QUEANBEYAN-PALERANG REGIONAL COUNCIL

Planning and Strategy Committee of the Whole Meeting Attachment

11 APRIL 2018

ITEM 4.1 DETERMINATION REPORT - REVIEW OF ENVIRONMENTAL FACTORS - SOUTH JERRABOMBERRA WATER AND SEWER INFRASTRUCTURE

ATTACHMENT 1 SOUTH JERRABOMBERRA WATER & SEWER REF - REV 2 - MAY 2017(2)

REVIEW OF ENVIRONMENTAL FACTORS

South Jerrabomberra Water and Sewer Servicing Infrastructure Strategy

May 2017

For submission to:

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2. This report is current at the date of the development application only.

3. This report is to be read in its entirety and in association with other documentation submitted as part of the Application.

4. This Review of Environmental Factors has been prepared by Knight Frank Town Planning with the assistance of Calibre Consulting and the Village Building Company.

Document Control				
Revision	**Date**	**Author**	**Peer Review**	**Approved**
DRAFT	28/10/15	AM/DW		
DRAFT	15/03/16	AM/DW		
Rev 1	01/06/16	AM/DW	MG	02/06/2016
Rev 2	10/05/17	AM/LC	LC/CG	10/05/2017

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EXECUTIVE SUMMARY

This REF has sought to identify the potential environmental impacts of proposed trunk water supply and sewer infrastructure required to service future development within South Jerrabomberra, in particular the South Tralee release area.

The works are to be undertaken by the proponent for the South Tralee release (Canberra Estates Consortium No.4 or CEC4) on behalf of Queanbeyan Palerang Regional Council (QPRC) in accordance with the Local Planning Agreement reached between both parties.

Under this agreement Council is to have a substantial degree of control over and supervision of the carrying out of the infrastructure works, whereby CEC4 is carrying out the infrastructure works on behalf of Council for the purposes of the *State Environmental Planning Policy (Infrastructure) 2007*.

Due to the topography of South Jerrabomberra the water supply and sewer infrastructure has the potential to service seven future development precincts within the South Jerrabomberra catchment including; Poplars, Environa, North Tralee, South Tralee, Morrison, Forrest and Walsh.

- Water Supply Infrastructure:

  To service the three identified pressure zones within the South Jerrabomberra Water Supply Catchment, two reservoirs sites (low level and high level) and a pressure reducing facility will be constructed to form the three pressure zones. The proposed trunk infrastructure will be required to be staged based on when proposed developments become developed.

  The first development of South Jerrabomberra will be the South Tralee development with the first stage of Tralee located within the Low Level pressure zone boundary.

- Sewer Infrastructure:

  It is proposed to stage the trunk sewer infrastructure from a single pump station near Jerrabomberra Creek. Two rising mains, plus a temporary smaller rising main, are proposed and will become operational at various stages of the developments. In addition to the rising mains wet well storage, emergency generator and pump selection will be augmented and replaced to ensure the proposed infrastructure can adequately service the future developments.

  During the early stages the proposed infrastructure will see the detention time exceed the maximum allowable time of 2 hours. It is proposed to install chemical dosing systems to reduce odour and septicity problems anticipated with the high detention times.

  State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) allows for QPR Council to undertake the proposed works without the need to obtain development consent. However, the infrastructure scheme is required to be assessed under Part 5 of the Environmental Planning &

Assessment Act, 1979 (EP&A Act). In particular, under Section 111 of the EP&A Act Council is obligated to examine all matters likely to affect the environment as a result of its construction and operation.

Accordingly, this Review of Environmental Factors (REF) has been prepared to assess the potential environmental impacts of the proposed scheme and identifies measures to mitigate and/or minimise these impacts. It also identifies whether the proposal is likely to significantly impact the environment, thereby requiring an environmental impact statement (EIS) to be prepared.

During the construction phase, the proposal could result in a number of short term impacts including (but not limited to):

- surface water run-off and sedimentation,
- noise and vibration,
- dust emissions,
- visual amenity, and
- disruption or delays along Tompsitt Drive.

However a range of measures including those identified in the accompanying servicing strategy (Appendix 4) and Construction Management Plans (Appendix 3) by Calibre Consulting will seek to mitigate such impacts.

Potential operational (long term) impacts include the visual impact of above ground water reservoirs and Sewerage Pumping Station, limited removal of existing vegetation, temporary odour and potential for overflow but only in extreme and/or rare events.

The visual impact of the permanent above ground utilities are not considered significant within the wider urban setting proposed for South Tralee. Screen landscaping is also proposed to further lessen the visual prominence of other structures, such as the pumping station.

In terms of the ecological impacts, the accompanying assessment by Kevin Mills & Associates in Appendix 7 concludes that '*construction of the proposed infrastructure will not have a significant impact upon environmental values. The land that is traversed contains very few natural features and those that are identified have been avoided and will be retained.*'

To avoid any potential impacts arising from the unlikely failure at the sewer pump station the following design and mitigation measures are proposed:

- Emergency storage tanks to store any overflow with a capacity of 8 hours of dry weather storage. This is a standard volume for emergency storage tanks and will provide adequate time for Queanbeyan City Council to respond to the failure e.g. arranger for suckers trucks to pump out the wet well, and/or in the event of a power failure have the power failure fixed or a generator deliver to site.

- A fixed generator is to be installed on site. This would allow for a reduction in the volume of required emergency storage and reduces the risks associated with power failures.

According to Calibre Consulting, the above measures will ensure there are no operational impacts from a failure of the sewer pump station.

There is a potential risk of an overflow from the water reservoir tanks i.e. discharging of treated potable water into the environment. Any overflows however will be treated (dechlorinated) prior to release to the environment to mitigate any potential impacts.

A more detailed discussion of potential environmental impacts, likelihood of occurrence and recommended impact mitigation and management measures are contained in the following REF report and accompanying technical reports in Appendices 3-13.

The proposed infrastructure is considered essential to the future release and development of land in South Jerrabomberra. It will have significant social and economic benefits by connecting currently un-serviced lands with Council's existing reticulated wastewater and potable water supply network.

This REF has identified and assessed the short and long term impacts of the proposed scheme and identified measures to minimise or negate potential impacts. On the basis of the supporting information, and provided the mitigation measures identified in this REF are satisfactorily implemented, the proposed scheme is unlikely to have a significant environmental impact.

Accordingly, the preparation of an EIS is not considered necessary.

This conclusion was further confirmed by a peer review of the REF carried out by SMEC consultants. The review concluded the following;

"Provided that appropriate environmental safeguards are implemented during both the operating and construction phases, we consider that assessment of potential environmental impacts meets the requirements of Clause 111 of the EP & A Act, and the proposal would not have a significant adverse impact on the environment. On this basis, preparation of and EIS is not warranted."

1 INTRODUCTION

1.1 Background Information

Queanbeyan Palerang Regional Council (QPRC) has requested a Review of Environmental Factors (REF) be prepared on their behalf to detail the design, construction and potential environmental impacts arising from proposed trunk sewer and water infrastructure works to be carried out for the proposed release area of South Tralee and the surrounding South Jerrabomberra area. This includes Poplars, North Tralee, Environa, Forrest and Walsh Lands as shown in Figure 1 below.

The South Tralee residential release area has progressed now to a stage where sewer and water services will be required to facilitate residential development.

