volumes. This however accounts for the worst movement, which is the right turn movement from the Laydown Access Road to the Pacific Highway. However, the additional average delay for the intersection in total is estimated to be 2.4 seconds during the PM peak with construction traffic

- It should also be noted that these results account for the most conservative scenario, however it is likely that workforce travel will occur outside of these peak hours and even less of an impact can be expected
- It is considered that the proposed construction generated traffic would have a minimal impact on the existing surrounding road network and that safety would not be compromised as a result of the Proposal.

Detailed movement summary reports are provided in the TIA (Appendix E).

Turns Warrants Assessment

An assessment has been undertaken of the appropriate treatments for the 5 access points proposed for construction vehicles, based upon the provisions of *Austroads Guide to Road Design - Part 4A: Unsignalised and Signalised Intersections, Section 4.8 (Warrants for BA, AU and CH Turn Treatments)*.

Due to the preliminary nature of the assessment and the details of construction movements not yet confirmed, a conservative assessment was conducted in assessing the necessary treatment options. A worst-case scenario was considered, where all accesses were tested with the assumption of all construction vehicles entering and exiting in the same hour.

Based on the expected peak hour traffic volumes, the turn warrants assessment shows that a basic left turn (BAL) treatment and basic right turn (BAR) treatment at each intersection would be sufficient for the access points to all five compounds. Upgrade works are therefore not required.

Figure 7-27 shows basic turn treatments applied to intersections in urban areas.

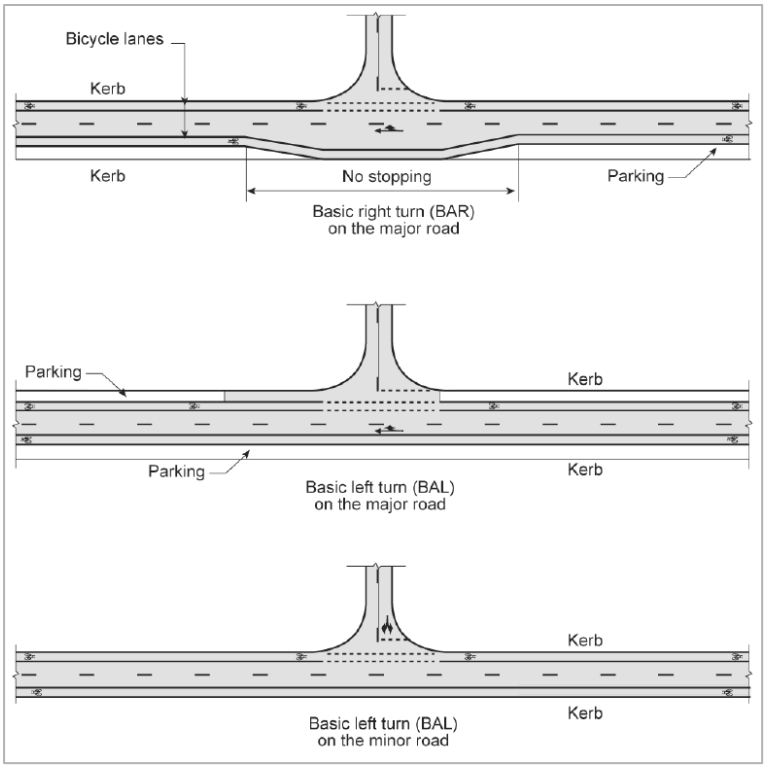

Figure 7-27 Basic turn treatments in urban areas

Absorption Capacity Assessment

A conservative assessment was performed, assuming that all construction vehicles would enter and exit the compounds simultaneously, during the network morning and afternoon peak hours. This assessment was conducted for all 5 accesses.

Table 7-45 shows the practical absorption capacity of the accesses, based on major stream traffic volumes, critical gap acceptance and follow-up headway parameters.

Table 7-45 Practical absorption capacity at each compound area access

Compound access	AM peak practical absorption capacity (vehicles per hour [vph])		PM peak practical absorption capacity (vph)	
	Left turn	Right turn	Left turn	Right turn
Access 1	-	543	-	541
Access 2	943	904	930	885
Access 3	950	871	943	829
Access 4	950	871	943	829
Access 5	876	755	814	658

The analysis indicates that the proposed accesses would allow for sufficient absorption capacity to accommodate for the development traffic demand during both AM and PM peak hours.

Table 7-46 shows the expected average delays to be experienced by construction vehicles at each access.

Table 7-46 Expected delays for construction vehicles entering wider network from compound areas

Compound access	AM peak average delay (s)		PM peak average delay (s)	
	Left turn	Right turn	Left turn	Right turn
Access 1	-	0.5	-	0.5
Access 2	0.1	0.3	0.2	0.4
Access 3	0.1	0.4	0.1	0.6
Access 4	0.1	0.4	0.1	0.6
Access 5	0.4	0.1	0.7	1.7

The access analysis indicates that the construction traffic vehicles would experience insignificant levels of vehicle delay in order to enter the major stream traffic flow. The accesses would operate within acceptable levels of vehicle delay.

Safe Intersection Sight Distance

Safe Intersection Sight Distance (SISD) is the minimum sight distance which should be available along the major road at any intersection.

The SISD assessment was performed under the conservative assumption that vehicles travelling along the Laydown Access Road and Rees James Road would travel at about 70 km/h, despite the posted speed being 50 km/h. This assumption is based on midblock traffic surveys conducted at Adelaide Street provided by Council for the purpose of this assessment, where travel speeds of about 80 km/h were recorded despite the posted 60 km/h speed limit. A speed increase of about 20 km/h was accordingly applied to Rees James Road and the Laydown Access Road due to them providing a similar north-south uninterrupted movement. Irrawang Street traffic is assumed to travel at about 50km/h in accordance with the posted speed limit, due to it being located within the Raymond Terrace town centre.

Access 1 is located on the Laydown Access Road, where a downhill grade is observed when travelling towards the east. The SISD is about 182 metres when travelling from the Pacific Highway on the east, and about 168 metres when travelling along the Laydown Access Road from the west. Figure 7-28 shows the sight distances and longitudinal grades at Access 1.

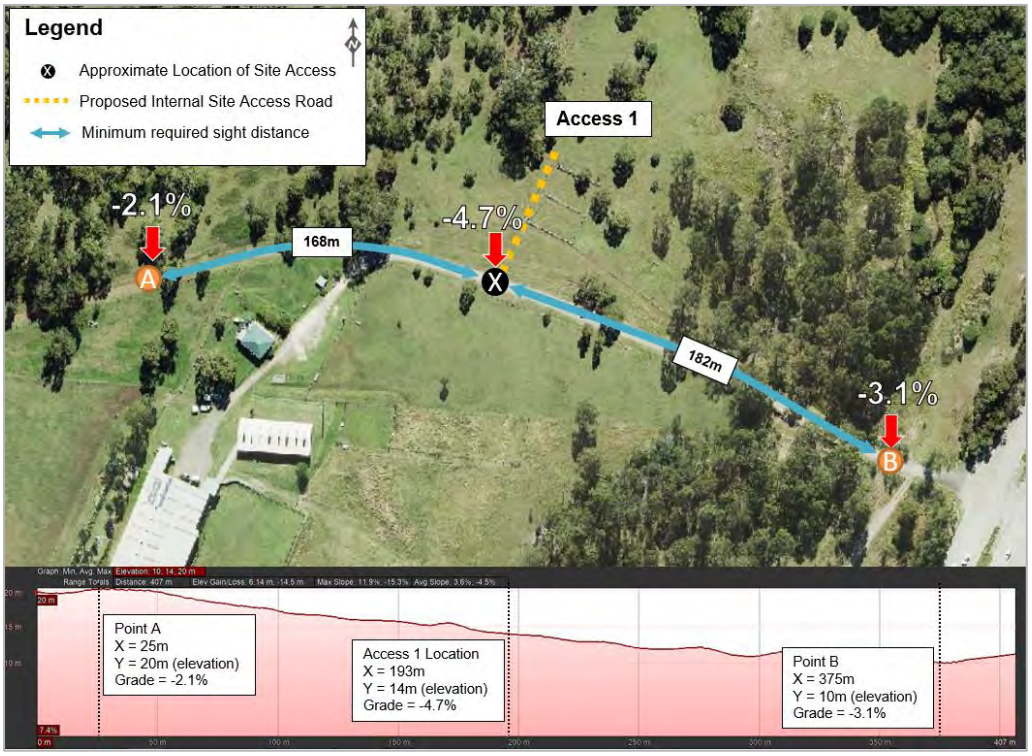

Figure 7-28 Access 1 – sight distances and longitudinal grades

Access 2 is located along Rees James Road, where an uphill grade is observed when travelling in the northern direction. Along this section, the vertical road alignment is relatively flat, with elevation gain of 1m in the 347-metre distance between Point A and Point B as shown in Figure 7-29. The SISD is about 177 metres when travelling along Rees James Road from the south, and about 170 metres when travelling from the north.

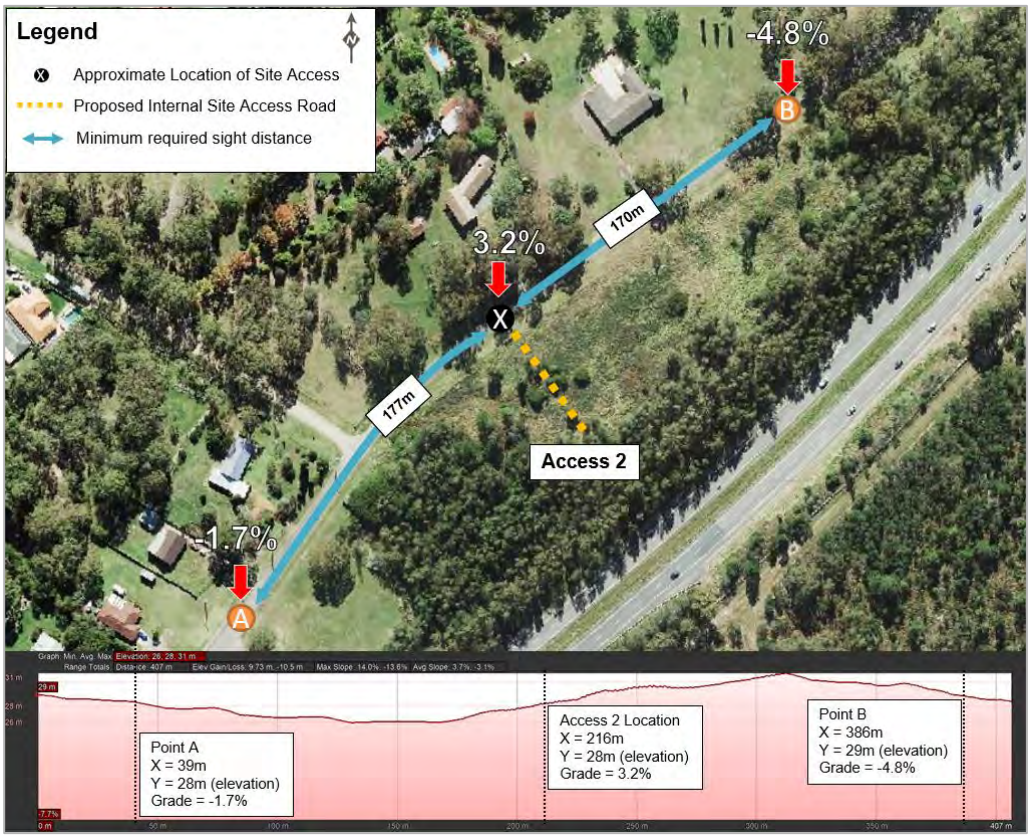

Figure 7-29 Access 2 – sight distances and longitudinal grades

Accesses 3 and 4 are located close to each other along Rees James Road, about 215 metres apart. When considering northbound travel beginning at Point A, Access 4 is located on a downhill grade shortly after the vertical alignment peaks. Access 3 is located along an uphill grade, with a relatively flat vertical alignment when travelling in the direction of Point B. The SISD when approaching Access 3 from the north is about 176 metres, and the SISD of Access 4 when approaching from the south is about 170 metres. Figure 7-30 shows the sight distances and longitudinal grades of accesses 3 and 4.

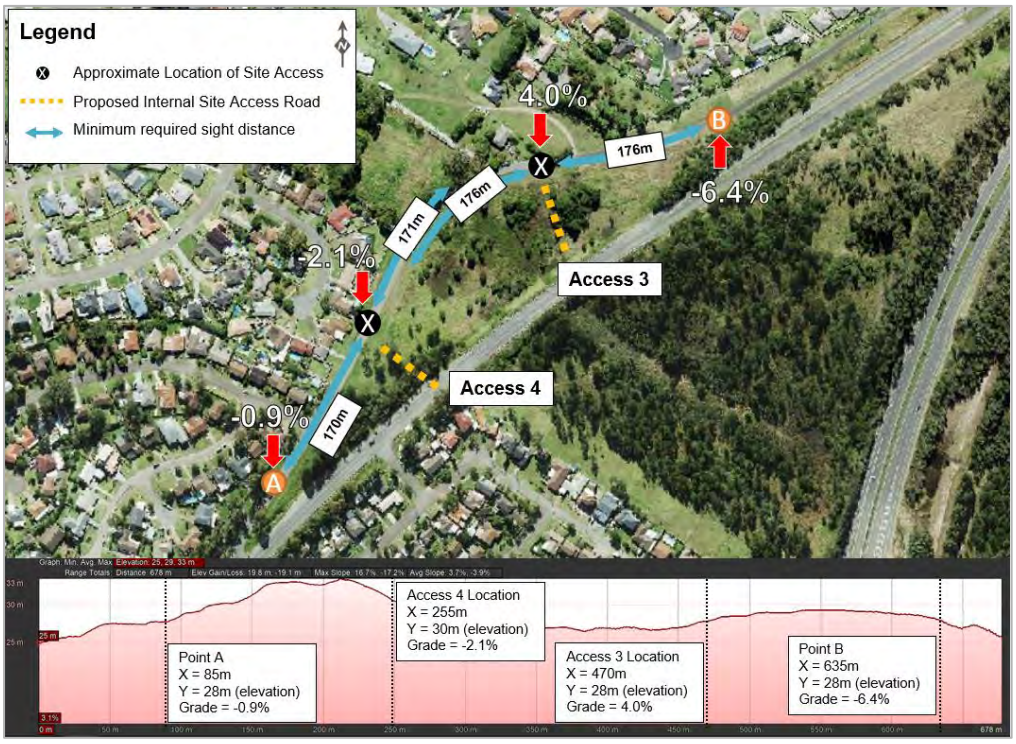

Figure 7-30 Accesses 3 and 4 – sight distances and longitudinal grades

Access 5 is located along Irrawang Street, which passes through the Raymond Terrace town centre. The surrounding vertical road alignment is relatively flat, with an elevation difference of about one metre in the 227 metre section between Point A and Point B. The SISD of the access is about 110 metres when approaching from the south, and about 117 metres when approaching from the north.

