHR08	An Incident Response Plan would be developed and implemented in the event of an accident or incident.	Operation
	OpHR09	The response to incidents within the motorway would be managed in accordance with the memorandum of understanding between Roads and Maritime and the NSW Police Service, NSW Rural Fire Service, NSW Fire Brigade and other emergency services.	Operation
Electric and magnetic fields	OpHR10	The detailed design of the project substations would ensure that the exposure limits for the general public suggested by the Draft Radiation Standard (<i>Australian Radiation Protection and Nuclear Safety Agency, 2006</i>) would not be exceeded at the boundary of the substation sites.	Detailed Design

Impact	No.	Environmental management measure	Timing
Aviation Measures	OpHR11	The project would be operated in line with Civil Aviation Safety Authority requirements, to the satisfaction of the Secretary of the Commonwealth Department of Infrastructure and Regional Development.	Detailed Design
Aviation Measures - lighting	OpHR12	Aviation hazard lighting, building lighting and surface road lighting would be designed and operated in accordance with the requirements of the Civil Aviation Safety Authority and the <i>Sydney Airport Master Plan 2033</i> .	Detailed Design and Operation
Cumulative impacts			
Cumulative impacts	CI01	Consultation would be undertaken with local communities potentially affected by the impacts of multiple projects in addition to the project.	Construction
	CI02	Where relevant, consultation would be undertaken with proponents of other nearby developments to increase the overall awareness of project timeframes and impacts.	Construction