The proponent of South Tralee, Canberra Estates Consortium No.4 has engaged Knight Frank Town Planning (KFTP) to prepare this REF under Part 5 of the *Environmental Planning and Assessment Act 1979 (EP&A Act)*. Calibre Consulting have provided input into the REF document in regards of the design of the proposed scheme.

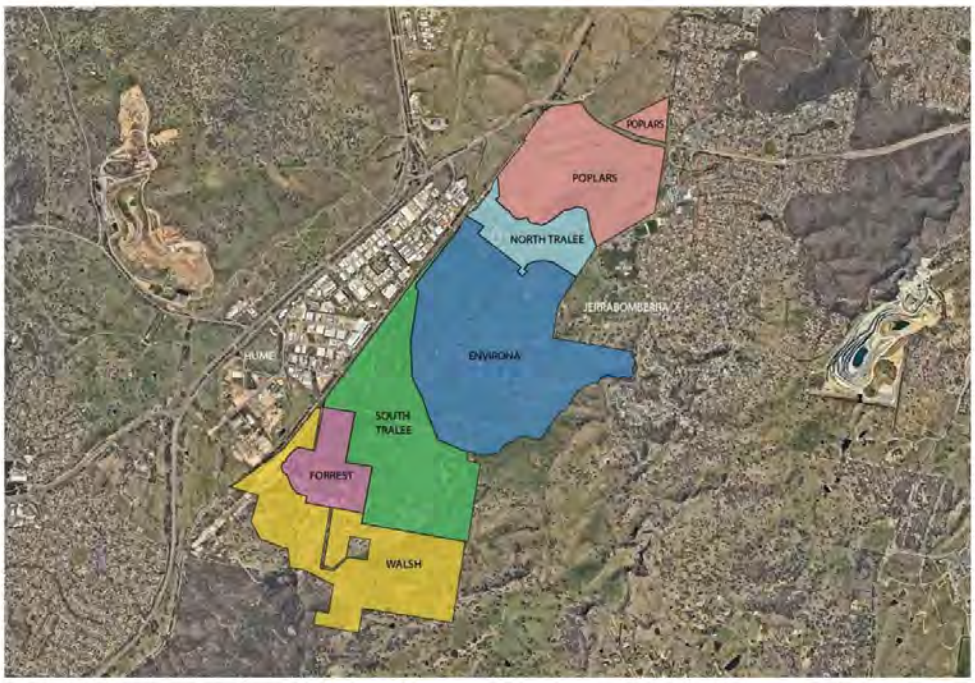

Figure 1: Sewer and Water Study Area

It is noted that QPRC has already approved in late 2014 a conceptual entry road to connect Tompsitt Drive (in the Poplars precinct) with South Tralee. Further, the Joint Regional Planning Panel also consented to a staged (concept) application in May 2015 for the development of South Tralee.

QPRC has previously advised the proponent on 5th May, 2015 that the required trunk sewer and water mains to service South Tralee (including associated utilities such as water reservoirs and sewage pumping station) would be undertaken on behalf of Council and therefore assessed under Part 5 of the EP& A Act, whilst ancillary or local reticulation works should form part of each staged application and assessed under Part 4 of the EP&A Act.

1.2 Scope of this REF

This REF provides justification for the proposed servicing approach for South Tralee, a detailed description of the proposal and the statutory planning context. The potential impacts of the proposed scheme have been considered against the matters listed in Clause 228 of the *Environment Planning and Assessment Regulation 2000 (EP&A Reg)*, which are summarised in Appendix 1 to this document.

This REF details the measures that will need to be implemented to avoid any potential environmental impacts of the Sewer and Water scheme. Relevant studies have been carried out on the existing environment including Flora and Fauna, Heritage, Contamination, Geotechnical and Acoustic/Odour of the effected lands to determine any required mitigation measures. Review of these assessments is detailed in Section 5 of this REF.

As noted above, the proponent will be designing and constructing the local sewer and water infrastructure for each of the residential development stages in South Tralee.

1.3 Objectives of this proposal

The objective of this REF is to determine a suitable strategy to deliver sewer and water services to the future residential area of South Tralee. The primary objectives are;

- To deliver a strategy that is both cost effective and of suitable size to cater for future residents in South Tralee and make allowance for other future development in South Jerrabomberra;
- Reduce any potential risks to public health;
- Improve public amenity; and
- Increase development potential and servicing for both South Tralee and surrounding areas.

1.4 Council consultation

Both the Village Building Company (VBC) and Calibre have had several meetings with QPRC to determine the design and scope of the proposed infrastructure. Most recently a design workshop was held with QPRC to address some of the comments received on the design on the 18th January 2016. These comments have been addressed throughout the REF document and on the engineering plans. A further meeting was held between Council, VBC and Calibre on the 10th of May to further discuss some minor amendments to the design.

Prior to this, a DCR meeting was held with Council on 13th August 2015 to discuss any matters that needed to be addressed with the design. Council were given a draft set of engineering drawings showing the proposed design, as well as a draft infrastructure report detailing the design and construction methods used for the REF works. Council provided a response to the draft design and is detailed in the table below.

Council Comments	Response
a) Water servicing • Water Supply Plan – Sheet 1 • Provide details of proposed method of construction of main across the travel land of Edwin Land Parkway and impacts on traffic movements • Provide details of other service locations • Provide details of any proposed vegetation clearing.	Additional plans have been included to show the method of construction, existing services and vegetation clearing i.e. Construction Management Plans. Refer to drawings C13085.1 R600-R605. The proposal is to bore under Edwin Land Parkway. Trenching will be required at two locations on the Jerrabomberra Roundabout, involving the closure of one lane at a time. The traffic impact of a lane closure has been assessed (refer to the traffic report). Other (existing services) have been shown on the drawings. Vegetation to be cleared has also been shown on the drawings.
• Water Supply Plan – Sheet 2 • Provide details of proposed method of construction of main across the travel lanes of Jerrabomberra Circle to a signalised intersection. • Provide details of other service locations • Provide details of any proposed vegetation clearing • Bend at Northern Entry Road/Tompsitt Drive will need to be located clear of the intersection road pavement and signal utilities.	As above additional plans have been included to show the method of construction, existing services and vegetation clearing i.e. Construction Management Plans. Refer to drawings C13085.1 R600-R605. Pipelines moved to be clear of the intersection road pavement.
• Water Supply Plan – Sheet 3 • Main to be deflected at proposed roundabout to avoid conflict with the travel land and annulus	Pipeline alignment amended. The pipeline alignment has been informed by the potential intersection upgrade. The alignment is clear of the current draft design for a signalised intersection.
• Water Supply Plan – Sheet 4 • Proposed crossing of Jerrabomberra Creek adjacent to the proposed bridge not favoured. Original discussions were focussed on crossing creek at location with shallow banks. If this location is to be accepted details of proposed construction method/stream protection/hydraulic efficiency of pipeline/protection of creek at scour valve will need to be provided as part of REF	Proposed Creek crossing, as shown on the drawings, is to open cut and concrete encased. A scour valve is proposed at the crossing location. The pipeline crossing location has been informed by the bridge, topography and flooding extends. The crossing location is 10m clear of the bridge structure to allow for adequate clearance to the bridge for both construction and maintenance. The pipeline has not been moved further west (away from the bridge) as this would make access more remote/difficult and increase the extent of pipeline