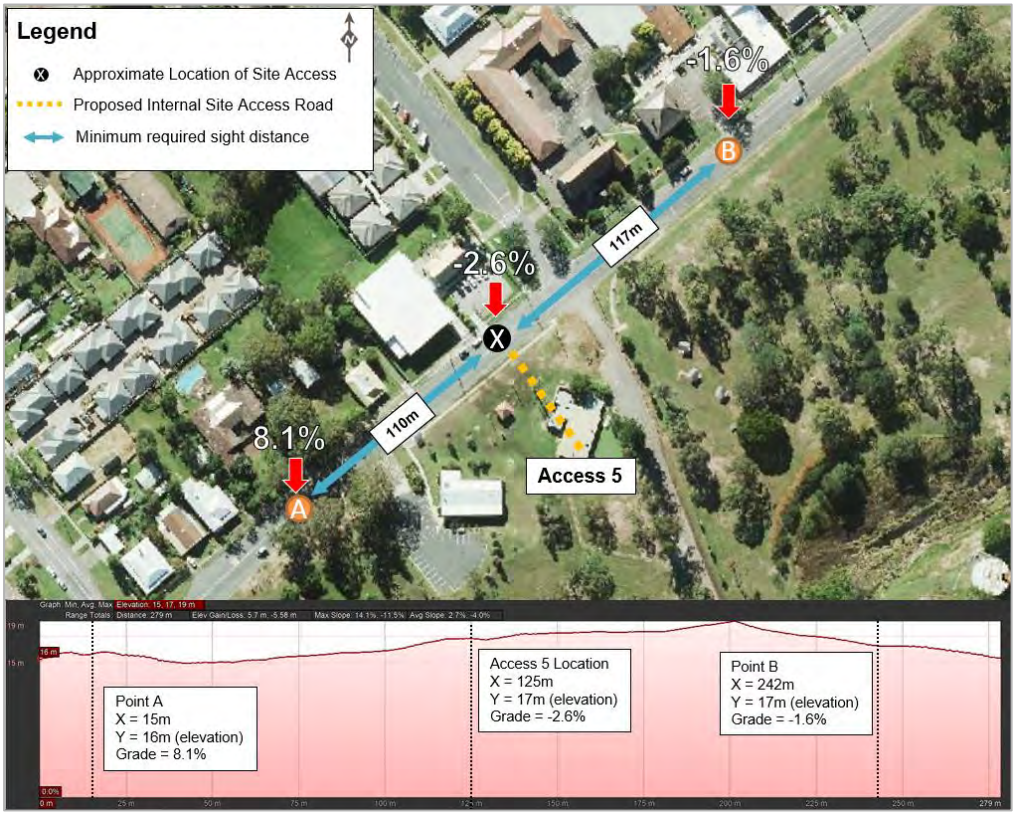

Figure 7-31 Access 5 – sight distances and longitudinal grades

As seen in the above analysis, it was found that the existing available SISD at all five accesses are greater than the minimum required distances for both directions of travel at each of the compound areas.

Approach Sight Distance

The various sight distance requirements for trucks should be driver eye height of 2.4 metres to pavement level at the stop or holding line (zero metres). Approach sight distances (ASDs) for trucks are numerically the same as the SISD values for trucks provided in *Austroads Guide to Road Design Part 3 (*Austroads 2016b). The same sight distance requirements were calculated as for SISD.

It was found that the existing ASD is more than the required minimum distances and that the proposed accesses would maintain safe sight distance standards.

Parking provision

It is proposed that temporary staff parking be provided at each work zone. Given the linear alignment of the pipeline and construction work, it is assumed that workers will park within the vicinity of the construction footprint and walk to where construction activities occur. It is recommended that parking on local residential street be avoided. It is also recommended that parking opportunities be recorded within a detailed Construction Traffic Management Plan (CTMP) which also designates parking locations to be used during the construction stage. This has been included as a mitigation measure in the section below.

Operation

Maintenance vehicle movements

During operation of the Proposal (i.e. following the completion of the construction stage), the estimated workforce would consist of a small number of workers (i.e. approximately 1-5 staff per maintenance activity). In a worst-case scenario if all workers travel alone, this would equate to 5 (two way) vehicle trips per day to do the required maintenance works.

It is not expected that there would be any heavy vehicle movements during the operational stage of the Proposal. It is considered that operational generated traffic would be negligible from a traffic engineering or transport planning perspective and that further analysis of the operational stage would not be required.

7.9.4 Mitigation measures

Construction

- A preliminary Traffic Management Plan (CTMP) has been provided as part of the TIA (Appendix E). This preliminary TMP provides a guide to be used for the final CTMP
- The preparation of a final CTMP should be developed in relation to the requirements provided by the *Roads and Maritime Services Traffic Control at Work Sites Manual Technical Manual* (2018). Consultation is required with Council, NSW Police and nearby schools during development of the final CTMP, addressing concerns such as (but not limited to) access locations, Council owned assets, the surrounding environment, and other transport modes

- Access along the road network through work sites will be provided for emergency service vehicles
- Temporary circulation roadways to the compounds should be designed to accommodate the swept path of the largest design vehicle using the facility plus the specified clearances from the vehicle body to vertical obstructions and other vehicles. This should be in line with *AS2890.2 Off Street Commercial Vehicle Facilities*
- Construction compound accesses would be designed with the assumption that the construction traffic heavy vehicles accessing the compounds would consist of Heavy Rigid Vehicles (HRVs). This would include the provision of a temporary access pavement and no lane lines or right-turn arrows marked on the minor road pavement for a basic right turn treatment. It should be noted that site constraints such as utilities should be taken into consideration during design stages which would ultimately inform the required access arrangements
- Signage where required, should be displayed during both daytime and at night with the retroreflective material used for the signs meeting the necessary requirements. Advisory truck turning signage shall be installed at the compound area access locations where heavy vehicle turn movements would occur, including the use of any advisory variable message signs for slow-moving heavy vehicles
- The final CTMP should also indicate how the impact to pedestrians would be managed to ensure safety. Construction traffic operators should be made aware of pedestrian movements within a detailed CTMP clearly indicating crossing locations, walkable desire lines and peak time of pedestrian movement
- It is not expected that the frequency and service times of public bus services would be impacted by construction traffic. However, it is proposed that the wider community and public transport service providers and users be notified in advance of expected construction activities and durations
- Parking on local residential street is to be avoided. To manage parking, the final CTMP would designate available parking locations to be used during construction activities
- Traffic management measures be put in place for the duration of construction to manage delays at the Pacific Highway/Laydown Access Road intersection such as avoiding travel of staff during peak background traffic hours and should be detailed in a final CTMP prior to construction.

Operation

As a result of the minimal impact of the Proposal, no mitigation measure would be required during operation.

7.10 Bushfire

The information presented in this section is based on the findings of the Bushfire Assessment Report undertaken by Australian Bushfire Consulting Services (ABCS) (refer to Appendix I).

The key issues which have been raised in the SEARs (No. 1291) identified an assessment of the risk of bushfire, including potential bushfire protection measures required for the Proposal in accordance with *Planning for Bushfire Protection 2006* (NSW Rural Fire Service).

A summary of the relevant SEARs and where they are addressed in this section is provided in Appendix A.

7.10.1 Methodology

The methodology for the bushfire assessment undertaken for the Proposal includes:

- Review of the existing environment within the Proposal site, including topography, vegetation, and the Proposal within its existing context
- Review of Council's plans and maps, including the Port Stephens LEP, Port Stephens DCP and Council's Bushfire Prone Land Maps
- Preparation of a Bushfire Assessment Report, which incorporated a summary of the information obtained from the above reviews, and an assessment of the Proposal against the following legislative requirements, standards and guidelines:
  - *Planning for Bush Fire Protection 2006*
  - *Draft Planning for Bush Fire Protection 2019*
  - *Rural Fires Act 1997*
  - *Rural Fires Regulation 2013*
  - *Environmental Planning and Assessment Act 1979*
  - *AS3959 – 2009 Construction of buildings in bushfire prone areas*
  - *AS3959 – 2018 Construction of buildings in bushfire prone areas*.

The aim of the Bushfire Assessment Report is to determine the measures required to address the existing bushfire risk on the Proposal Site, and the bushfire risk posed by the Proposal.

7.10.2 Existing environment

The intensity and spread of bushfires are influenced by environmental features such as surrounding vegetation and topography. The existing environment relevant to the bushfire assessment for the Proposal site comprises the following and are detailed in Table 7-47 below.

- Vegetation in land considered to be bushfire prone is identified in Council's Bushfire Prone Land Map as being:
  - With or within 100 metres of Category 1 (high) hazards or
  - With or within 30 metres of Category 2 (low) hazards or
  - With or within 30 metres of Category 3 (medium) hazards.
- Topography, including an assessment to determine the effective slope of the land on and surrounding the Proposal site.

Table 7-47 Existing Environment - Bushfire

Parameter	Existing Environment
Bushfire mapping	• The northern part of the Proposal site is within an area mapped as a buffer zone from Bushfire Vegetation Category 1 (high hazard) which consist of areas of forest, woodlands, heaths and wetlands. • Additionally, the Proposal site traverses Vegetation Category 2 (low hazards) at the north (Kings Hill URA) and south (Raymond Terrace) as outlined in Figure 7-32. Vegetation Category 2 generally consists of rainforests, shrublands, open woodlands and grasslands.
Vegetation	• Vegetation to the north and west of the Proposal site includes grassy woodland within grazed pastures in excess of 170 metres in all directions. Vegetation to the south and east of the Proposal site has been identified as forest-type vegetation zoned E2 Environmental Conservation, which is to be preserved. This vegetation encompasses eucalypts trees between 10 to 20 metres tall, having crowns that touch and overlap (foliage cover of approximately 50-60%) with an understorey of small trees, shrubs and grasses.
Topography	The slope of the land surrounding the Proposal site includes the following topographic data: • 0-5 degrees downslope within the hazard to the east and south • 0 degrees or upslope within the hazard to the north and west.

Figure 7-32 below shows an extract of Port Stephens Council Bushfire Prone Land Map outlining the Proposal site and the surrounding vegetation mapping.

LEGEND

Kings Hill URA

Bush fire prone area

Vegetation Category 1

Vegetation Category 2

Vegetation Buffer

Proposed water and wastewater infrastructure alignment

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Coordinate System: GDA 1994 MGA Zone 56
Date issued: October 18, 2019
Aerial imagery supplied by NSW LPI

1:25,000 at A4

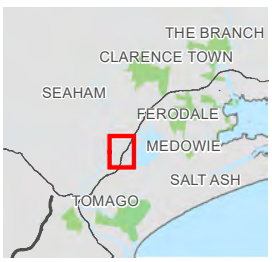

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Figure 7-32 Bushfire Prone Land Map

7.10.3 Potential impacts

Construction

The majority of the Proposal includes infrastructure (the water and wastewater pipelines) located underground. These would not be exposed or pose a bushfire risk. However, there are above ground components included in the Proposal that may be exposed to bushfire risk. These relate to the above ground components of the WWPS and the educt vent shaft pipes which are considered as non-habitable ancillary development similar to Class 10a and 10b structures in the context of *Planning for Bushfire Protection 2006* (PBP). As stated in the Bushfire Assessment Report by ABCS, there are no minimum APZs applicable to non-habitable structures located greater than 6 metres from a habitable dwelling, which is the case of this Proposal.

The vegetation identified as being a hazard to the proposed WWPS footprint is within the Kings Hill URA to the north and west, within E2 Conservation Land to the south and east. In accordance with the provisions of PBP, vegetation must be assessed within 140 metres of the Proposal site and the effective slope of the land. Where a mix of hazards is found, the highest hazard is said to predominate.

To ensure adequate defendable space for the Proposal, ABCS recommend that interim APZs are maintained since the construction stage until the Kings Hill URA is fully developed. Interim APZs would incorporate minimum distances of 12 metres to the north, west and south, and 29 metres to the east of the WWPS footprint (see Figure 7-33). This separation space ensures the proposed WWPS footprint is in an area determined to be less than or equal to 29 kW/m2 radiant heat impact. These interim APZs would be located within R2 zoned land and are outside any environmental conservation zones.

Potential ignition risks from construction works include human activity (e.g. smoking), vandalism (e.g. arson), sparks from plant or machinery operations (e.g. grinding and rock cutting) and Hot Work operations (e.g. welding, gas cutting, etc.). Further to this, ABCS identified that there is low risk of ignition of the vegetation surrounding the proposed vent shafts in normal operational conditions. It is considered that given the robust nature of the galvanised steel pipes, the need for greater defendable space around the educt vents is unnecessary. In addition, the bushfire prone vegetation surrounding the WWPS at the north of the Proposal site will be eventually removed as the Kings Hill URA is fully developed.

LEGEND

- Permanent asset protection zone (Kings Hill URA)
- Interim asset protection zone (WWPS)
- Potential location of WWPS
- Kings Hill URA
- Proposed water infrastructure alignment
- Proposed wastewater infrastructure alignment

1:2,500 at A4

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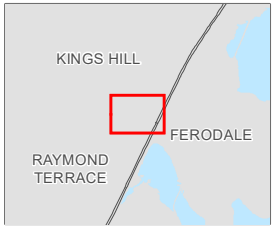

Figure 7-33 Proposed Interim Asset Protection Zones

Date: 18/10/2019 Path: \\HC-AUS-NS-FS-01\jobs\AA006855\L-GIS\A_Current\B_Maps\Pipeline_EIS\EIS\KHD_PipelineEIS_007_PipelineBushFireAPZ_A4P_v2.mxd
Created by : AB
QA by : EH

Operation

The operation of the Proposal has been considered in the relation to the provisions of PBP. As mentioned above, the aboveground components of the Proposal may be exposed to bushfire risk. However, these components are considered as non-habitable structures in accordance with PBP.

Although there are no specific bushfire requirements for these non-habitable structures, the assessment for the Proposal has considered the risks in bushfire prone land surrounding the Proposal site in order to meet the objectives of PBP.

The objectives of PBP generally apply to buildings. However, compliance of the Proposal with the objectives of PBP is summarised in Table 7-48.