Council Comments	Response
	under the 100 year flood extend. Further downstream from the current location the Creek opens up to include a wide flood plane to the west i.e. increasing the length of any crossing.
• Water Supply Plan – Sheet 5 to 7 • Satisfactory	-
• Water Supply Plan – Sheet 8 • Justification for Road 1 crossing point at midblock location required. It is intended to coincide with a scour directed to the detention basin/water quality pond?	Crossing required at some point along the road. Proposed crossing point aligns with a change in grade on the road where the road starts to elevate. Location can be moved if desired. No scour valve proposed at this location. Crossing point will align with other services where practical to do so.
• Water Supply Plan – Sheets 9-12 • Satisfactory	-
b) Sewer • Sewer Concept Master Plan –Sheet 1-6 • Satisfactory	-
• Sewer Concept Master Plan –Sheet 7 • Issue of creek crossing – refer to comments on water supply drawings	Proposed Creek crossing, as shown on the drawings, is to open cut and concrete encased. A scour valve is proposed at the crossing location. Refer to comments above in regards to the water crossing.
• Sewer Concept Master Plan –Sheet 8 • Satisfactory	-
• Sewer Concept Master Plan –Sheet 9 • Provide details of proposed method of construction of main across the travel lanes of Tompsitt Drive and impacts on traffic movements.	Refer to Construction Management Plan Appendix 3 The proposal is to open trench across the travel lanes of Tompsitt Drive. The proposal is to undertake the crossing in two sections (minimum) i.e. to keep traffic lanes open around the works at all times. The works will include the closure of one lane at a time. The traffic impact of a lane closure has been assessed (refer to the traffic report).
Further Action: • Check if land falls under Yarrowlumla LEP – if so this will introduce the SEPP Koala Habitat • Final and staged developments need to be identified on the plans • Be aware that there may be a design to change the roundabout please keep this in mind. • A site visit is to be arranged with Danny and John • To continue with the proposal address the matters stated above.	• The land associated with the Sewer and Water REF does not fall under Yarrowlumla LEP • Staged developments are identified on the engineering plans. • Noted that there may be a design change at the round a bout.

1.5 Agency consultation

As these proposed works are being assessed under Part 5 of the EP&A Act,

Legal advice has been sought to determine whether any approvals may be required from other agencies. This advice can be found in Appendix 13.

2 PROPOSAL NEED AND JUSTIFICATION

2.1 Proposal Need

2.1.1 Existing Planning Approvals – South Jerrabomberra

South Jerrabomberra has progressed to a stage where water and sewerage infrastructure will be required to support future residential development within the South Tralee Release.

On October 2014, QPRC approved the concept for an Arterial road to service the South Tralee Release area (DA175-2013). Following this approval, a concept for the urban development of South Tralee was also approved, facilitating the release of four subsequent stages of residential subdivision, passive (buffer) and conservation open space, recreational facilities and a neighbourhood centre.

The residential concept (DA 263-2013) was approved in May 2015. The first residential staged DA was lodged in July 2015 and Council has requested the REF be prepared prior to the approval of Stage 1 to confirm how the development would be serviced.

2.1.2 Future Urban Growth and Demand

Currently, the Queanbeyan Sewer and Water services extend to the existing Jerrabomberra Residential area to the east of South Jerrabomberra.

South Tralee is the first release area in South Jerrabomberra to be developed, requiring the extension and amplification of existing services to allow for new housing to be constructed. Other potential growth areas in South Jerrabomberra include Poplars, Environa, North Tralee, Forrest/Morrison Lands and Walsh Lands are all within the South Jerrabomberra catchment area. The initial Sewer and Water services will cater for the South Tralee residential area, with the potential for expansion as required to each of the future developments areas mentioned above.

2.1.3 Existing Water and Sewer Network Capacity

South Jerrabomberra is currently un-serviced with regards water and sewer infrastructure. Only 6 inhabited dwellings occupy this area and only two sewer connections exist. These include:

- Cross border connection into Hume (IL 592m) which would only be sufficient to provide temporary service to the early Stages of South Tralee, and
- 600m diameter existing gravity trunk main in North Jerrabomberra which transfers sewer flows from the existing suburb of Jerrabomberra to the Queanbeyan Sewer Treatment Plant (QSTP) (IL608m).

The accompanying report in Appendix 4 by Calibre Consulting entitled '*South Jerrabomberra Water and Sewer Servicing Strategy – Technical Paper*' (October, 2015) details the proposed connections to the existing Sewerage network.

The existing water connections in close proximity to South Tralee include:

- 1st Queanbeyan Offtake Edwin Land Parkway (HGL 685m)
- Cross border connection into the Gilmore Water Supply Zone (HGL 724m)
- Jerrabomberra Parkway from the Jerrabomberra Reservoir (HGL 681m)
- Straight off the Jerrabomberra Reservoir (HGL 683m)

Through correspondence with Icon, Calibre have identified that the preferred connection (due to available water pressures) is via the 1st Queanbeyan Offtake of Edwin Land Parkway to the north-east of South Jerrabomberra.

2.1.4 Projected Demand Assessment (Water and Sewer Services)

Calibre engineering has carried out an assessment of the water and sewer services required for the purpose of this REF.

As a significant amount of South Jerrabomberra is still yet to be assessed for development potential, the water and sewer requirements have been based on projected development at South Tralee, with the potential to expand as required to meet the needs of future development.

2.2 Consideration of Alternative Options

The development of a Sewer and Water network for South Jerrabomberra has been designed to achieve the best possible outcome for the area.

The Calibre report and design have taken into account the following when determining a strategy;

- The existing Sewer/Water networks and their capabilities
- Topography and Catchment area of South Jerrabomberra
- Projected residential density/dwellings for South Tralee

A full description of the proposed Sewer and Water strategy is detailed in Section 3 of this REF.

Alternative options to the scheme now proposed were previously investigated (either by The Village Building Company, QPRC and or its Design Consultants) for the provision of sewer and water infrastructure to service South Jerrabomberra.

2.2.1 Sewer:

Alternative options include a sewerage treatment plant, several (versus one) sewer pump stations, and pumping or gravity connections across to Hume (ACT). These other options were not pursued after initial analysis due to various technical, economic, environmental or planning constraints. The current strategy, as proposed in this REF, was considered the best practical solution to provide sewer infrastructure to South Jerrabomberra.

A sewerage treatment plant would have had several potential environmental impacts on the downstream environment. Any sewerage treatment plant would have been located near the Jerrabomberra Creek with potential discharge to the Creek. A sewer treatment plant would have also

been a duplication in assets for QPRC to operate and maintain i.e. an additional treatment plant to the current plant in Oaks Estate. Capital costs for a treatment plant would be significant and these funds would be better spend on upgrades to existing services. Due to these various constraints this option was not pursued.

Due to topographical constraints the original concept put forward by The Village Building Company's consultant (Calibre Consulting) was a single sewer pump station located at the northern (downstream) end of South Tralee which would have required an additional sewer pump station to service Environa and North Tralee. QRPC did not support this option as it duplicated assets for Council to operate and maintain. The preferred option is to have a single pump station to service the South Jerrabomberra Catchment.

Icon Water confirmed that a connection across the Territory border into their network was technically feasible but due to capacity constraints at their Fyshwick Treatment Plant they could only service a very limited part of South Tralee. Due to capacity constraints and potential cross border connection issues this option was not considered further.

2.2.2 Water:

A number of possible connections where identified that could service all or part of the South Jerrabomberra area. These connections include:

- Hume water supply zones (jurisdiction Icon Water)
- 1st Queanbeyan Offtake - Edwin Land Parkway (jurisdiction QPRC)
- Gilmore Reservoir (jurisdiction Icon Water)
- Jerrabomberra Reservoir - Halloran Drive (jurisdiction QPRC)
- Existing 450mm main near the intersection of Brudenell Drive and Jerrabomberra Parkway (jurisdiction QPRC)

- Hume Water Supply Zone

The South Tralee development is located adjacent to the ACT suburb of Hume within the jurisdiction of QCC. Icon Water advice indicated that there was inadequate capacity to service the entire South Tralee and adjacent developments from the Hume water supply zone. However, temporary connections could be possible from the Hume water supply zone to supply minimum pressures into the first stage(s) of South Tralee. As any connections would be temporary the South Tralee development would need to provide an additional supply as demands increased. Icon Water estimates that possibly the first 2 stages of the South Tralee development (34 l/s -peak hour demand) could be serviced from the Hume water supply zone.

- 1st Queanbeyan Offtake

This offtake is located along Edwin Land Parkway and connects straight off the 1800mm diameter Googong Water Transfer Main (GTM). A single metered offtake exists off the GTM which services the existing development of Jerrabomberra. An existing stub is located downstream of the meter on the offtake, it is proposed to connect off this stub to service the South Jerrabomberra development.

Information provided by Icon Water indicated a minimum available connection pressure of 685m AHD will be available at this location and has capacity to supply the entire South Jerrabomberra development.

- Gilmore Reservoir

The Gilmore Water Supply Zone connection option was deemed not feasible due to there being no spare capacity available at the reservoir.

- Existing 450mm Main

This existing 450mm main is downstream of the existing Jerrabomberra reservoir and services the existing suburb of Jerrabomberra. An option to supply water from the 450mm main at the intersection of Brudenell Drive and Jerrabomberra Parkway was considered a viable alternative option. A connection point downstream of the existing Jerrabomberra Reservoir would allow for the first stages of South Tralee to be directly serviced of this main and defer the need for the low level reservoir. This main also has adequate pressure and capacity to service South Jerrabomberra. This option was considered a feasible option for the development but resulted in South Jerrabomberra reservoirs being supplied via the existing Jerrabomberra Reservoir rather than direct from the Icon Water main which was the preferred supply option. The supply point will however be used to service future developments in Poplars.

- Alignment options

Alternative alignments for both the sewer and water mains from Jerrabomberra to South Tralee were considered. The alternatives included laying mains along the rail corridor or 'short cutting' across North Tralee and Poplars. There were two main constraints to these alternative alignments. The first constraint being the extent of the 100 year flood plain in North Tralee. Any location further west from the current location would significantly increase the footprint of the mains in the 100 year flood plain. This was considered an undesirable outcome. The second constraint is environmental constraints with Poplars with the land to the west being zoned as an Environmental Conservation Area. With regards to the Jerrabomberra Creek crossing consideration was given to attaching the pipelines to the proposed Northern Entry Road bridge. It was considered that this option would make access for maintenance difficult as QPRC to not own any plant that would allow for access to the pipelines from the bridge.

3 DESCRIPTION OF THE PROPOSAL

3.1 Scope of works

To service the South Tralee Residential area, this REF proposes the following;

- Sewer Pump Station
- High level reservoir
- Low level reservoir
- Trunk water and sewer mains

Operational and design details have been detailed in accompanying plans and servicing strategy report prepared by Calibre Consulting (refer Appendices 3 and 4). A summary of these works is provided below.

3.1.1 Water Supply Infrastructure

There is an existing Bulk Water supply connection point already provided for the South Jerrabomberra area by ICON Water along Edwin Land Parkway at what is referred to as the Queanbeyan 1st offtake. A connection will be made from this connection point with a proposed water main laid along the verge of Tompsitt Drive and the proposed South Tralee northern entry road to a lower level reservoir to service a low pressure zone of South Tralee. Water will then be pumped from this location to a second high level reservoir which will service the balance of the South Jerrabomberra Residential Development area consisting of high and intermediate pressure zones.

To service the three identified pressure zones within South Jerrabomberra Water Supply Catchment, two reservoirs sites (a low level and a high level reservoir site) and a pressure reducing facility will be constructed to cater for the three pressure zones. The proposed trunk infrastructure will be required to be staged based on when proposed developments become developed. The first development of South Jerrabomberra will be the South Tralee development with the first stage of South Tralee located within the Low Level pressure zone boundary.

The works include:

- Approximately 6,400 metres of 375mm diameter water main
- Approximately 1,360 metres of 300mm diameter water main
- Ancillary pipe fittings (bends, air release valves, scour valves etc)
- Low level Water reservoir tank and associated ancillary facilities
- A booster pump station
- High level Water reservoir tank and associated ancillary facilities
- Pressure Reductions Valves
- Access roads and reservoir site works including associated earthworks

3.1.2 Sewer infrastructure

It is proposed to service the South Jerrabomberra Development areas by way of a single sewer pump station located in North Tralee. This sewage pump station will be designed to pump all sewage flows generated from the fully developed South Jerrabomberra Development areas (except Poplars) but constructed in stages as developments come on board. Flows will be pumped up to Tompsitt Drive via rising mains along the proposed South Tralee northern entry road. The sewer flows will then discharge into an existing trunk sewer at Tompsitt Drive which will transfer flows to the Queanbeyan Sewer Treatment Plant.

The works include:

- Approximately 2,330 metres of 375mm trunk gravity sewer main
- Approximately 2,220 metres of temporary 110mm rising main
- Approximately 2,220 meters of 225mm and 375mm rising main
- Ancillary pipe fittings (bends, air release valves, scour valves etc)
- Sewer pump station (wet well, valve chamber and ancillary works)
- Emergency storage tanks
- Emergency storage basin
- Chemical dosing units
- Access road and sewer pump station site works including associated earthworks

3.2 Ultimate and Staged Water Supply Servicing Infrastructure

To service the three identified pressure zones within South Jerrabomberra Water Supply Catchment, two reservoir sites (low level and high level) and a pressure reducing facility will be constructed to inform the three pressure zones. The proposed trunk infrastructure will be required to be staged based on when developments come online. The first development of South Jerrabomberra will be the South Tralee development with the first stage of South Tralee located within the Low Level pressure zone boundary.