Table 7-48 Compliance with the objectives of Planning for Bushfire Protection 2006

Objective	Compliance
1. Afford occupants of any building adequate protection from exposure to a bush fire;	The Proposal would involve underground pipelines and aboveground non-habitable structures related to the WWPS and educt vent shafts. Once the Kings Hill URA is developed, it would provide an APZ to bushfire prone vegetation in excess of 100 metres to the north and west, 30 metres to the south, and 60 metres to the east of the WWPS footprint.
2. Provide for a defendable space to be located around buildings;	As stated above, there are no minimum APZs applicable to non-habitable structures. However, the recommended interim APZs would provide a minimum defendable space of 12 metres to the north, west and south, and 29 meters to the east of the WWPS footprint, allowing sufficient reduction in fire heat until the Kings Hill URA is fully developed.
3. Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition;	The width of the defendable space mentioned above would allow appropriate APZs to avoid flame contact and minimise the risk of material ignition. These APZs would be maintained in accordance with the NSW Rural Fire Service's document *Standards for Asset Protection Zones* and Appendix 4 of *Draft Planning for Bushfire Protection 2019*.
4. Ensure that safe operational access and egress for emergency service personnel and residents is available;	Until the Kings Hill URA is fully developed, it is unnecessary to provide access and egress to cater for evacuating residents and emergency service personnel. In the interim, temporary access would be provided to the WWPS for fire vehicles. This temporary access is to allow for safe access of fire vehicles in accordance with the specifications outlined in the operational mitigation measures in the section below.
5. Provide for ongoing management and maintenance of bush fire protection measures, including fuel loads in the APZ; and	Interim APZs would be maintained to ensure adequate defendable space until the Kings Hill URA is fully developed, noting the URA would be established in accordance with the relevant guidelines in the Port Stephens DCP. These interim APZs would be located within R2 zoned land and outside any environmental conservation zones.
6. Ensure that utility services are adequate to meet the needs of firefighters (and others assisting in bush fire fighting).	It is considered that, if present at the time of any fire, a single Category 1 Fire Appliance (i.e. a fire truck) with a minimum water capacity of 3,500 litres would be a sufficient resource for this need.

7.10.4 Mitigation measures

Construction

The following actions would be considered for implementation, where reasonable and feasible, for mitigation of bushfire risk during construction:

- Safe work procedures during construction would include means to limit smoking within bushfire risk areas to predetermined safer areas, appropriate signage, maintenance of plant and equipment, operator awareness program and bushfire policy for Hot Work operations and ignition prevention, or fuel reduction in Hot Work areas
- A Hot Work Permit would be required if Hot Work is undertaken in the open within a hazardous area, or if a Total Fire Ban (TOBAN) is in force, regardless of whether the Hot Work is in a hazardous area or not. It would be prohibited to carry out any Hot Work activity in the open during a TOBAN, unless authorised under an exemption issued by RFS
- The contractor would include Safe Work Method Statement and Procedure Policies that address bushfire safety during construction (e.g. human activity and hot work)
- The aboveground components in the WWPS are to be constructed with the following material to withstand ember attack and radiant heat impact:
  - Above ground pipes, vent shafts, and services and equipment enclosures would be made from non-combustible material
  - Any wiring would be installed in non-combustible conduit or enclosed metal services gantry trays
  - The electrical connection box and switch board enclosures would be ember proof. There should be no gaps greater than 2 millimetres into the internal side of the enclosures
  - Electrical transmission lines would be located underground and installed with short pole spacing (30 metres), unless crossing gullies, gorges or riparian areas
  - BAL 29 Construction under AS3959 – 2009 or 2018 ‘Construction of buildings in bushfire prone areas’ may be used as a guide only.
- Interim APZs would ensure defendable space is maintained until Kings Hill URA is fully developed. In this regard, APZs are recommended with a minimum of 12 metres to the north, west and south, and 29 meters to the east of the WWPS footprint (refer to Figure 7-33 in Section 7.10.3 of this EIS). These APZs would be located within R2 zoned land and outside any environmental conservation zones. APZs around the vent shafts pipes are unnecessary as the risk of ignition is considered low around those components.

Operation

The following mitigation measures would be implemented during the operation of the Proposal:

- Access to the WWPS for fire vehicles would be provided in accordance with the specifications in the Bushfire Assessment Report, which include:
  - A minimum carriageway width of 4 metres
  - Passing bays every 200 metres that are 20 metres long by 2 metres wide, making a minimum trafficable width of 6 metres at the passing bay
  - A minimum vertical clearance of 4 metres to any overhanging obstructions, including tree branches

  - Access must provide loop around the WWPS compound or a suitable turning area
  - Curves must have a minimum inner radius of 6 metres and are minimal in number to allow for rapid access and egress
  - The minimum distance between inner and outer curves is 6 metres
  - The crossfall is not more than 10 degrees
  - Maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads
  - An RFS compatible lock is provided within any locked gate system.
- The contractor would include Safe Work Method Statement and Procedure Policies that address bushfire safety during operation and maintenance of plant and equipment
- Management of the landscaped areas within the Proposal site would be undertaken to reduce bushfire risk.

8 OTHER ENVIRONMENTAL ISSUES

8.1 Other issues

This section provides a discussion on other environmental issues which although not raised in the SEARs (No. 1291), are considered important in the assessment of the Proposal. In particular, Table 8-1 provides information on the methodology, existing environment, an impact assessment and mitigation measures that would need to be implemented to manage the potential environmental impacts of the Proposal.

Table 8-1 Other environmental issues

Issue	Methodology	Existing environment	Potential impacts	Mitigation measures
Hazard and risk	• Identification of existing and potential hazards associated with construction and operational activities and processes to be undertaken at the Proposal site. • As discussed in Section 5.4.6 of this EIS, the Proposal is not considered 'hazardous' as defined by SEPP 33. • Identification of mitigation measures and management controls to mitigate and manage potential risks.	• The majority of the Proposal site is greenfield. The surrounding land is primarily undeveloped and vegetated or rural residential, particularly at the northern portion of the Proposal site. • The southern portion of the Proposal site is located within Raymond Terrace, which mostly comprises low density residential development. • As stated in Section 2.2 of this EIS, existing residential receivers are located along Irrawang Street, Adelaide Street and Rees James Road, with the closest residential receiver located about 12 metres from the Proposal site.	<u>Construction</u> • Potentially contaminated soil and groundwater that would be disturbed during construction of the underground pipeline. • Fuels, glues, sealants and other hazardous goods that would be used during construction. • As no buildings would be cleared during the construction of the Proposal, no disturbance of asbestos-containing material is anticipated. <u>Operation</u> • As stated in Section 4.2.2 of this EIS, a chorine injection point would be required during operations for the water pipeline. Chlorine is classified as a hazardous chemical (No. 7782-50-5) under Safe Work Australia - Hazardous Chemical Information System (HCIS). • The above ground components of the Proposal (i.e. WWPS and vent shafts) would be located within bushfire prone land and may be exposed to risk of ignition (refer to Section 7.9 of this EIS).	<u>Construction</u> • Hazards associated with the construction of the Proposal would be managed through the implementation of a CEMP. In addition, construction will be undertaken in accordance with the *Work Health and Safety (WHS) Act 2011*. • During construction, fuels, glues, sealants and other hazardous goods would be stored on site, in accordance with relevant specifications to ensure these substances do not spill into the surrounding environment during refuelling activities, transport and delivery. <u>Operation</u> • The chlorine injection point will be designed and managed in accordance with *HWC Standard Technical Specification – Chemical Storage and Delivery Systems* (STS 670) and the relevant Australian Standards and legislation requirements (e.g. POEO Act).

Issue	Methodology	Existing environment	Potential impacts	Mitigation measures
Landscape and visual amenity	• Desktop review to identify environmental features, public viewpoints and sensitive receptors located within or in close proximity to the Proposal site. • Identification and assessment of the visual impacts of the components of the Proposal and the visual sensitivity of the surrounding environment to the Proposal site. • Identification of mitigation measures to manage potential impacts.	• North: The northern part of the Proposal site generally comprises undeveloped and vegetated land. The Kings Hill URA (yet to be constructed) and the association Riding for the Disabled Australia (RDA) are located within close proximity to the Proposal site. • South: The southern part of the Proposal site is located within the suburb of Raymond Terrace, comprising low to medium density residential development. These are the nearest sensitive receivers to the Proposal site. • East: To the east of the Proposal site is generally undeveloped, vegetated and comprises the Grahamstown Dam. • West: To the west of the Proposal site contains a large coastal wetland (Irrawang Swamp) that comprises vegetated areas and watercourses. • The extent of the Proposal site is generally undulating to the south of the wetland, flat across the wetland and gently	<u>Construction</u> • The construction of the Proposal would involve temporary visual impacts. These impacts would relate to the installation of construction compounds, construction works (excavations) and use of construction equipment along the Proposal site. Overall, construction activities are considered to be temporary and relatively short term in nature. <u>Operation</u> • The majority of the Proposal includes water and wastewater pipelines located underground, which would not result in any permanent visual impacts. Potential visual impacts could be evident from aboveground infrastructure, which comprises the proposed WWPS and ventilation stacks along the wastewater pipeline. • Potential visual receptors impacted by aboveboard components of the WWPS would include users at the RDA and future residents at the Kings Hill URA. However, potential impacts are expected to be negligible given the undulating nature of the landscape, remote setting and extensive vegetation which has a moderate ability to absorb visual impacts arising from aboveground elements of the Proposal. • The extent of views to the location of the WWPS would be minor, with the exception of the RDA which is obscured by distance, topography and vegetation. However, the WWPS would be	<u>Construction</u> • Where feasible and reasonable, structures and materials in the construction compounds, such as stockpiles and machinery, would be sited to minimise temporary visual impacts occurring during construction works. • The Proposal site would be kept in clean and orderly state to minimise any visual impacts that may arise during construction activities. <u>Operation</u> • Suitable material and finishes, including those which are non-reflective and blend with the surrounding landscape, would be selected for the aboveground components of the Proposal (i.e. WWPS and ventilation stacks). Materials and finishes of these components would be selected at detailed design to ensure low visual intrusion on surrounding areas.

Issue	Methodology	Existing environment	Potential impacts	Mitigation measures
		undulating north of the RDA.	generally low scale and therefore would not dominate the surrounding environment. Therefore, the level of impact on the views from the RDA are considered to be low. • The proposed ventilation stacks comprise minor aboveground structures that would be sympathetic with the surrounding environment and therefore, the potential impact is considered low. In the context of the surrounding environment, the Proposal would comprise minor aboveground structures that would not significantly impact on the scenic values of the local area.	
Socio-economic	• Desktop review to identify potential social and economic impacts associated with the Proposal in the context of the surrounding environment. • Review of available data, including DPIE's 2016 population and household projections, Australian Bureau of Statistics (ABS) Census Data (2016), and Council's Community Profile with population trends within the LGA. • Identification and assessment of potential impacts arising from the construction and operation of the proposal.	• The 2016 census data indicated that the population of Raymond Terrace (located within the southern part (and to the south of) the Proposal site) included 14,067 people, which represented almost 20% of the population in the Port Stephens LGA. • The labour force in the LGA in 2016 was 33,883 with 29,181 people employed and 1,876 people unemployed (5.5%). The top profession is the manufacturing sector. • As noted in Section 3 of this EIS, the Kings Hill URA has been rezoned to provide additional supply	<u>Construction</u> • Socio-economic impacts related to the construction of the Proposal would be temporary (approximately nine months) and largely localised to the construction area. The construction of the Proposal would result in short-term adverse impacts, such as potential impacts on land use and property, amenity and environmental impacts, traffic and access, public safety, and disruption of services and utilities. • Detailed environmental assessments of traffic, noise and vibration, biodiversity, heritage, water and hydrology, soils and contamination, air quality, hazard and risk, and other environmental issues are presented in Section 7 and in this table. • There would also be a temporary benefit through construction with the employment of the construction workforce and associated multiplier	<u>Construction</u> • A CEMP would be prepared to address the management of key environmental issues outlined in Section 7 of this EIS, including some issues outlined in this table (e.g. hazard and risks, land use and property). • If out of hour works (OOHW) must occur during construction, potential noise receivers would be notified within ten (10) days prior any construction in accordance with HWC requirements. • If works must occur out of hours, preference should be given to day and/or evening time works (i.e. between 7 am and 10 pm). As noted in Section 7.8, noise intrusive works should be completed before 10 pm where feasible to do so. Additionally, a detailed out of hours noise assessment should be conducted prior any OOHW being undertaken.

Issue	Methodology	Existing environment	Potential impacts	Mitigation measures
	• Consultation with relevant stakeholders, including government agencies, community members and local groups has been undertaken since early stages of the Proposal to inform about the scope of works in the Proposal site, and the potential impacts arising from the key issues identified in the SEARs (refer to comments raised and responses within Section 6 of this EIS). • Identification of mitigation measures to manage potential impacts.	for future housing and the growing population within the LGA. • The Kings Hill URA would provide significant residential land supply to accommodate future housing for the resident population in the LGA, which is predicted to increase by 18,650 people by 2036.	effect (i.e. investment in the local economy). <u>Operation</u> • The operation of the proposal may generate beneficial and adverse socio-economic impacts that would be experienced at a local and regional level. The potential socio-economic impacts related to the operation of the Proposal include the provision of water and wastewater services to the Kings Hill URA, as well as positive employment impacts as a result of the operation of the Proposal. • Amenity impacts during operation are considered minor and can be mitigated. As stated in Section 7, traffic and transport, air quality and noise impacts would be negligible as a result of the operation of the Proposal.	<u>Operation</u> • Mitigation measures have been identified for each of the key issues in Section 7 as well for the issues included in this table. The aim is to avoid, minimise and mitigate potential environmental impacts that may result from the construction and operation of the Proposal, and inherently, the associated socio-economic impacts that may result.
Land use and property	• Desktop review of existing land use to identify potential impacts of the Proposal on land use and property. • Potential socio-economic impacts of the Proposal are considered above in this table. • Ongoing consultation has been undertaken to respond to individual concerns from community members. Other relevant stakeholders, such as local community groups,	• The Proposal intercepts a variety of land uses between Raymond Terrace (south) and Kings Hill URA (north). The majority of the land uses along the Proposal site consist of road reserves, parklands, a wetland, and residential/rural uses. • The Proposal would run parallel to and across Irrawang Street, Adelaide Street and Rees James Road as shown in Figure 4-10. The Proposal would	<u>Construction</u> • Potential impacts on land use would generally occur during construction. Anticipated impacts include temporary disruption (in terms of access) of land uses along the Proposal site. <u>Operation</u> • The Proposal would be located within easements through existing lots owned by various landowners. Land ownership along the Proposal site is addressed in Section 2.2 of this EIS. • No private properties would be directly impacted as a result of the Proposal.	<u>Construction</u> • Land use and property impacts arising from the Proposal would be minimised where practicable to the extent necessary during construction activities. A CEMP would be prepared for the Proposal as mentioned above. <u>Operation</u> • All easement negotiations and acquisitions would be undertaken in consultation with landowners and in accordance with the corresponding legislative requirements.

Issue	Methodology	Existing environment	Potential impacts	Mitigation measures
	government agencies and utility providers have also been consulted in respect of land use and property impacts. Consultation is addressed in Section 6 of this EIS. • Identification of mitigation measures to manage potential impacts.	intersect other public infrastructure as described in Section 4.2.3 of this EIS. • The majority of the sensitive receivers are located within Raymond Terrace as outlined above in this table.	• Potential impacts during operations would involve maintenance access which would be infrequent and not impact on the use of the land.	

8.2 Ecologically sustainable development

Table 8-2 ESD

Issue	Precautionary principle	Inter-generational equity principle	Conservation of biological diversity and ecological integrity	Improved valuation, pricing and incentive mechanisms
Ecologically sustainable development	The precautionary principle requires an evaluation of the risks of serious or irreversible environmental damage associated with a proposed development. The Proposal has been assessed with the purpose of reducing the risk of serious and permanent impacts on the environment. Specialist studies have been undertaken to provide accurate information to assist with the evaluation and development of the Proposal. Where a level of uncertainty was identified in the data used for assessment, a conservative worst-case scenario analysis was undertaken. Mitigation measures which have been developed to manage the potential environmental impacts during construction and operation of the Proposal, as identified in these assessments, are provided in Section 11 of this EIS.	The inter-generational equity principle is concerned with ensuring that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations. Should the Proposal not proceed, the principle of intergenerational equity may be compromised, as the future residential area at Kings Hill URA would have no water and wastewater infrastructure to service the 3,500 residential dwellings projected to develop over a twenty-five-year period. In addition, the Proposal would be constructed and operated according to high environmental standards as outlined with the CEMP and operating licence to avoid or minimise any adverse environmental impacts. Continuous improvement would be carried out to ensure that best practice methods are being employed wherever possible.	This principle stipulates that biological diversity and ecological integrity should be fundamentally considered when assessing the impacts of a proposal. An assessment of the existing local environment at the Proposal site has been undertaken to recognise any potential impacts of the proposal on local biodiversity. The assessment undertaken as part of the BDAR and summarised in Section 7.3 of this EIS, concluded that the Proposal would require the removal of 5.22 hectares of native vegetation. However, no threatened flora species listed under the EPBC Act and/or BC Act were identified within the Proposal site. Impacts on the identified biodiversity values have been avoided and minimised in the Proposal as far as practicable. Where impacts cannot be avoided, the scale and extent of impacts has been determined, and a range of mitigation measures have been recommended to ameliorate impacts on the biodiversity values during construction and operation.	This principle requires that costs to the environment are incorporated or internalised in terms of the overall project costs, ensuring that decision making takes into account the environmental impacts. As a result, this EIS has, where possible, avoided or minimised environmental impacts and identified mitigation measures for areas where adverse environmental impacts may occur. While acknowledging that it is often difficult to place a reliable monetary value on the residual, environmental and social impacts of the Proposal, the value placed on avoiding and minimising the environmental impacts of the Proposal is demonstrated in the design features incorporated into the proposal and the extent of environmental investigations that have been undertaken to inform this EIS. The implementation of mitigation measures represents a capital and/or operational cost for the Proposal, as a valuation in economic terms of environmental resources.

9 CUMULATIVE IMPACTS

Cumulative impact can be defined as the successive, incremental and combined impact (both positive and negative) of an activity on society, the economy and the environment that is caused by past, present or reasonably foreseeable future activities. The cumulative nature of impact considers both interactions between different impacts within a single proposal and interactions between numerous proposals.

This section considers the overall environmental effect of the Proposal, drawing together the potential impact across environmental factors (as discussed throughout Sections 7 and 8) and taking into account of other existing or known likely future projects.

9.2.1 Surrounding area

The cumulative impact assessment has considered present and future projects of the suburbs surrounding the Proposal site, which include Kings Hill and Raymond Terrace.

9.2.2 Other development

As outlined in Section 1.2, other projects currently being undertaken for Kings Hill include the Concept DA for the Kings Hill URA, and the proposed interchange and stormwater channel seeking planning approval as separate applications (REFs) under Part 5 of the EP&A Act. These are, subject to sign-off and approval, proposed to be constructed potentially within a similar construction timeline.

Whilst subject to separate environmental assessment and approval, the Proposal would overlap the impact area (north of the Proposal site) for the proposed stormwater channel and proposed interchange.

In addition to the above, Roads and Maritime have recently commenced the preparation of environmental approval documentation for the M1 Pacific Highway Motorway extension. This project although located approximately 9 kilometres south-west of the Proposal site has the potential for some minor cumulative impacts, should construction programs coincide.

In addition to these projects, no other relevant developments were identified in Council's DA Tracker during the preparation of this EIS.

An overview of the key projects (and their status) that have the potential to interact with the Proposal are provided in Table 9-1. The locations of the Kings Hill projects in the context of the Proposal are provided within Figure 9-1[4].

Table 9-1 Present and future projects

Proposed development	Description	Status	Proposal's overlap
Kings Hill Stormwater Channel	Proposed stormwater channel that would capture stormwater run-off from Kings Hill URA, the adjacent Pacific Highway and proposed interchange at Kings Hill.	Application currently under assessment. REF expected to be on Public Display Q1 2020.	Located within the northern portion of the Proposal site, toward the eastern side of the Pacific

[4] The M1 Pacific Motorway extension has not been shown on this map as it is not geographically connected to the Proposal site (i.e. there is no direct overlap with this project located approximately 9 kilometres south-west).

Proposed development	Description	Status	Proposal's overlap
			Highway carriageway.
Kings Hill Interchange	Proposed grade separated interchange over the Pacific Highway at Kings Hill to enable safe and efficient access and egress from the proposed Kings Hill URA.	Application currently under assessment. REF expected to be on Public Display Q1 2020.	Located within the northern portion of the Proposal site, toward the eastern side of the Pacific Highway carriageway.
KHD Concept Application	The DA for the KHD Concept Masterplan and Stage 1 enabling works would support a mix of general residential, mixed use and local centre land. This proposal is expected to comprise a total of 1,900 residential lots. Note: The entire rezoned land at Kings Hill URA is expected to comprise in excess of 3,500 residential dwellings developed over a twenty-five-year period.	Application currently under assessment (DA-2018/772.1). DA submitted to Council in Q2 2019.	Located at the northernmost portion of the Proposal site toward the west of the Pacific Highway.
M1 Pacific Motorway extension to Raymond Terrace	Construction of a 15km extension of the M1 Pacific Motorway at Black Hill to the A1 Pacific Highway at Raymond Terrace.	SEARs issued by DPIE in March 2019. EIS currently under preparation.	Located approximately 9 kilometres south-west of the Proposal site.

LEGEND

- Kings Hill URA
- Proposed water infrastructure alignment
- Proposed stormwater channel
- Proposed interchange

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Coordinate System: GDA 1994 MGA Zone 56
Date issued: October 21, 2019
Aerial imagery supplied by NSW LPI

1:37,500 at A4

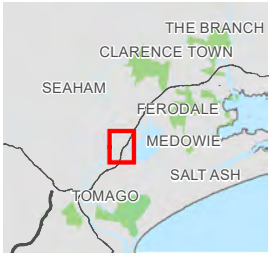

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Figure 9-1 Kings Hill URA and associated infrastructure

9.2.3 Potential impacts

Potential cumulative impacts could arise from the concurrent development of the Proposal and the Kings Hill projects and an additional project in the region (e.g. M1 Pacific Motorway extension). An overview of the potential impacts of other projects that have the potential for a cumulative impact is provided in Table 9-2 .

As a worst-case scenario, it has been considered that these projects can occur concurrently (construction and operation) in order to identify the overall cumulative impacts within the surrounding area.

Table 9-2 Cumulative Impacts

Project	Key construction impacts	Key operational impacts
Kings Hill Stormwater Channel	• Ecological impacts which include the loss of 18 ha of native vegetation, loss of fauna habitat, fauna injury and mortality, and some indirect impacts such as edge effects and weeds • A koala land bridge would be constructed to provide future habitat connectivity • Dispersal of sediments and water pollutants that may result in soil erosion, siltation and off-site movement of eroded sediments by wind and/or stormwater into receiving environments • Noise and vibration from earthworks, vegetation clearing and vehicle movements affecting sensitive receivers located along the Pacific Highway • Air quality impacts from bulk earthworks, vehicle movements, and plant and machinery	• Indirect impacts such as edge effects, weeds and noise on fauna • Will prevent stormwater entering Grahamstown Dam for any rainfall event up to the 0.2% AEP, and would provide stormwater management for the Kings Hill URA
Kings Hill Interchange	• Ecological impacts which include the loss of 12 ha of native vegetation, loss of fauna habitat, fauna injury and mortality, and some indirect impacts such as edge effects and weeds • Dispersal of sediments and water pollutants that may result in soil erosion, siltation and off-site movement of eroded sediments by wind and/or stormwater into receiving environments • Noise generated from vegetation clearing and earthworks affecting sensitive receivers located along the Pacific Highway	• Indirect impacts such as edge effects, weeds and noise on fauna • Will provide safe and suitable vehicular access from the Kings Hill site to the Pacific Highway • Low to moderate visual impacts for Pacific Highway users (motorists) and for the receivers located to the west of the Pacific Highway • The proposed stormwater channel discussed above would assist in capturing stormwater run-off from the proposed interchange
KHD Concept Application	• Ecological impacts which include the loss of 211 ha of native vegetation, loss of fauna habitat, fauna injury and mortality, and	• Indirect impacts such as edge effects, weeds and noise on fauna

Project	Key construction impacts	Key operational impacts
	some indirect impacts such as edge effects and weeds • Potential traffic and stormwater impacts. However, these could be mitigated though the proposed interchange and stormwater channel as discussed above. • Temporary soil and erosion impacts, including potential impacts to the downstream environment	• Will support a mix of general residential, mixed use and local centre land use zones and is expected to yield in excess of 3,500 residential dwellings over a twenty-five year period.
M1 Pacific Motorway extension to Raymond Terrace	• Ecological impacts which include the loss of native vegetation, loss of fauna habitat, fauna injury and mortality, and some indirect impacts such as edge effects and weeds • Noise and vibration impacts on sensitive receivers located along the road • Stormwater, soil and erosion impacts	• Will provide15 kilometres of dual carriageway motorway with two lanes in each direction, bypassing Hexham and Heatherbrae. • Minimum flood immunity along the proposed roadway between Black Hill and Tomago for a one in 100 year flood event • Minimum flood immunity along the roadway between Tomago and Raymond Terrace for a one in 20 year event. • Improved connection between the M1 Pacific Motorway and the Pacific Highway.

9.2.4 Potential impacts and mitigation

The projects in close proximity to the Proposal would generally be developed to benefit Raymond Terrace and surrounding areas, providing additional housing (Kings Hill URA), access (Kings Hill interchange and the M1 Motorway extension) and reducing stormwater impacts (Kings Hill stormwater channel).

These projects if undertaken separately or concurrently would present temporary impacts through construction, namely through noise, traffic and access and stormwater.

The operation of these projects may result in changes to the immediately surrounding noise environment through noise impacts however these would be mitigated.

The relevant environmental assessments for these projects include safeguards and mitigation measures to mitigate potential impacts of these projects. Should these projects be undertaken concurrently it is considered that these mitigation measures would be suitable to ensure that collectively they would not result in a significant or unreasonable cumulative impact on the surrounding environment or community.

The mitigation measures for both construction and operation specific to this Proposal are summarised in Section 11.

10 ENVIRONMENTAL RISK ASSESSMENT

An environmental risk analysis (ERA) has been undertaken to identify the key environmental impacts associated with the construction and operation of the Proposal, as identified in Sections 7 and 8. The ERA also assigns a ranking of environmental risk to each issue before and after the application of the mitigation measures identified throughout those sections.

This section outlines the environmental risk assessment undertaken for the Proposal for the purposes of:

- defining key environmental issues for assessment
- (on completion of the assessments), ensuring that any residual environmental risks are acceptable, assuming the effective implementation of proposed management measures.

10.1 Methodology

10.1.1 Initial Risk Assessment

The ERA identified the potential environmental impacts associated with the Proposal and assigned a risk ranking to each of the impacts identified. Risks were based on initial risk assessment categories (unmitigated environmental impacts) which are identified in Table 10-1.

Table 10-1 Initial risk categories

Risk category	Description
A	May have medium to high impact and requires further investigation to determine level of potential impact and to identify appropriate measures to manage and mitigate the impact.
B	May have low to medium impact; however, environmental impacts can be reduced to acceptable levels through use of standard or identified management measures.
C	Would have low impact and standard measures can be used to manage the impact.

Issues with an identified initial risk category ‘A’ are treated as ‘key issues’ for the EIS, which are also key issues identified within the SEARs (No. 1291). These issues are addressed in detail in Section 7 of this EIS.

Some additional environmental issues that were identified as having an initial risk category of ‘B’ or were also assessed as ‘key issues’ in this EIS, in order to satisfy the SEARs. These included: soils and contamination, waste management, air quality and odour, traffic and transport, bushfire and cumulative impacts.

Although not addressed within the SEARs, issues identified as having an initial risk category of ‘C’ were also assessed in this EIS as ‘other environmental issues’ (Section 8). These included: hazard and risk, landscape and visual amenity, socio-economic, land use and property.

10.1.2 Residual Risk Assessment

Subsequent to the initial risk assessment, this EIS has been prepared and mitigation measures identified to address the environmental risks associated with the Proposal. The effectiveness of mitigants is demonstrated by a residual risk assessment with findings presented in Table 10-3. 'Residual environmental risk' was assessed on the basis of the 'significance' of the environmental effects of the Proposal and the effectiveness of management actions in addressing likelihood and consequence of potential impacts triggered by the Proposal (i.e. the ability to adequately manage those effects to minimise harm to the environment).

'Significance of effects' is based on the sensitivity of the receiving environment, the level of understanding of the type and extent of impacts, and the level of community concern about those impacts. The 'manageability' of environmental effects is based on the complexity of the mitigation measures, the known level of performance of the safeguards proposed, and the opportunity for 'adaptive management'. Adaptive management is a structured, iterative process of optimal decision making in the face of uncertainty, with an aim to reducing uncertainty over time via system monitoring. In this context, it refers to the implementation of management actions and plans that include monitoring of impacts and appropriate contingency measures, should identified trigger levels be reached.

The residual risk categories are defined in Table 10-2.