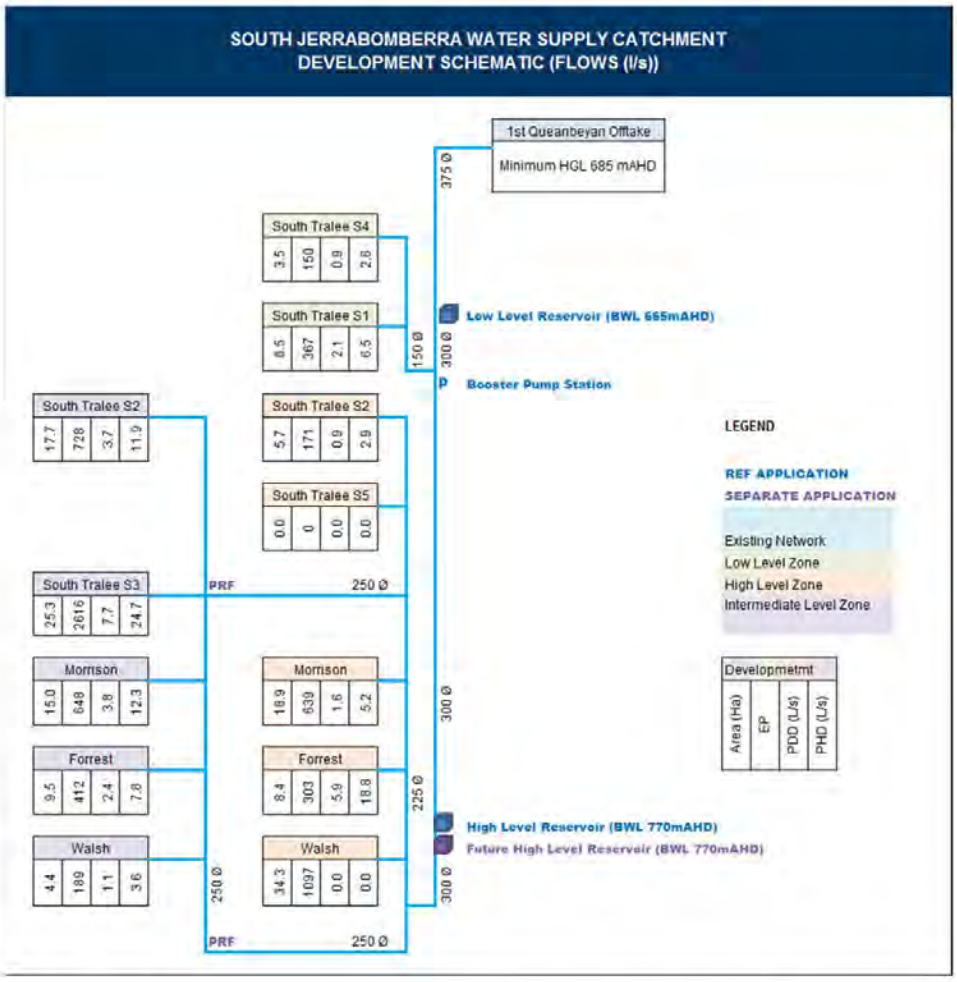

Figure 2: South Jerrabomberra Water Supply Catchment Schematic Flows

3.2.1 Low Level Zone

Trunk Mains:

The existing 1st Queanbeyan Offtake at Edwin Land Parkway is the preferred connection point for the South Jerrabomberra Water Supply Catchment. The 1st Queanbeyan Offtake is approximately 5,800m away from the proposed reservoir location adjacent to the future Dunn's Creek Road. To minimise head loss through the main a DN375mm PN35 DICL main is proposed. The alignment of the water main will follow Tompsitt Drive along the proposed Northern Entry Road before following the proposed local South Tralee Roads to the proposed reservoir site. In accordance with QPRC advice, the water main will deviate from the Northern Entry Road at Jerrabomberra Creek where the water main will be laid underneath the creek instead of continuing along the proposed Northern Entry Road bridge. To ensure backfilling of the main will not erode away the main will be concrete encased across the creek.

With regards to the Jerrabomberra Creek crossing consideration was given to attaching the pipelines to the proposed Northern Entry Road bridge. It was considered that this option would make access for maintenance difficult as QPRC does not own any plant that would allow for access to the pipelines from the bridge.

The size of low level main has been designed to carry peak day demand flows over a period of 18 hours. Five scour outlets and four air valves are proposed along the pressure mains to aid in maintenance of the main during low demands.

Low Level Reservoir:

The low level reservoir is proposed to be placed further up the ridge line as possible to service the largest area of South Tralee, however it is restricted by the 1st Queanbeyan Offtake boundary conditions and head loss anticipated through the 375mm main. The ground elevation of the reservoir has been set at 665mAHD which will service developments located below elevations of 640mAHD.

Current road layouts and proposed demands indicate that Stage 1 and Stage 4 of South Tralee will be serviced from the Low Level zone. In addition to servicing these peak hour demands including the required emergency storage, the Low Level Reservoir will act as a balancing tank for the remaining South Jerrabomberra Water Supply Catchment demands.

The Low Level Reservoir is proposed to be a propriety glass fused to steel tank with a total water storage volume of 0.83 ML. The reservoir is proposed to be approximately 5m high with a diameter of approximately 15m. . The design of the reservoir has been in accordance with the Design and Construction Specification for Water Works (August 2014).

An outlet pipe of DN300mm DICL main is proposed where flows will be conveyed to either the high level zone by a booster pump station or to service the low level zone, via a 150mm main.

The alignment of the trunk 375mm main and Low Level Reservoir Arrangement can be seen on the REF drawings.

3.2.2 High Level Zone

The high level zone has been designed to cater for both the high level and intermediate level demands for the South Jerrabomberra Water Supply Catchment. The high level reservoir needs to be located above the 770mAHD contour to service the remaining areas.

Trunk Mains:

To service the remaining South Jerrabomberra Water Supply Catchment a trunk main will be required from the low level reservoir to the high level reservoir. A DN300mm main is proposed to convey the required flow approximately 900 metres to the proposed high level reservoir. To provide sufficient pressure a booster pump station will be required.

The size of low level main has been designed to carry peak day demand flows over a period of 18 hours. Two scour outlets and one air valve are proposed along the pressure mains to aid in maintenance of the main during low demands.

The alignment of the DN300mm main will follow the edge road of South Tralee.

High Level Reservoir:

The proposed high level reservoir(s) will be located at an elevation to service both the proposed high level and intermediate pressure supply zones. A total reservoir storage of 3.53 ML will be required to cater for the peak day demands and emergency storage of the high and intermediate zone. Due to the steep terrain around the preferred reservoir location, two reservoirs are proposed to minimise the required earthwork cut and allow a staged approached to service the future developments of the South Jerrabomberra Water Supply Catchment.

If a single reservoir was proposed a larger diameter tank would be required. As the tank should be placed on natural ground (versus fill) and the required location is steep terrain the additional cut 'into the side of the hill' would be significant. As a result of these topographical constraints it was considered a more practical response to the existing terrain was to have two small diameter tanks resulting in a more sympathetic response to the existing environment.

The first reservoir which informs this REF process will be sized to cater for the future demand of South Tralee, with the future high level reservoir making up the remainder of the demand. The proposed reservoir to service South Tralee is proposed to be a propriety glass fused to steel tank with a total water storage volume of 1.484 ML. The reservoir is proposed to be approximately 10m high with a diameter of approximately 15m. The design of the reservoir has been in accordance with the Design and Construction Specification for Water Works (August 2014).

The future high level reservoir will require a total operating volume of 2.11 ML and maintain a similar height will require a diameter of 23.2 m. The reservoir site will be graded to ensure minimal earthworks will be required when the future reservoir comes online. The final size of this reservoir would be reviewed prior to final design/construction as the demands used in this report to size the second tank are based on early planning advice. It is feasible that the yields suggested from the currently unzoned land to the south will not be fully achieved and the tank size could be reduced. This is one reason for the proposed staging of the tanks to avoid an oversized tank i.e. allow for the design to be based on actual yield (demand) versus estimated from high level planning.