Table 10-2 Residual risk categories

Risk category	Description
A	Sensitive receiving environment; type or extent of impacts not well understood; potential high level of community concern. Substantial mix of mitigation measures required; effectiveness of safeguards not yet proven; adaptive management not possible.
B	Resilient or disturbed receiving environment; type and extent of impacts understood; some community interest. Straightforward set of mitigation measures required; effectiveness of safeguards understood; adaptive management possible.
C	Degraded or highly disturbed receiving environment; type and extent of impacts fully understood; little or no community interest. Little, none or standard suite of mitigation measures required; adaptive management not required.

As shown in Table 10-3 below, no level 'A' residual environmental risks were identified for the Proposal. There were, however, a number of level 'B' residual risks identified. These level 'B' risks are not considered significant environmental risks on the basis of robust available mitigation measures to be implemented as part of the Proposal.

10.2 Environmental risk assessment

The ERA for the Proposal is presented in Table 10-3.

Table 10-3 Environmental risk assessment

Environmental aspect	SEARs / Key Issue?	Initial risk identified	Risk review and proposed mitigation	Residual risk	EIS Reference
Soils and contamination	Yes	Potential to interact with contaminated soil during construction *Initial risk category: B*	The Proposal site has the potential to include areas of soil contamination. Sources of contamination may include fill herbicides and/or pesticides. However, given the historical uses at the Proposal site, the potential for contamination is considered to be low. The CEMP would include suitable mitigation measures to manage, as necessary, any unacceptable levels of contamination during construction. The Proposal is not anticipated to have adverse impacts on the environment as a consequence of the operational activities.	B (neutral)	Section 7.1
		Potential to encounter or disturb acid sulfate soils during construction *Initial risk category: B*	The majority of the Proposal site is mapped as Class 5 category acid sulfate soils, with the exception of two sections at the northernmost portion which marginally intersect Class 3 category soils. An ASSMP would be prepared. The Proposal is not anticipated to result in any adverse impact on classed soils subject to the implementation of the ASSMP.	B (neutral)	Section 7.1
Water and hydrology	Yes	Impacts on the quality and quantity of surface and groundwater flows during construction and operation *Initial risk category: A*	Construction activities would result in soil disturbance over a small area of the Kings Hill URA watercourse, including potential downstream sedimentation and water quality impacts to nearby watercourses (e.g. Grahamstown Dam and Irrawang Swamp). Potential impacts also include spills or leaks of fuels, lubricants and hydraulic oils from construction plant and equipment. A SWMP and ESCP, or equivalent, would be incorporated into the CEMP for the Proposal. Groundwater may be intercepted during construction. However, the nature and duration of impacts would be confirmed at detailed design. In terms of operational impacts, discharge of water during commissioning of the pipes would be undertaken in accordance with HWC procedure *EP0112 'Dechlorination for discharge water'* (or equivalent) to improve water quality and avoid impacts to Irrawang Swamp.	B (reduced)	Sections 7.2 and 7.3

Environmental aspect	SEARs / Key Issue?	Initial risk identified	Risk review and proposed mitigation	Residual risk	EIS Reference
		Potential flooding affectation during operation *Initial risk category: B*	Flood hazard mapping in the Port Stephens LEP and previous reporting (e.g. *Williams River Flood Study*) have identified that the majority of the Proposal would be located outside flood prone land. The construction footprint of the WWPS would be located both above the 100-year flood level and outside of the riparian corridors of the ephemeral watercourses in accordance with HWC requirements. However, the exact location of the WWPS would be determined at detailed design.	C (reduced)	Section 7.2
Biodiversity	Yes	Potential impacts to the Coastal Wetland during construction *Initial risk category: A*	As discussed previously in this EIS, the Proposal traverses a mapped Coastal Wetland (ID 36586) under the Coastal Management SEPP. As noted above, appropriate sediment and erosion controls would be installed prior to the commencement of construction (and earthworks) to reduce run-off into adjoining vegetation and downstream to the Coastal Wetland.	B (reduced)	Section 7.3
		Impacts on biodiversity during construction *Initial risk category: A*	The Proposal would result in the removal of approximately 5.22 hectares of native vegetation from within the Proposal site. However, none of the vegetation in the Proposal site is equivalent to any TEC listed under the EPBC Act and/or BC Act. Biodiversity offsets would be established to mitigate the impact of the Proposal on threatened species, as outlined in the BDAR. In addition, construction activities would generate short-term impacts (e.g. noise, vibration, dust, light spill) which could affect adjacent native vegetation and native fauna (e.g. Grey-headed Flying-fox camp). Construction works at the Kings Hill URA watercourse would be undertaken during periods of no flow so that fish passage would not be impacted. No impacts to threatened fish are anticipated. A Flora and Fauna Management Plan (or equivalent) would be prepared and implemented as part of the CEMP. A number of mitigation measures would be implemented to address any residual impacts on biodiversity as part of the Proposal.	B (reduced)	Section 7.3
Aboriginal heritage	Yes	Unexpected damage and/or destruction of Aboriginal heritage items of significance during construction and operation	Two newly recorded Aboriginal sites were located during the surface survey for the Proposal and have been registered with the Aboriginal Heritage Information Management System (AHIMS), namely: AHIMS ID 38-4-2023 - KHW01 Artefact Scatter and PAD, and AHIMS ID 38-4-2025 - KHW02 PAD. No Aboriginal sites or areas of archaeological sensitivity have been	B (reduced)	Section 7.4

Environmental aspect	SEARs / Key Issue?	Initial risk identified	Risk review and proposed mitigation	Residual risk	EIS Reference
		Initial risk category: A	identified in the remaining portion of the Proposal site. Further testing will be undertaken during detailed design to determine the extent of subsurface artefacts that may be within the Proposal site. Should items of Aboriginal heritage significance be identified, disturbance will not occur until an AHIP is granted under s90 of the NP&W Act.		
Non-Aboriginal heritage	Yes	Damage and/or destruction of non-Aboriginal heritage items of significance during construction and operation *Initial risk category: A*	There are two items listed on the HWC s170 register: Irrawang Pottery Site (SHI#3630109) and Grahamstown Dam (including the spillways) (SHI# 3630054). A program of archaeological test excavation would be undertaken at detailed design to identify if relics are present and if there is a possibility of avoiding them by refining the pipeline alignment. Should items of non-Aboriginal heritage significance be identified, disturbance will not occur until an excavation permit is received under s139 of the Heritage Act.	B (reduced)	Section 7.5
Waste management	Yes	Potential for waste to be not managed appropriately impacting on the surrounding environment *Initial risk category: B*	Waste generated during construction and operation of the Proposal would be managed and disposed appropriately to avoid negative impacts on the environment. Waste management and disposal will be undertaken in accordance with the relevant policies and guidelines. Measures to mitigate the effect of the waste streams would be incorporated into the Proposal's CEMP.	C (reduced)	Section 7.6
Air quality and odour	Yes	Impacts of dust on surrounding receivers during the construction of the Proposal *Initial risk category: B*	The Proposal has the potential to generate dust from activities and truck movements during construction. An assessment has been undertaken which confirms that the dust generated will be negligible and will not have an adverse impact on the surrounding receivers. The CEMP would include suitable controls to manage potential dust impacts.	C (reduced)	Section 7.7
		Impacts of odour on surrounding receivers during the operation of the Proposal *Initial risk category: B*	An assessment of the potential odour emissions of the Proposal has been undertaken. The proposed WWPS, pump well, valve pit and any educt ventilation stacks installed within the WWPS location would be potential sources of odour. However, odour concentrations on surrounding receivers would be below the relevant criteria. Furthermore, a number of procedures would be implemented in accordance with HWC guidelines to mitigate any odour issues.	C (reduced)	Section 7.7

Environmental aspect	SEARs / Key Issue?	Initial risk identified	Risk review and proposed mitigation	Residual risk	EIS Reference
Noise and vibration	Yes	Increased noise and vibration levels at adjoining receivers (including nearby residential areas and sensitive receivers) during construction and operation *Initial risk category: A*	An assessment of the potential noise emissions of the Proposal during construction and operation has been undertaken. The proposed construction activities would result in an occasional exceedance of criteria located directly adjacent to the compound areas when construction work is occurring at these locations. In terms of vibration impacts, the separation distance from the nearest receivers is sufficient to mitigate any potential impacts. A CNVMP will be developed as part of the CEMP and implemented to include the appropriate control measures to avoid, reduce and manage noise and vibration impacts. These measures include: restricted construction hours and staging of noisy construction activities to avoid excessive noise on surrounding receivers. Potential noise emissions arising from operational activities are associated with the proposed WWPS. The Proposal is anticipated to comply with the established noise criteria through the implementation of the relevant acoustic control measures within HWC guidelines.	B (reduced)	Section 7.8
Traffic and transport	Yes	Traffic impacts of the proposal during construction and operation *Initial risk category: B*	A TIA for both construction and operational impacts has been undertaken. The minor additional traffic generation from the Proposal will not result in any adverse impacts on the performance, capacity or safety of the surrounding road network during construction or operation. In addition, temporary staff parking provided at each construction compound would be suitable to ensure that there is no overspill of staff parking in the surrounding area. The measures outlined in the TIA and the preliminary CTMP which will be developed as part of the CEMP would be implemented during construction of the Proposal to further control traffic movements and reduce associated impacts.	B (neutral)	Section 7.9
Bushfire	Yes	Potential to increase the incidence and severity of bushfires. *Initial risk category: B*	Portions of the Proposal site (northern parts) are mapped bushfire prone under the Port Stephens LEP. The Proposal would include a number of mitigation measures, including interim APZs around aboveground structures (e.g. WWPS and ventilation stacks), on-site equipment and procedures, to ensure that there is limited potential for increased occurrence or severity of bushfire on the Proposal site or surrounds.	C (reduced)	Section 7.10

Environmental aspect	SEARs / Key Issue?	Initial risk identified	Risk review and proposed mitigation	Residual risk	EIS Reference
Hazard and risk	No	Occurrence of hazards and risks during construction and operation *Initial risk category: C*	All construction works would be undertaken in accordance with the *Work Health and Safety (WHS) Act 2011* as a minimum. In addition, the mitigation measures outlined in the PSI and the CEMP would be implemented and include appropriate measures to manage hazards and risks that could potentially occur during construction of the Proposal. In terms of operational activities, the chlorine injection point required for the water pipeline would be designed and managed in accordance with *HWC Standard Technical Specification – Chemical Storage and Delivery Systems* (STS 670).	C (neutral)	Section 8.1
Landscape and visual amenity	No	Change in visual amenity of areas surrounding the Proposal site, impacting the community *Initial risk category: C*	The Proposal would involve temporary and short-term visual impacts during construction. Appropriate measures to avoid, reduce and manage construction visual impacts would be implemented as part of the CEMP. Permanent visual impacts relate to the aboveground components of the Proposal (e.g. WWPS and ventilation stacks). However, the level of impact on views is considered to be low given the nature of the surrounding landscape. Suitable material and finishes would be utilised for aboveground infrastructure to ensure minimal visual intrusion on surrounding areas.	C (neutral)	Section 8.1
Socio-economic	No	Disruption to the local community during construction and operation *Initial risk category: C*	Socio-economic impacts related to the construction of the Proposal would be temporary (approximately nine months) and largely localised to the construction area. These impacts would be appropriately managed through the implementation of mitigation measures included in the CEMP. There would also be a temporary benefit with the employment of the construction workforce and the associated investment in the local economy. Impacts during operation of the Proposal are considered to be minor and include traffic and transport, noise and vibration, air quality and odour, among others. These operational impacts can be mitigated, including the associated socio-economic impacts that could arise as a consequence of the Proposal. In addition, positive impacts related to the operation of the Proposal would include the provision of water and wastewater services to the Kings Hill URA, as well as employment generation.	C (neutral)	Section 8.1

Environmental aspect	SEARs / Key Issue?	Initial risk identified	Risk review and proposed mitigation	Residual risk	EIS Reference
Land use and property	No	Potential impacts on land use and property *Initial risk category: C*	Potential impacts on land use would generally occur during construction. Anticipated impacts would include temporary access disruption of land uses along the Proposal site. No private properties would be directly impacted as a result of the Proposal. A CEMP would be prepared for the Proposal as mentioned above. All easement negotiations and acquisitions would be undertaken in consultation with landowners and in accordance with the corresponding legislative requirements.	C (neutral)	Section 8.1
Cumulative impacts	Yes	Cumulative impacts on the environment and community as a result of works associated with the construction and operation of the Proposal *Initial risk category: B*	The Proposal includes cumulative impacts from construction and operation, occurring concurrently with other development within the area (e.g. Kings Hill URA, proposed interchange and proposed stormwater channel). Mitigation measures would be implemented in relation to each issue associated with the Proposal (e.g. biodiversity, water and hydrology, traffic, air quality and odour, noise and vibration, etc.) to ensure that the Proposal is not a significant contributor to cumulative impacts. Mitigation measures specific to the Proposal are summarised in Section 11.	B (neutral)	Sections 9 and 11

11 COMPILATION OF MITIGATION MEASURES

The EIS for the Proposal has identified a range of environmental impacts and recommended management and mitigation measures to avoid, to remedy and to mitigate these impacts (refer to Sections 7 and 8 of this EIS). This compilation of mitigation measures has been provided to satisfy Schedule 2, Part 3 clause 7 (1)(e) of the EP&A Regs.

This section presents a summary of the measures which would be implemented, either prior to construction, during construction or during operation of the Proposal. These draft mitigation measures may be revised in response to public submissions to the EIS and/or design changes following public exhibition of this EIS. It is envisaged that these mitigation measures will form the basis for the Conditions of Consent which would be provided for the Proposal, subject to approval.

The draft Compilation of Mitigation Measures for the Proposal is provided in Table 11-1.

The 'implementation stage' column of Table 11-1 details the timing as to when the specific mitigation measures would be undertaken. For example, a CEMP may be prepared prior to construction, but would not be 'implemented' until the construction phase.

For the purpose of this Compilation of Mitigation Measures, the following definitions apply to the terms used in the implementation phase column:

- *Pre-construction phase* – initial stage of physical works for the Proposal, which are not included within the definition of construction
- *Construction phase* – either prior to, or during construction of all physical works for the Proposal
- *Operation phase* – either prior to, or during the operation of the Proposal.

Table 11-1 Draft compilation of mitigation measures

No.	Mitigation measure	Implementation stage
0.	**General environmental management**	
0A	Pre-construction requirements for the Proposal include: • Finalise the detailed design of the Proposal • Undertake intrusive geotechnical investigation as part of detailed design • An Arborist Report is to be prepared by a suitable qualified arborist • Undertake Detailed Site Investigation (DSI) as required under *SEPP 55 – Remediation of Land* • Apply and obtain approval under s138 of the *Roads Act 1993* for construction works located on public road reserves • Apply and obtain approval for 'dredging and reclamation' as required under Clause 201 of the *Fisheries Management Act 1994* • Apply and obtain approval under s91 of the *Water Management Act 2000* for works that involve 'aquifer interference' • Apply and obtain 'controlled activity approval' as required under s91 of the *Water Management Act 2000* • Apply and obtain an Aboriginal Heritage Impact Permit (AHIP) under s90 of the *National Parks and Wildlife Act 1974*, if required • Apply and obtain s139 exemption for archaeological test excavation and/or s140 permit under the *Heritage Act 1977*, as required	Pre-construction
0B	A Construction Environmental Management Plan (CEMP) would be prepared to manage impacts on the environment during the construction phase. This would address management of the following: • Contamination and acid sulphate soils • Soil erosion, surface water and groundwater • Flora and fauna preservation and protection • Heritage (including unexpected finds during excavations) • Waste management • Air (odour and dust) emissions • Noise and vibration • Traffic and access • Bushfire management • Hazard and risk management	Construction

No.	Mitigation measure	Implementation stage
	• Community consultation.	
0C	The design and operation of the Proposal would be in accordance with the conditions in the current Raymond Terrace Waste Water Treatment Works (WWTW) Environmental Protection Licence (EPL) (No. 217). This EPL includes both the WWTW and the associated reticulation system that is owned and operated by HWC.	Operation
1.	**Soils and contamination**	
1A	Whilst there is a low risk of contamination, given that some potential onsite sources of contamination have been identified (i.e. potential fill, acid sulfate soils and presence of herbicides and pesticides), a protocol for managing contamination (if it is uncovered) is to be detailed within the CEMP.	Construction
1B	In order to confirm that contamination will not pose a risk to human health or the environment, the following measures should be undertaken: • A DSI of the site soils prior to any excavation works to confirm that risk to human health or the environmental is removed or minimised within the Proposal site. The DSI should be completed in accordance with the *NSW OEH (2011) Guidelines for Consultants Reporting on Contaminated Sites* and the *NEPC (2013)*; and/or • Having an experienced contaminated land professional present on the Proposal site throughout the excavation works to screen the soils and manage the stockpiling of excavated materials.	Construction
1C	All materials requiring removal from the Proposal site will need to be classified in accordance with the *NSW EPA (2014) Waste Classification Guidelines*. This material should only be transported from the Proposal site to an appropriately licensed landfill for disposal or to an appropriately licenced recycling facility which is licenced to receive this material, and waste disposal dockets kept for 'cradle to grave' waste tracking purposes.	Construction
1D	An Acid Sulfate Soil Management Plan (ASSMP) would be prepared as part of the CEMP for any Classed 3 category soils to be excavated within the Proposal site.	Construction
2.	**Water and hydrology**	
2A	Detailed topographic survey would be undertaken during detail design to ensure any constructability issues and impacts on the existing drainage, catchment areas and topography are identified and minimised as far as practicable.	Pre-construction
2B	The proposed wastewater pumping station (WWPS) would require on-site detention to mitigate peak flows to existing conditions in accordance with the Port Stephens DCP requirements. Additional water quality treatment may also be required. This would be determined during detailed design based on the size and configuration of the aboveground footprint in accordance with Port Stephens Council requirements.	Pre-construction
2C	Staging and timing of works are particularly important when working in higher risk areas for impacts such as near concentrated flow paths (existing or temporary), watercourses and riparian corridors, spillways, the existing pit and pipe drainage network and areas below	Construction

No.	Mitigation measure	Implementation stage
	the flood planning level. Construction activities will be staged and timed (where possible) to limit the area and duration of disturbance, as well as avoid wet weather periods.	
2D	Any concentrated stormwater discharge or sewer overflow relief would be directed east. Stormwater outlets to the watercourse would be strategically positioned to minimise the potential for localised scouring due to point discharge with scour protection provided where required.	Construction
2E	Installation of the WWPS flow relief structure would be in accordance with HWC standards.	Construction
2F	A Soil and Water Management Plan (SWMP) and Erosion and Sediment Control Plan (ESCP), or equivalent, would be incorporated into the Construction Environmental Management Plan (CEMP) for the construction of the Proposal. The SWMP and ESCP would be developed in accordance with the principles and requirements of the 'Blue Book'. The ESCP will be progressively updated to reflect the changing nature of the Proposal site as construction activities progress. The following aspects would be addressed within the SWMP and ESCP: • Appropriate sediment and erosion controls to be implemented prior to soil disturbance • Demarcation of vegetation clearing boundaries, sensitive areas and vegetation within vicinity of the construction footprint that is to be retained prior to construction, clearing or stripping works commencing • Stormwater management to avoid flow overexposed soils • Location of stockpiles to be outside of localised depressions, overland flow paths, riparian corridors and areas below the flood planning level as far as practicable • Inspection of all erosion and sedimentation control works prior to and post rainfall events • Reinstatement of disturbed areas is to be undertaken as soon as practicable progressively throughout the phased works to minimise disturbed areas exposed to the forces of erosion at any one time • Wheel wash or rumble grid systems installed at exit points to minimise dirt on roads • Construction traffic restricted to delineated access tracks and maintained until construction complete • Pre-start checks, as well as maintenance in accordance with manufacturers requirements to be undertaken on equipment to minimise the potential for leaks and spills from vehicles • Storage of materials on-site to be minimised • Suitable waste receptacles to be provided and maintained • Storage of any fuels, oils, lubricants, chemicals and Dangerous Goods and similar products will be stored in accordance with appropriate standards with emergency spill kits maintained on-site. • Wet weather monitoring protocol including Grahamstown Dam water levels as well as predicted rainfall events	Construction

No.	Mitigation measure	Implementation stage
	• Site boundary controls will be implemented (e.g. sediment fencing, earth banks, mulch bunds, swales and table/diversion drains) around the perimeter of the site, as early in the construction process as possible • Temporary construction erosion and sediment control measures that would be implemented prior to construction of the Proposal include sediment fences, temporary sediment ponds, shaker grids and/or wash down areas at all vehicle access points, and sandbags (or similar) for protection of all existing stormwater infrastructure • In addition, the SWMP will include the protocol and specific mitigation measures related to the pipeline commissioning in accordance with HWC requirements • Inspection and monitoring of erosion and sediment control measures, pipeline performance, watercourses and downstream water quality will be undertaken regularly throughout the construction period and following large rainfall events.	
2G	The commissioning of the pipelines, ongoing inspection of the pipelines and management of the WWPS overflow relief would be in accordance with HWC standards.	Operation
2H	For a period of six (6) months following construction, regular monitoring will be undertaken for the Proposal site rehabilitation, pipeline performance, watercourses and downstream water quality. Any scour, vegetation or water quality issues that arise would be investigated and rectified.	Operation
3.	**Biodiversity**	
3A	• A Flora and Fauna Management Plan would be prepared and implemented as part of the CEMP. It will include, but not be limited to: – plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas – pre-clearing survey requirements – procedures for unexpected threatened species finds and fauna handling – procedures addressing relevant matters specified in the Policy and guidelines for fish habitat conservation and management (DPI Fisheries, 2013) – protocols to manage weeds and pathogens.	Construction
3B	Site inductions for construction staff will include a briefing on the potential presence of threatened species and their habitat adjacent to the Proposal site, their significance and locations and extents of no-go zones.	Construction
3C	Clearance of native vegetation would be minimised as far as is practicable.	Construction
3D	The limits of vegetation clearing would be marked on plans and on site with signed fencing so that clearing activities are constrained to approved areas only.	Construction

No.	Mitigation measure	Implementation stage
3E	Where fauna species are identified in vegetation to be cleared, animals would be removed and relocated to adjacent bushland prior to felling. If this is not possible, the tree would be sectionally dismantled or soft felled under the supervision of an ecologist or wildlife carer, before relocating the animal.	Pre-construction
3F	Pre-clearance surveys would be undertaken to identify any breeding or nesting activities by native fauna in hollow-bearing trees and native vegetation. No breeding attempts or active nests should be disrupted, as far as practical.	Pre-construction
3G	Prior to clearing, all hollow-bearing trees would be marked by an ecologist so that they are retained and avoided by contractors. Their location would be recorded using a GPS.	Pre-construction
3H	Eucalypts in Newbury Park and Boomerang Park adjacent to the subject land would be protected during construction.	Construction
3I	A two stage clearing process for the removal of hollow-bearing trees would occur.	Pre-construction
3J	Hollow-bearing tree removal and disturbance of the tree drip line of any hollow-bearing trees would be avoided.	Pre-construction and Construction
3K	The pipeline trench would be microsited to avoid tree driplines. If tree driplines cannot be avoided, measures would be put in place in accordance with *AS4970-2009 Protection of trees on development sites*.	Pre-construction
3L	A pre-start-up check for sheltering native fauna of all infrastructure, plant and equipment and/or during relocation of stored construction materials would be undertaken.	Pre-construction
3M	If any pits/trenches are to remain open overnight adjacent to native vegetation, they would be securely covered, if possible. Alternatively, fauna ramps (logs or wooden planks) would be installed to provide an escape for trapped fauna.	Construction
3N	Appropriate sediment and erosion controls would be installed prior to the commencement of earthworks and construction, around the impact area, to reduce run-off into adjoining vegetation and downstream to the Coastal Wetland.	Pre-construction and Construction
3O	Discharge of water into watercourses and overland flow paths that drain to Irrawang Swamp during commissioning of pipes would be avoided. HWC's *Procedure EP0112 – Dechlorination of discharge water* would be followed.	Construction
3P	Where possible, earthworks would be undertaken during dry weather conditions. Clearing of vegetation should be avoided during overland flow events.	Construction
3Q	Soil or mulch stockpiles would be located away from key stormwater flow paths to limit potential transport of these substances into waterways and Irrawang Swamp.	Pre-construction and Construction
3R	Works at the Kings Hill URA watercourse would be undertaken during periods of no flow so that fish passage is not blocked.	Construction

No.	Mitigation measure	Implementation stage
3S	Stabilisation of disturbed areas would be undertaken as soon as practicable after disturbance.	Construction
3T	Regular maintenance checks are to occur along the pipelines to prevent leaks.	Operation
3U	Construction activities within 250 metres of the Grey-headed Flying-fox Camp as shown in Figure 7-8 (Section 7.3.3 of this EIS) would only occur between March and July.	Construction
3V	Reasonable and feasible noise mitigation measures would be implemented when any works occur within 250 metres of the Grey-headed Flying-fox Camp (between March and July) and would include the installation of temporary noise barriers where construction activities result in generating noise above average background levels (as outlined in Section 2.4 of the *Noise and Vibration Assessment* at Appendix N).	Construction
3W	The Grey-headed Flying-fox camp would be monitored at regular intervals (daily) by a suitably qualified ecologist during any construction activities occurring within 250 metres of the camp (between March and July) to detect any stress response signs. Noise monitoring would occur concurrently. If a stress response is detected, works would cease and mitigation measures would be reviewed/amended. Construction activities within 100 metres of the Grey-headed Flying-fox camp as shown in Figure 7-8 (Section 7.3.3 of this EIS) generating noise above average background levels (as outlined in Section 2.4 of the *Noise and Vibration Assessment at* Appendix N) would be limited to a maximum of 2.5 hours in any 12 hour period, preferably at sunrise or sunset or during the night.	Construction
3X	Species selection for any revegetation works within the Proposal site would include species commensurate with the mapped Plant Community Type (PCT).	Operation
3Y	Equipment used for treating weed infestation would be cleaned prior to undertaking work in the Proposal site to minimise the likelihood of transferring any exotic plant material and soil.	Construction
3Z	Soil stripped and stockpiled from areas containing known weed infestations would be stored separately and is not to be moved to areas free of weeds.	Construction
3AA	Vehicles, equipment, materials and footwear are to be clean on entry (free of soil, mud and/or seeds) to minimise the introduction or spread of *Phytophthora cinnamomi*.	Construction
4.	**Aboriginal heritage**	
4A	A heritage induction will be provided to all onsite personnel so that they are aware of their obligations under the *National Parks and Wildlife Act 1974* with respect to archaeological artefacts or human remains, including 'stop-work' conditions applicable in the event that any identified or suspected heritage artefacts or human remains are discovered at any time.	Construction
4B	In the event identified or suspected historical artefacts or human remains are detected at any time, all disturbance work should immediately cease within 20 metres of the find and temporary protective fencing erected around this 'no-go zone' pending further management advice from the heritage division of DPIE. If the find consists of or includes human remains, the NSW Police Department and NSW Coroner's office would be contacted.	Construction and Operation

No.	Mitigation measure	Implementation stage
4C	If works do not impact AHIMS ID 38-4-2023 - KHW01, site boundaries for the scatter and PAD will be delineated by temporary fencing or other visual markers. A heritage consultant is to be on site to determine where the fencing will be installed. Fencing will remain until completion of construction.	Pre-construction and Construction
4D	A program of test excavation under the *Code of Practice* will be undertaken at AHIMS ID 38-4-2023 - KHW01 (if impacts cannot be avoided), AHIMS ID 38-4-2025 - KHW02 and Area A (adjacent to AHIMS ID 38-4-2025 - KHW02) prior to commencement of earthworks in these areas to determine if there are subsurface artefacts present and to determine their extent. Any newly identified sites will be submitted to AHIMS.	Pre-construction
4E	If impact to any artefacts cannot be avoided, an Aboriginal Heritage Impact Permit (AHIP) will be sought from the heritage division of DPIE for surface salvage of artefacts and/or subsurface archaeological excavation. Any AHIP works will be undertaken in accordance with DPIE requirements.	Pre-construction
4F	A portion of AHIMS ID 38-4-2025 - KHW02 and Area A is in close proximity to a historic archaeological site. Due to the overlap, the methodology for archaeological test excavation will take into consideration the protection of relics under the *Heritage Act 1977* and the conditions of any s139 exemption and/or s140 permit issues for investigation and/or impact to historic archaeological remains. Non-Aboriginal relics cannot be impacted under an AHIP and historical archaeological investigations cannot impact Aboriginal Objects. Hence, historic heritage and AHIP approvals will need to be held concurrently to allow for the excavation of Aboriginal and non-Aboriginal contexts.	Pre-construction
5.	**Non-Aboriginal heritage**	
5A	A heritage induction will be provided to all onsite personnel so that they are aware of their obligations under the *Heritage Act 1977*.	Construction
5B	A stop work procedure for unexpected heritage finds will be included in the CEMP for the Proposal to ensure the appropriate management of historic heritage finds. This involves the obligation to stop ground disturbing works in the area of the find, contacting the project heritage consultant, implementing management strategies as directed by the heritage consultant and/or heritage division of DPIE (formerly OEH) and recommencing works in that area only once clearance has been obtained from the heritage consultant and/or DPIE.	Construction
5C	A program of archaeological test excavation will be undertaken either prior to approval or at detailed design to identify if relics are present and if there is a possibility of avoiding them by refining the pipeline alignment. The archaeological test excavation program will be conducted in accordance with a Section 139 (s139) exception issued by NSW Heritage (Department of Premier and Cabinet) under the *Heritage Act 1977*. The application for the s139 exception will be supported by the Statement of Heritage Impact (SoHI) and a standalone excavation methodology (Archaeological Research Design [ARD]). The excavation methodology will include detailed assessment of potential archaeological remains, archaeological potential mapping, and detailed significance assessment.	Pre-construction
5D	Based on the results of the s139 archaeological testing, the final pipeline alignment may be refined to avoid as much impact as possible to significant archaeological remains. Depending on the results of the s139 archaeological testing a call-out procedure and/or archaeological monitoring may be required during construction works.	Pre-construction and Construction