Booster Pump Station:

A pump station will be required to boost pressures to service both high and intermediate pressure zones. Current demands indicate that a pump duty of 45 l/s @ 110 m will be required to service the high level reservoir(s). The pump station is proposed to be located within the low level zone reservoir compound connecting off the low level reservoir outlet pipe. A duty assist standby arrangement is proposed to firstly aid maintenance and ensure water can be delivered to the high level reservoir during low flows.

3.2.3 Intermediate Level Zone

In order to maintain adequate pressure within the intermediate zone a pressure reducing facility is proposed adjacent to Dunn's Creek Road, with the provisions for a future PRFV building within the developments of Forrest or Morrison. Two pressure reducing valves (PRV) have been proposed based on current road layouts and indicative pipe sizing. The use of two PRVs will aid maintenance activities between the zones. The pressure reducing facility does not form part of the REF Application.

Other valves (and fittings) associated with the reservoirs, valves and pump station including telemetry between the offtake pump station and two reservoirs will be required.

3.3 Ultimate and Staged Sewerage Servicing Infrastructure

To service the ultimate sewer catchment all flows will be conveyed to the proposed pump station adjacent to Jerrabomberra Creek. Due to the distance between the proposed pump station and connection point the rising main will require to be sized to reduce the velocity head and subsequently the total head required to be pumped. Flows will be pumped to a high point adjacent to the Queanbeyan Network, whereby flows will then gravitate into the existing 600mm gravity main before entering the QSTP.

Due to the extended time frame between developments it is proposed to stage the ultimate pump station infrastructure to reduce septicity issues within the system and improve the detention time within the network during the initial stages of South Tralee.

3.3.1 Ultimate Infrastructure

Assuming a duty assist standby arrangement, a combined pump duty of 280l/s @ 56m Head will be required to pump the PWWF through a 437mm equivalent diameter rising main. The ultimate rising main will consist of a DN225mm and DN375mm PN35 DICL rising mains and be staged accordingly.

The ultimate pump station operating volume is required at 31.0m³, this is proposed to be constructed as two separate wet wells in accordance with Sydney Water amendment to WSA as pump flows exceed 200 l/s.

To cater for emergency storage additional underground storage tanks are proposed with a total operating volume of 314m³ to service the ultimate development however they will be staged in accordance with when additional developments come on line. A schematic of the overall strategy including the proposed trunk mains to service the South Jerrabomberra Sewer Catchment is shown on Figure 3

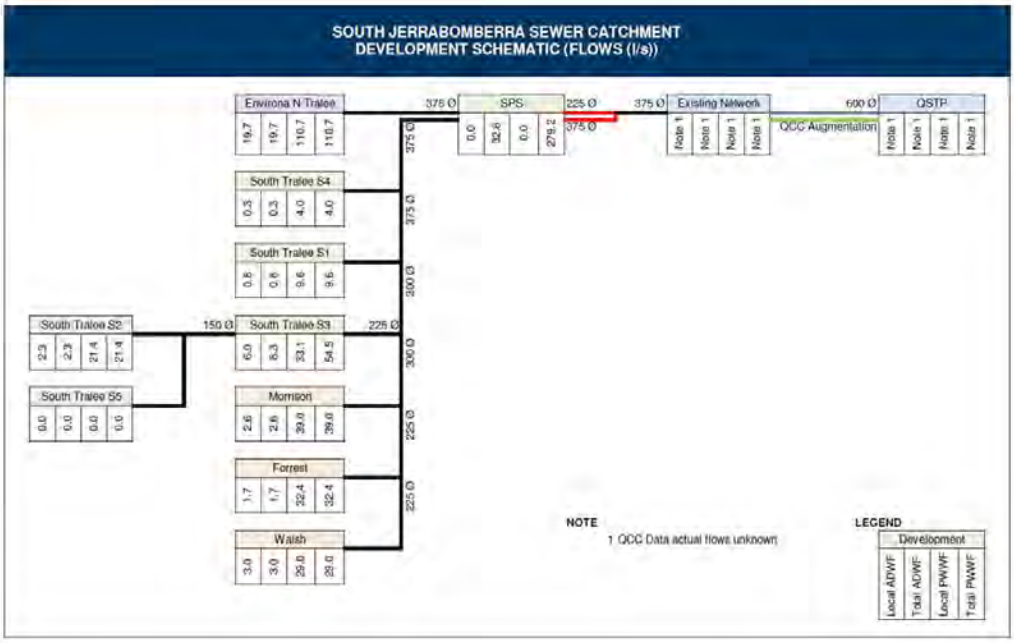

Figure 3: South Jerrabomberra Sewer Catchment Servicing Schematic

3.3.2 Staging (Stages A-D)

Due to the extended time frame between developments it is proposed to stage the ultimate infrastructure to reduce septicity issues within the system and improve the detention time within the network during the early stages of South Tralee.

Four main development stages are proposed to service the South Jerrabomberra sewer catchment area, which have been allocated to the development areas.

Stage A – South Tralee Stage 1
Stage B – South Tralee Stage 1 + South Tralee Stages 2-5
Stage C – South Tralee + Morrison, Forrest and Walsh
Stage D (Ultimate) – South Tralee, Morrison, Forrest, Walsh + Environa

The initial development Stage A has been proposed to account for the initial development flows. This initial development Stage A will service up to 127 houses of the first stages of South Tralee. Stage A and Stage B will inform this REF application with the future stages of Stage C and Stage D have been identified to show that the ultimate sewer network can be serviced by the infrastructure proposed for stages A and B.

It is unclear when Stage D will be constructed and the extent of demand that will be needed to be serviced from the sewer pump station, due to the various demands possible from a commercial

development. It is recommended that no ultimate demand infrastructure be constructed until the actual Environa demand and timing of this demand is known.

Stage A

It is proposed to service the initial flow of the South Tralee with a DN110mm HDPE main. This main is only a temporary main and will be designed to account for flows for the first 127 connected houses and site construction compound. The HDPE is proposed to be laid within the future 375mm main trench adjacent to the 225mm main required for Stage B. Once sufficient demand warrants the HDPE will be terminated and flows will be conveyed through the 225mm main as identified in Stage B.

Pump Selection:
A temporary set of two pumps in series will be able to deliver a duty of 6.5l/s @ 85m head, due to Stage 2 of South Tralee being scheduled 3-6 months behind Stage 1 which will warrant augmenting Stage A pumps, a temporary standby pump is believed to be unwarranted.

Wet Well
It is proposed to: construct a wet well capable of servicing Stage A, Stage B and Stage C to minimise disturbances to the future live sewer network. The wet well is proposed to contain an operating volume of 1.2 m3 which can be managed by the construction of a 3.2m diameter 8.5m deep wet well and an operating depth of 0.15m.

Emergency Storage:
It is proposed to service Stage A and Stage B emergency storage requirements during Stage A. A total operating volume of 259m3 will be required and can be managed by installing 3×100m3 FRP storage tanks.

Vents/Chemical Dosing:
Chemical dosing systems will be constructed at the sewer pump station to address potential odour and septicity issues anticipated from the low flows of the initial stages. Vent stakes will be constructed at critical locations along the sewer network. Vent stakes will be constructed at the sewer pump station, downstream of the rising main (manhole S050) and the connection point into the existing gravity network. Vent stakes will consist of a mixture of extraction fans, biological treatment or chemical dosing where required to address specific odour issues.