No.	Mitigation measure	Implementation stage
5E	An updated heritage report will be prepared that provides a final assessment of impacts to significant archaeological remains that may result from installation of the pipeline. The updated heritage report will provide recommendations for further approvals and archaeological investigation that may be required.	Pre-construction
5F	Where there will be impacts to relics as a result of construction of the Proposal, a Section 140 (s140) permit issued by NSW Heritage under the *Heritage Act 1977* must be in place prior to commencement of works. Archaeological salvage excavation may also be required under the s140 permit prior to commencement of pipeline installation works	Pre-construction
5G	Any archaeological remains identified through background research and the s139 archaeological test excavation program in the immediate vicinity of the works area will be identified and mapped in the CEMP and physically cordoned off during works to prevent any inadvertent impacts.	Pre-construction and Construction
5H	Vibration impacts to heritage items must not exceed the recommended screening level of 7.5 millimetres per second. Vibration monitoring occurs during works in the vicinity of heritage items is recommended. Vibration monitoring and inspection by a structural engineer who is familiar with heritage structures should be undertaken (where required) if the predicted ground-borne vibration levels exceed the anticipated rating and/or cause impacts to significant fabric.	Construction
5I	A qualified arborist will prepare a report as part of detailed design, post approval and as relevant, to determine whether there will be impacts to the root zones of the heritage listed trees in Boomerang Park. Advised additional mitigation measures from this report are to be implemented as required.	Pre-construction and Construction
6.	**Waste management**	
6A	Measures to mitigate the effect of the construction waste streams would be incorporated into the Proposal's CEMP, including the following information: • Characterisation of construction waste streams • Procedures to manage construction waste streams, including handling, storage, classification, reuse and tracking • Mitigation measures for avoidance and minimisation (including reuse) of waste materials • Roles and responsibilities for ensuring compliance with the mitigation measures • Training, monitoring, reporting and reviewing requirements to ensure compliance with the mitigation measures.	Pre-construction and Construction
6B	The major sources of waste during operation would be limited to maintenance works. Where feasible and reasonable, waste would be managed, reused and recycled in accordance with the *Waste Avoidance and Resource Recovery Strategy 2014-2021*.	Operation
7.	**Air quality and odour**	
7A	Implementation of dust protection measures during construction activities, such as solid screens or barriers around dust generating activities. Other measures include covering or fencing stockpiles to prevent wind erosion.	Construction

No.	Mitigation measure	Implementation stage
7B	Construction vehicles would comply with relevant vehicle emission standards, where applicable. Speed limits would also be established and enforced.	Construction
7C	Vehicles entering and leaving the Proposal site are to be covered and secured to prevent escape of materials during transport.	Construction
7D	Reinstatement of areas impacted during the construction of the Proposal and rehabilitation works would be undertaken progressively during the construction phase, as soon as practicable.	Construction
7E	Dust suppression (water cart), and wheel wash/shakedown will be implemented during construction works. Details on these measures will be included in the CEMP.	Construction
7F	Air quality monitoring is not considered necessary for the Proposal. However, it may be undertaken to assure that the impacts are as predicted within the *Air Quality Assessment* at Appendix M.	Construction
7G	Mitigation and management measures identified for construction activities would be impended during operation and maintenance activities, where necessary and applicable.	Operation
7H	Maintenance activities would involve the use of cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques, such as water sprays or local extraction, e.g. suitable for local exhaust ventilation systems.	Operation
7I	Any potential operational impacts can be managed through good design and adherence to HWC standards, including the use of odour control units which can assist in ensuring that odour emissions are maintained at the minimum during routine operation and maintenance.	Operation
7J	Ongoing air quality/odour monitoring is not considered necessary. However, an air quality and odour complaints log should be kept, allowing identification of any issues which may arise and require rectification.	Operation
8.	**Noise and vibration**	
8A	During construction works it is recommended that best practice management strategies, where feasible and reasonable, are applied to manage any potential noise impacts. A Construction Noise and Vibration Management Plan (CNVMP) will be developed as part of the CEMP. The CNVMP will contain the following measures: • Construction activities will be generally undertaken between the nominated construction hours, between 7:00am-6:00pm Monday to Friday, and 8:00am-1:00pm Saturday, with no work on Sundays or public holidays • If works must occur out of hours for justified reasons (e.g. worker safety or reduction of impact on traffic), preference would be given to day and/or evening time works (i.e. between 7 am and 10 pm). Noise intrusive works would be completed before 10 pm where feasible to do so. Additionally, a site specific out of hours assessment of impacts would be required in order to determine appropriate noise and vibration mitigation measures. Potential noise receivers would be notified within ten (10) days prior any construction activity in accordance with HWC requirements	Construction

No.	Mitigation measure	Implementation stage
	• Where practicable, particularly noisy construction works will be staged with consideration to the least sensitive time of day for the closest receivers, providing respite periods as necessary – particularly during works adjacent to surrounding receivers • Where practicable, equipment and work areas will be strategically positioned to reduce the noise emission to noise sensitive receivers. • Construction machinery will be well maintained and equipment not in use would be shut down • All plant would be properly maintained and low vibration alternatives for plant would be implemented where practicable. Plant that have high and low vibration operating settings should be run on the lowest effective vibration setting • Where vibration intensive works are required to be undertaken within the specified minimum working distances, vibration monitoring should be undertaken to ensure acceptable levels of vibration are satisfied • Construction within the 250 metre radius of the Grey-headed Flying-fox camp should be limited to the months of March to July to minimise potential impacts on the camp. If this cannot be achieved, noise monitoring and acoustic barriers are recommended to mitigate construction noise impacts as outlined in the *Noise and Vibration Impact Assessment* at Appendix N. • A noise and vibration complaints log should be kept, allowing identification of any issues which may arise and require rectification.	
8B	Operational noise from the WWPS would be managed through the use of the design requirements established within Section 5.6.13 of the *Hunter Water Corporation Water and Sewer Design Manual (Water Pumping Stations)*. The Proposal would implement HWC's acoustic control measures to ensure compliance with NPI criteria.	Operation
8C	Operational noise emissions from all potential sources in the context of the final position of the WWPS would be assessed at detailed design to ensure that compliance with the NPI criteria is achieved.	Pre-construction
9.	**Traffic and transport**	
9A	A preliminary Construction Traffic Management Plan (CTMP) has been provided as part of the Transport Impact Assessment. This preliminary TMP provides a guide to be used for the final CTMP.	Construction
9B	The preparation of a final CTMP should be developed in relation to the requirements provided by the *Roads and Maritime Services Traffic Control at Work Sites Manual Technical Manual* (2018). Consultation is required with Council, NSW Police and nearby schools during development of the final CTMP, addressing concerns such as (but not limited to) access locations, Council owned assets, the surrounding environment, and other transport modes.	Construction
9C	Access along the road network through work sites will be provided for emergency service vehicles.	Construction
9D	Temporary circulation roadways to the compounds should be designed to accommodate the swept path of the largest design vehicle using the facility plus the specified clearances from the vehicle body to vertical obstructions and other vehicles. This should be in line with *AS2890.2 Off Street Commercial Vehicle Facilities*.	Construction

No.	Mitigation measure	Implementation stage
9E	Construction compound accesses would be designed with the assumption that the construction traffic heavy vehicles accessing the compounds would consist of Heavy Rigid Vehicles (HRVs). This would include the provision of a temporary access pavement and no lane lines or right-turn arrows marked on the minor road pavement for a basic right turn treatment. It should be noted that site constraints such as utilities should be taken into consideration during design stages which would ultimately inform the required access arrangements.	Construction
9F	Signage where required, should be displayed during both daytime and at night with the retroreflective material used for the signs meeting the necessary requirements. Advisory truck turning signage shall be installed at the compound area access locations where heavy vehicle turn movements would occur, including the use of any advisory variable message signs for slow-moving heavy vehicles.	Construction
9G	The final CTMP should also indicate how the impact to pedestrians would be managed to ensure safety. Construction traffic operators should be made aware of pedestrian movements within a detailed CTMP clearly indicating crossing locations, walkable desire lines and peak time of pedestrian movement.	Construction
9H	It is not expected that the frequency and service times of public bus services would be impacted by construction traffic. However, it is proposed that the wider community and public transport service providers and users be notified in advance of expected construction activities and durations.	Construction
9I	Parking on local residential street is to be avoided. To manage parking, the final CTMP would designate available parking locations to be used during construction activities.	Construction
9J	Traffic management measures be put in place for the duration of construction to manage delays at the Pacific Highway/Laydown Access Road intersection such as avoiding travel of staff during peak background traffic hours and should be detailed in a final CTMP prior to construction.	Construction
10.	**Bushfire**	
10A	Safe work procedures during construction would include means to limit smoking within bushfire risk areas to predetermined safer areas, appropriate signage, maintenance of plant and equipment, operator awareness program and bushfire policy for Hot Work operations and ignition prevention, or fuel reduction in Hot Work areas.	Construction
10B	A Hot Work Permit would be required if Hot Work is undertaken in the open within a hazardous area, or if a Total Fire Ban (TOBAN) is in force, regardless of whether the Hot Work is in a hazardous area or not. It would be prohibited to carry out any Hot Work activity in the open during a TOBAN, unless authorised under an exemption issued by Rural Fire Service (RFS).	Construction
10C	The contractor would include Safe Work Method Statement and Procedure Policies that address bushfire safety during construction (e.g. human activity and hot work).	Construction
10D	The aboveground components in the WWPS are to be constructed with the following material to withstand ember attack and radiant heat impact: • Aboveground pipes, vent shafts, and services and equipment enclosures would be made from non-combustible material	Construction

No.	Mitigation measure	Implementation stage
	• Any wiring would be installed in non-combustible conduit or enclosed metal services gantry trays • The electrical connection box and switch board enclosures would be ember proof. There should be no gaps greater than 2 millimetres into the internal side of the enclosures • Electrical transmission lines would be located underground and installed with short pole spacing (30 metres), unless crossing gullies, gorges or riparian areas • *BAL 29 Construction under AS3959 – 2009 or 2018* 'Construction of buildings in bushfire prone areas' may be used as a guide only.	
10E	Interim asset protection zones (APZs) would ensure defendable space is maintained until Kings Hill URA is fully developed. In this regard, APZs are recommended with a minimum of 12 metres to the north, west and south, and 29 meters to the east of the WWPS footprint (refer to Figure 7-33 in Section 7.10.3 of this EIS). These APZs would be located within R2 zoned land and outside any environmental conservation zones. APZs around the vent shafts pipes are unnecessary as the risk of ignition is considered low around those components.	Construction
10F	Access to the WWPS for fire vehicles would be provided in accordance with the specifications in the Bushfire Assessment Report, which include: • A minimum carriageway width of 4 metres • Passing bays every 200 metres that are 20 metres long by 2 metres wide, making a minimum trafficable width of 6 metres at the passing bay • A minimum vertical clearance of 4 metres to any overhanging obstructions, including tree branches • Access must provide loop around the WWPS compound or a suitable turning area • Curves must have a minimum inner radius of 6 metres and are minimal in number to allow for rapid access and egress • The minimum distance between inner and outer curves is 6 metres • The crossfall is not more than 10 degrees • Maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads • An RFS compatible lock is provided within any locked gate system.	Construction and Operation
10G	The contractor would include Safe Work Method Statement and Procedure Policies that address bushfire safety during operation and maintenance of plant and equipment.	Operation
10H	Management of the landscaped areas within the Proposal site would be undertaken to reduce bushfire risk.	Operation
11.	**Hazard and risk**	

No.	Mitigation measure	Implementation stage
11A	Hazards associated with the construction of the Proposal would be managed through the implementation of a CEMP. In addition, construction will be undertaken in accordance with the *Work Health and Safety (WHS) Act 2011*.	Construction
11B	During construction, fuels, glues, sealants and other hazardous goods would be stored on site, in accordance with relevant specifications to ensure these substances do not spill into the surrounding environment during refuelling activities, transport and delivery.	Construction
11C	The chlorine injection point will be designed and managed in accordance with *HWC Standard Technical Specification – Chemical Storage and Delivery Systems* (STS 670) and the relevant Australian Standards and legislation requirements (e.g. POEO Act).	Operation
12.	**Landscape and visual amenity**	
12A	Where feasible and reasonable, structures and materials in the construction compounds, such as stockpiles and machinery, would be sited to minimise temporary visual impacts occurring during construction works.	Construction
12B	The Proposal site would be kept in clean and orderly state to minimise any visual impacts that may arise during construction activities.	Construction
12C	Suitable material and finishes, including those which are non-reflective and blend with the surrounding landscape, would be selected for the aboveground components of the Proposal (i.e. WWPS and ventilation stacks). Materials and finishes of these components would be selected at detailed design to ensure low visual intrusion on surrounding areas.	Operation

12 JUSTIFICATION AND CONCLUSION

This section presents a justification of the Proposal and a conclusion to the EIS. It considers a range of issues, including proposal benefits, protections of the environment, and the objects of the EP&A Act.

12.1 Proposal justification

The Proposal is considered necessary to support the Kings Hill URA, including development of residential dwellings, as well as a town centre through the provision of water and wastewater infrastructure, specifically:

- Pipes and pumping station(s) to convey wastewater from Kings Hill URA to a wastewater treatment works, where wastewater is treated before being discharged to waterways or reused
- Pipes to convey drinking water from an existing water main trunk to Kings Hill URA.

An environment impact assessment of the Proposal has been undertaken as presented within the EIS. PM No. 1 Pty Ltd is seeking approval for the development of a water and wastewater supply pipeline and a WWPS to support the development of the Kings Hill URA, which has been identified as a future housing opportunity by the Plan. This development has a forecasted population of 11,000 and would greatly contribute to economic growth and jobs in the LGA. The provision of secure potable water would not only improve people's lives, local environments, and strengthen the community but it would ultimately stimulate the state and regional economy. Further, the Proposal represents investment in regional infrastructure that would secure potable water supplies to the growing community at Kings Hill URA.