Water top up:
Immediately after the pump station is first commissioned the flows to the wet well will be very low. Once the first residential dwelling in South Tralee is connected to the wet well it is proposed to top up the wet well with water (potable or second class) on a regular basis until at least 10 houses have been connected to the pump station to manage the initial very low flows. . A minimum of 17,000l per day, or one water truck, will be used to ensure the pumps operate and the rising main is flushed at least once daily.

Stage B

It is proposed to terminate the existing 110 HDPE main proposed in Stage A once demand exceeds the capacity of the proposed Stage A pump configuration and connect into the existing 225mm rising main previously constructed in Stage A. As the proposed Stage B main will be operating for only for 5 years before Stage C becomes operational a 2% stormwater ingress would be acceptable. A 225mm rising main will contain a detention time of 3.1 hrs, which exceeds the maximum requirements of 2 hours. Reducing the pipe diameter to reduce the detention time will increase the velocity and velocity heads above available pumping ranges for municipal sewer systems. As the detention times are higher than desirable, chemical dosing is proposed to mitigate the potential issues associated with longer detention times.

Pump Selection:
The initial pumps and valving will need to be decommissioned and removed from the valve chamber to allow for the larger duty/standby configuration to service Stage B. An individual duty of 51l/s @ 55m head is proposed for each pump.

Wet Well:
No augmentations are proposed with the wet well for Stage B as all volumes have been provided within Stage A. However the operating volume will increase to 5.8m3 with an operating depth of 0.7m.

Emergency Storage:
No additional emergency storage will be required for Stage A.

Vents/Chemical Dosing:
The odour control measures will be re-commissioned to account for the increase in flows anticipated.

Stage C

To service Stage C it is proposed to construct a 375mm rising main adjacent to the existing 225mm rising main proposed in Stage B. The temporary 110mm HDPE main will require to be removed. The 225mm rising main will be temporary decommissioned for Stage C to reduce the detention time within the network. Utilising only the 375mm main will lead to a detention time of 4.7 hrs, which currently exceeds the maximum requirements of 2 hours. As noted above (with Stage B) the detention times are higher than desirable therefore chemical dosing is proposed to mitigate the potential issues associated with longer detention times.
The proposed 375mm rising main has been designed to account for 3% stormwater ingress, however will still be experiencing 2% when the main is constructed.

Pump Selection:
An additional pump will be included to the Stage B pump configuration creating a duty / assist / standby arrangement. The combined pump arrangement will provide a duty of 172l/s @ 50m Head with two pumps running. VSDs will be introduced to the pump station to account for flows that increased above the designed PDWF.

Wet Well:
No augmentations are proposed with the wet well for Stage C as all volumes have been provided within Stage A and Stage B. However the operating volume will increase to 15.0m^3 with an operating depth of 1.88m.

Emergency Storage:
It is proposed to increase the emergency storage to cater for the additional flows for Stage C. A total operating volume of 470m3 will be required and can be managed by augmenting the initial underground storage tanks with an additional 2×100m3 FRP storage tanks. The combined 5 tanks will contain an operating volume of 500m3.

Vents/Chemical Dosing:
The odour control measures will be re-commissioned to account for the increase in flows anticipated.

Stage D (Ultimate)

The ultimate scenario will maintain the proposed 375mm main identified in Stage C and recommission the temporary closed 225mm diameter rising main proposed in Stage A and Stage B. Both mains will run concurrently to service the ultimate demand of South Jerrabomberra. The ultimate scenario rising mains have been designed to account for 3% stormwater ingress.

Pump Selection:
All three pumps will require to be upgraded to a new duty / assist /standby arrangement and will contain a duty of 280 l/s @ 56m Head with two pumps running.

Wet Well:
It is proposed to construct an additional wet well 3.2m diameter adjacent to the existing wet well. The new wet well will increase the operating capacity of the combined wet wells to 31.0m^3 with an operating depth of 2.0m. The new wet well will collect Environa Flows before entering the original wet well before being pumped through the rising main.

Emergency Storage:
It is proposed to increase the emergency storage to cater for the additional flows for Stage D. A total operating volume of 1017 m3 will be required and can be managed by augmenting the existing underground storage tanks with an additional 5×100 m3 FRP storage tanks. The combined 10 tanks will contain an operating volume of 1,000m3.

Vents/ Chemical Dosing:
The odour control measures will be re-commissioned to account for the increase in flows anticipated.

Table 1: Sewer Pump Station Staging Summary

SEWER PUMP STATION STAGE	WET WELL	PUMPS	EMERGENCY STORAGE	RISING MAINS	EP	REF APPLICATION
STAGE A	Single Wet Well	Two temporary pumps, 6.5l/s duty @ 85m head	300m^3	Temporary 110mm HDPE main. Construct 225mm DICL main	359 – South Tralee Stage 1	REF Application i.e. Built as part of South Tralee Subdivision Stage 1
STAGE B		Duty/standby, 51l/s duty @ 55m head		Decommission 110mm HDPE main, direct flows to	4,096 – South Tralee	REF Application i.e. Built as part of South Tralee

SEWER PUMP STATION STAGE	WET WELL	PUMPS	EMERGENCY STORAGE	RISING MAINS	EP	REF APPLICATION
				225mm main.		**Subdivision Stage 2**
STAGE C		Duty/assist/standby, 172 l/s @ 50m head	500m3	Construct second 375mm rising main. Direct flows through 375mm main.	7,216 – South Tralee, Morrison, Forrest and Walsh	Future works
STAGE D	Second Wet Well added	Upgraded duty/assist/standby pumps, 280l/s @ 56m head	1,100m^3	Recommission 225mm main. Use both rising mains.	15,736 - South Tralee, Morrison, Forrest, Walsh, North Tralee and Environa	Future works

3.4.1 Gravity Sewer

Gravity mains were initially graded at 1.0% for 150mm mains and 0.5% for mains greater than 150mm to ensure sufficient capacity through the main. It is not anticipated that all mains will be required to be laid at the minimum grade and may be laid steeper to increase the capacity and meet site constraints; this will be further detailed during detailed design. The trunk main that connects the developments to the proposed SPS has increased the grade from the minimum available to 1.25%. The increase in grade will reduce the pipe diameter while still being able to be constructed.

To service the South Jerrabomberra Sewer Catchment to the proposed Sewer Pump Station two separate gravity mains are proposed, Environa and North Tralee will be serviced by a future 375mm main with the remaining developments of South Tralee, Forrest, Morrison and Walsh being serviced by a 375mm diameter main at the SPS. The main will be laid at a minimum grade of 1.25% to increase the capacity of the main.

This REF application will address the gravity main up to Dunn's Creek Road and will consist of a 300mm diameter main before increasing to a 375mm main near Sheppard Street to account for the additional flows anticipated from South Tralee.

3.4 Construction Activities

3.5.1 Timing and staging

The works proposed under this REF application are required to service the future development area of South Jerrabomberra. The first development within South Jerrabomberra is South Tralee which has a Conceptual Development Application approved and Development Application lodged with Council for the first stage of South Tralee. As such the works identified within this REF are anticipated to be

constructed concurrently with the works associated with the development of South Tralee and the associated Northern Entry Road. These works will commence as soon as the necessary approvals are in place.