The Proposal has been proven to be consistent with the relevant local and State government planning instruments. No significant environmental impacts have been identified during the preparation of the EIS. The environmental impacts identified are considered to be able to be mitigated through the implementation of the identified mitigation measures for construction and operation of the Proposal.

Construction of the Proposal would result in relatively minor short-term impacts to the local environment. These temporary impacts would be generally confined to the Proposal site and immediate surrounds.

A range of measures are proposed to mitigate these potential environmental impacts. A CEMP, including the mitigation measures proposed in this EIS, would be prepared prior to commencement of construction of the Proposal. Assuming the CEMP is successfully implemented, no significant environmental impacts during the construction stage are predicted.

Operation of the Proposal would result in relatively minor impacts to the local environment. The operation of the Proposal would be in accordance with HWC's procedures, as well as other relevant guidelines, as mentioned throughout the EIS.

The development of the Proposal is therefore required and, as a result of mitigating potential environmental impacts, would not significantly impact on the surrounding environment or community.

12.2 Objects of the *Environmental Planning and Assessment Act 1979*

The objects of the EP&A Act provide a framework within which the justification of the Proposal can be considered. A summary of this assessment is provided in Table 12-1.

Table 12-1 Assessment against the objects of the EP&A Act

Object of the Act	Comment
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	The Proposal and the management and mitigation measures detailed in this EIS allow for the proper management, development and conservation of natural and other resources. The Proposal would support social and economic welfare by providing water and stormwater infrastructure for the Kings Hill URA. However, the Proposal would result in the loss of vegetation which forms part of Hunter Water's Grahamstown Dam catchment area and the highway road reserve. Notwithstanding this, the removal of vegetation would be mitigated through the establishment of biodiversity offsets for the Proposal.
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	Ecologically sustainable development has been considered and is addressed in Section 8.2.
1.3(c) To promote the orderly and economic use and development of land.	The Proposal is expected to result in economic benefits at a local and regional level by supporting the use and development of land at Kings Hill which is an URA identified in the Lower Hunter Regional Strategy 2006-31 and the Port Stephens LEP. The Proposal has the potential to create job opportunities and potential economic benefits for Raymond Terrace businesses during construction.
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the Proposal.
1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	The proposal is designed to minimise the environmental impacts. As discussed in Section 7, the proposal would result in some impacts on the environment. The mitigation hierarchy (avoid, minimise, mitigate and offset) has been considered for all identified impacts, and strategies to minimise and mitigate these impacts have been developed and are summarised in Section 11. Further, the removal of vegetation would be mitigated through the establishment of biodiversity offsets for the Proposal.

Object of the Act	Comment
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The proposed alignment would be refined during detailed design to, where possible, minimise impacts on heritage items. Should any heritage items or areas of Aboriginal be impacted suitable permits would be obtained and further mitigation measures implemented prior to construction.
1.3(g) To promote good design and amenity of the built environment.	The Proposal is designed to support and promote the development of the Kings Hill URA. The Proposal has been designed to minimise impacts on the natural and future built environment.
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Not relevant to the Proposal.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	Not relevant to the Proposal.

In summary, the Proposal is considered to be consistent with the objectives of the EP&A Act.

12.3 Conclusion

The Proposal, which is classified as Designated Development in accordance with Coastal Wetland (ID 36586) listed under Coastal Management SEPP, as defined by Part 2, Division 10(2) of the Coastal Management SEPP, has been subject to an EIS in accordance with the EP&A Act, EP&A Regs and the SEARs. The potential environmental, social and economic impacts, both direct, indirect and cumulative, have been identified and thoroughly assessed as part of this EIS. The assessment concluded that no significant environmental impacts have been identified as a result of the Proposal. It is considered that any potential impacts can be satisfactorily mitigated through a range of measures that have been identified within the EIS. In addition, the Proposal has been assessed against – and has been found to be consistent with – the priorities and targets adopted in relevant and draft State plans as well as Government policies and strategies.

The Proposal would provide significant benefit in terms of providing water and wastewater infrastructure for Kings Hill URA, a development which is expected to yield in excess of 3,500 residential dwellings over a twenty-five year period. This Proposal accompanies concurrent applications for the proposed stormwater channel and interchange at Kings Hill, which would also support the Kings Hill URA. Overall, the EIS concludes that the development proposed is in the public interest and approval is recommended.

13 REFERENCES

Australia ICOMOS (2013) *The Burra Charter*. Adopted 31 October 2013

Australian Bureau of Statistics (ABS) (2016a), 2016 Census QuickStats (Raymond Terrace), Commonwealth of Australia, Canberra, accessed February 2019, http://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/106031122

Australian Bureau of Statistics (ABS) (2016b), 2016 Census QuickStats (Port Stephens (A)), Commonwealth of Australia, Canberra, accessed February 2019, http://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/LGA16400

Austroads (2009) *Austroads Guide to Road Design Part 4a: Unsignalised and Signalised Intersections*

Austroads (2016) *Guide to Traffic Management Part 3: Traffic Studies and Analysis and Highway Capacity Manual*

Bickford, A (1993) *The Irrawang Pottery Site: Assessment of cultural Significance and Options for Its Future.* Anne Bickford and Associates, Heritage Consultants

BIOCM (2017) *Assessment of wetland vegetation and habitats within Irrawang Swamp* to inform REF for proposed stormwater Channel, Kings Hill NSW

BMT WBM (2013) *Kings Hill Urban Release Area Water Management Strategy Guidelines*

BMT WBM (2009) *Williams River Flood Study*

BOM (2019a) *Williamtown, New South Wales Daily Weather Observations: Williamtown RAAF*, Bureau of Meteorology. Available online: http://www.bom.gov.au/climate/dwo/201704/html/IDCJDW2145.201704.shtml

Birmingham, J. (1993) Attachments to Draft Contribution Irrawang Significance Statement. In Bickford, *The Irrawang Pottery Site: Assessment of Cultural Significance and Options for its Future*

Birmingham, J., Jack, I., & Jeans, D. (1983) *Industrial Archaeology in Australia: rural industry*. Richmond: Heineman

CoA (2010) *Survey guidelines for Australia's threatened bats.* Guidelines for detecting bats listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. Commonwealth of Australia

CoA (2015) *Referral guideline for management actions in grey-headed and spectacled flying-fox camps,* Commonwealth of Australia

CoA (2017) *Draft National Recovery Plan for the Grey-headed Flying-fox (Pteropus poliocephalus),* Commonwealth of Australia

Department of Environment and Climate Change (2009) *Interim Construction Noise Guideline*, DECC NSW

DEC (2006) *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW*. NSW Environment Protection Authority

DEC (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities working draft*, NSW Department of Environment and Conservation, Hurstville. Available online: https://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf

DECC (2009) *NSW Interim Construction Noise Guidelines* (ICNG)

DECC (2006) *Technical Framework: Assessment and Management of Odour from Stationary Sources in NSW*

DECC (2006) *Technical Notes: Assessment and Management of Odour from Stationary Sources in NSW*

DECC (2008a) *Best practice guidelines for the grey-headed flying fox*. NSW Department of Environment and Climate Change, Sydney

DECC (2009) *Guidelines on the Duty to Report Contamination Under the Contaminated Land Management Act 1997*

DECC (2008b) *Recovery Plan for the Koala (Phascolarctos cinereus)*, NSW Department of Environment and Climate Change, Sydney

DoE (2013) *Matters of National Environmental Significance. Significant Impact Guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999*, Commonwealth of Australia

DoE (2014) *EPBC Act Referral Guidelines for the vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)*, Commonwealth of Australia

DPI (2007) *Key Fish Habitat Maps,* NSW Department of Primary Industries. Available online https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0009/634347/PortStephens.pdf

DPI (2013) *Policy and guidelines for fish habitat conservation and management*, NSW Department of Primary Industries. Available online http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0009/468927/Policy-and-guidelines-for-fish-habitat.pdf

DPI (2019) *Fisheries NSW Spatial Data Portal*, NSW Department of Primary Industries. Available online: https://webmap.industry.nsw.gov.au/Html5Viewer/index.html?viewer=Fisheries_Data_Portal

DPI (2013) *NSW Department of Primary Industries Policy and Guidelines for Fish Habitat Conservation and Management*

DPIE (2019a) *Bionet: Atlas of NSW Wildlife,* NSW Department of Planning, Industry and Environment. Available online: http://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx

DPIE (2019b) *Vegetation Information System Classification database*, NSW Office of Environment and Heritage. Available online: www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx

DPIE (2019c) *Regent Honeyeater – Profile*. NSW Department of Planning, Industry and Environment. Available online: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10841

DPIE (2019d) *Little Bent-winged Bat – Profile*. NSW Department of Planning, Industry and Environment. Available online: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10533

Eby, P. and Law, B. (2008) *Ranking the feeding habitats of Grey-headed flying foxes for conservation management*. Report for The Department of Environment and Climate Change (NSW) & The Department of Environment, Water, Heritage and the Arts

Hunter Water Corporation (2008) *Water and Sewer Design Manual, Section 4 Small to Medium Submersible Sewage Pumping Stations And Sewer Rising Mains*

Hunter Water Corporation (2009) *Wastewater Pump Stations (WWPS) Technical Addendum HWC TA WWPS-01* - Revision 1

Institute of Air Quality Management (2016) *Guidance on the assessment of dust from demolition and construction version 1.1*

Jack, I., & Liston, C. (1982, September) *A Scottish Immigrant in New South Wales - James King of Irrawang.* Journal of the Royal Australian Historical Society

HWC Standard Technical Specification – Chemical Storage and Delivery Systems (STS 670)

Hunter Water Corporation Standard Technical Specification for Construction of Sewer Rising Mains (STS403)

Hunter Water Corporation Standard Technical Specification for Construction of Submersible Sewage Pumping Stations (STS402)

Hunter Water Corporation Standard Technical Specification for Chemical Storage and Delivery Systems (STS670)

Hunter Water Corporation Standard Technical Specification for Environmental Protection Measures for Construction sites (STS900)

Landcom (2004) *Managing Urban Stormwater: Soils and Construction – Volume 1*

Natural Resources Access Regulator (2018) *Guidelines for Controlled Activities on Waterfront Land*

National Environment Protection Council (1999) *National Environment Protection (Assessment of Site Contamination Measure 1999* as amended 2013

NEPC (2016) *National Environment Protection (Ambient Air Quality) Measure as amended*, National Environment Protection Council

Northrop (2017) *Spillway Flood Impact Analysis Study for Proposed Stormwater Diversion Channel*, Northrop

NSW Environment Protection Authority (2017) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*

NSW Environment Protection Authority (2006) *Guidelines for the Site Auditor Scheme.* Environment Protection Authority

NSW Environment Protection Authority (1995) *Sampling Design Guidelines. Environment Protection Authority*, Chatswood

NSW Environment Protection Authority (2018) *Waste Avoidance and Resource Recovery Report 2017-2018*

NSW Environment Protection Authority (2014) *NSW Waste Classification Guidelines*

NSW DECC (2009) *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*

NSW Government (2016a), Hunter Regional Plan 2036, Department of Planning and Environment NSW

NSW Government (2016b), 2016 NSW population and household projections, Department of Planning and Environment NSW

NSW Scientific Committee (2010) *Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion - Determination to make minor amendment to Part 3 of Schedule 1 of the Threatened Species Conservation Act.* Available online: http://www.environment.nsw.gov.au/determinations/lowerhunterspottedgumminoramendments.htm

RFS (2015) *NSW RFS Guide for bush fire prone land mapping* V5b Nov 2015

OEH, formerly NSW Heritage Office (2001) *Assessing Heritage Significance.* Heritage Office, NSW Department of Planning

OEH (2010) *Lower Hunter & Central Coast Environmental Management Strategy (LHCCREMS)* (VIS map 2225)

OEH (2012), *Greater Hunter Native Vegetation Mapping v4.0. VIS ID 3855*. Office of Environment and Heritage, NSW

OEH (2015) *Flying-fox Camp Management Policy 2015*, State of NSW and Office of Environment and Heritage

OEH (2017) *Biodiversity Assessment Method*, Available online: https://www.environment.nsw.gov.au/resources/bcact/biodiversity-assessment-method-170206.pdf

OEH (2017b). *Guidance to assist a decision-maker to determine a serious and irreversible impact*, Available online: https://www.environment.nsw.gov.au/resources/bcact/guidance-decision-makers-determine-serious-irreversible-impact-170204.pdf

OEH (2018a) eSPADE https://www.environment.nsw.gov.au/eSpade2WebApp

OEH (2018b) *'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method*

Peake, T.C. (2006) *The Vegetation of the Central Hunter Valley, New South Wales*. A report on the findings of the Hunter Remnant Vegetation Project. Hunter–Central Rivers Catchment Management Authority, Paterson

Pennay, M., Law, B. and Reinhold, L. (2004) *Bat calls of New South Wales: Region based guide to the echolocation calls of Microchiropteran bats*. New South Wales Department of Environment and Conservation, Hurstville

Port Stephens Council (2002) *Port Stephens Council Comprehensive Koala Plan of Management* (CKPoM). Available online: http://www.portstephens.nsw.gov.au/grow/land-environment-and-heritage/environmental-plans-and-strategy/comprehensive-koala-plan-of-management

Port Stephens Council (2011). *Port Stephens Planning Strategy 2011-2036*. Available online: https://www.portstephens.nsw.gov.au/grow/port-stephens-planning-strategies/port-stephens-planning-strategy

Port Stephens Council (2018) *Raymond Terrace Flying-fox Camp Management Plan*, https://www.portstephens.nsw.gov.au/grow/land-environment-and-heritage/environmental-plans-and-strategy/raymond-terrace-flying-fox-camp-management-plan

Roads and Maritime Services (2002) (Roads and Maritime, formerly Roads and Traffic Authority) *Guide to Traffic Generating Developments*, Version 2.2

RPS (2019) *Kings Hill Development: Species Impact Statement*

SMEC (2014) *Kings Hill Development Wastewater Servicing Strategy (Revision G)*

SMEC (2017) *Kings Hill Development Water Servicing Strategy (Revision H)*

UK Institute of Air Quality Management (2016) *IAQM Guidance on the Assessment of Dust from Demolition and Construction*

Wastewater Supply Code of Australia (WSA 03) – Hunter Water Edition

Water Supply Code of Australia WSA – 2002-2.3 Hunter Water Edition.

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ARCADIS Design & Consultancy for natural and built assets