Anticipated construction commencement: Late 2016
Anticipated construction completion of the first stage of works: Mid 2017

Some of the components of the REF are for future developments (e.g. to service Environa), these will not be constructed until there is a demand for them. Timing of the construction of the ultimate infrastructure is subject to the development timeframes which are unknown but could be assumed to be at least 10 years plus.

Once commissioned, the proposed scheme would be operated by QPRC. Ongoing operations will include 24 hour monitoring, chemical dosing operations, and routine maintenance.

3.5.2 General

- Contractor to obtain approvals for all relevant environmental permits prior to commencement of works.
- Contractor to obtain approval for traffic management plans and develop vehicle movement plans within the site of works prior to commencement of works.
- Contractor to obtain approval for road opening permits, where applicable, prior to commencement of works.
- Contractor to establish temporary site compounds and associated access.
- Contractor to establish environmental controls approved by EPA.
- Clearing and grubbing of the construction area as required.
- Contractor is responsible to finalise the CEMP and submit to the EPA for approval.

3.5.3 Material Storage

- Contractor shall establish material storage areas at locations agreed by the Superintendent. Locations are to not interfere with normal usage of access roads, other designated areas of the site or any overland flow paths. Consideration may be given for other storage locations for pipework, pipe bedding and backfill material, and excavated spoil.
- Contractor shall provide fencing and environmental controls to all storage areas as approved by EPA.

3.5.4 Pipeline Construction

- Contractor shall confirm location of all existing services.
- Contractor shall set out lines and levels for the new 375mm (Water) diameter pipeline, sewer pipelines and other associated works.
- Open trench length is to be limited to a length which can be restored within approximately 4 hours as noted in Emergency Restoration below. It is suggested this length be in the order of 20m-40m.
- In fill areas, excavate trench using excavator with bucket. Care is to be taken to minimise trench over break. Excavation equipment is to be positioned to not impart loading from tracks over any

existing services. As such, excavators with offset boom arrangements may be required for portions of the work.

- In rock, excavate trench using rock cutting or grinding techniques that minimise vibration. Examples of suitable techniques include chain trenching, rock sawing or rock grinding. Excavation equipment is to be positioned to not impart loading from tracks over any existing services. As such, trenching equipment with offset saw or chain arrangements may be required for portions of the work.
- Limited blasting may be used during construction, however only in areas clear of potential impacts. QPRC approval would be required for any blasting and is unlikely to be approved for any areas close to existing residents, Hume, bridges, the railway line or other critical infrastructure.
- Vibration monitoring is to be installed to confirm the Contractor's methodology is not exceeding recommended limits.
- Contractor shall remove and dispose excavated spoil to spoil locations agreed by the Superintendent. All spoil is to be placed in the locations agreed on site i.e. no spoil will be taken off site.
- For trenches greater than 1.5m depth, Contractor shall obtain geotechnical advice in writing regarding suitable trench support. Suitable supports may include shoring. Benching is not recommended within Edwin Land Parkway or Tompsitt Drive due to the close proximity of existing services.
- The Contractor shall bed and lay pipework in accordance with QPRC Specifications. Bedding and pipeline materials are to be brought from storage areas as required. Material cannot be stored in a location that may block access roads.
- Contractor shall backfill pipework with general fill or granular material in accordance with QPRC Specifications. Backfill material is to be brought from storage areas as required.
- Contractor shall construct other elements of the pipeline progressively with main installation including thrust blocks, scour valves, air valves and associated fittings.

3.5.5 Surface Restoration

- For existing sealed roads, Contractor shall reconstruct pavements to match existing pavement including asphalt or seal surface as specified on the drawings and specification.
- For existing unsealed roads, Contractor shall reconstruct pavements to match existing with suitable road base as specified on the drawings and specification.

3.5.6 Emergency Restoration

When notified by the Superintendent:

- Disturbed roadways are to be reinstated to a suitable surface within 4 hours of notification.
- Existing excavation works are to be ceased and any exposed ends of pipework capped.
- Trench excavation is to be backfilled to surface levels with excavated material, or material from storage. Backfilled material is to be compacted to provide a solid, even travelling surface.
- Surplus materials are to be removed from the access road. In emergency situations, stockpiling adjacent to the access road will be acceptable if access and WHS is not compromised.
- Upon receipt of approval to recommence works, backfilled material can be excavated as per excavation in fill, and pipeline construction recommenced.

3.5 Construction Impacts

The following sections describe the potential construction traffic, disturbance and operational impacts associated with the installation of REF associated infrastructure.

The proposed construction works will include the following processes:

- Stripping/excavating exercises continuous operation each day during use.
- Removal and stockpile of surplus material, approximately 12 rigid truck movements each way per day (assuming 50m/day production rate – 80m3). Surplus material will be placed on site.
- Pipe laying exercises (backhoe and light vehicle) intermittent operations each day during use.
- Backfilling exercises intermittent operations each day during use.
- Compaction of backfill intermittent operations each day during use.
- Rock excavation as required for excavation in rock.

In order to achieve approximately 50m per day* of pipe laying (4x Pipes) and the required equipment and project team is estimated below.

Table 2 Construction Equipment and Team

Construction Equipment/Mobile Plant	Project Team
2x Excavators (30t-50t)	Supervisor (PM, PE)
1x Backhoe	Foreman
1x Padfoot roller	Leading Hand
1x Rigid Truck	2x Plant Operators
	2x Labourers

*Note that 50m per day assumes no excavation in rock. If excavation in rock, production rate may drop to approx. 25m per day.

Construction of the pipelines will progress along the length of the pipelines so any construction activity in one location will be for a short period of time as the work moves along the alignments of the pipeline. Construction works for the water reservoirs and sewer pump station will be static at their respective sites during construction. All construction activities will be short term and not considered significant.

3.6 Civil Works Traffic, Impact

The estimated construction traffic and traffic movements for the proposed works are described below:

- Employee traffic (light vehicles) up to approximately 12 vehicles movements each way per day.
- Delivery of mobile plant, 3 semi-trailer, 2 Backhoe and 2 rigid truck movement at beginning and end of the project.
- Deliveries of bedding sand, up to 5 semi-trailer each way per day (assuming 50m/day production rate – 80m3).
- Deliveries of pipes and other materials, 2 semi-trailer each way per week.

3.7.1 Potential Impacts During Peak Construction Traffic

Peak traffic is likely to occur at any time when production rate is highest (i.e. no excavation in rock), at this point there will be approximately 12 employee movements each way (light vehicle), 5 delivery movements each way for bedding sand (semi-trailer), 14 movements each way for removal of surplus material (rigid truck/backhoe), 1-2 continuous excavation exercise (excavator), 1-2 continuous backfill exercise (excavator) and 1 intermittent compaction exercise (pad foot roller).

Peak disturbance is likely to be in the case of rock excavation. Although sand delivery, backfill and compaction will reduce, a rock hammer may be required continuously during these periods and it is likely that the second excavator would also contribute to a second excavation front, potentially also using a rock hammer. At this point there would be approximately 10 employee movements each way (light vehicle), approx. 2 delivery movements each way for bedding sand (semi-trailer), 6 movements each way for removal of surplus material (rigid truck/backhoe), 1 or 2 continuous excavation exercise including rock hammer (excavator + rock hammer), 1 intermittent backfill exercise (excavator) and 1 occasional compaction exercise (pad foot roller).

A traffic management plan would be prepared by the Contractor in accordance with QPRC requirements. The traffic management plan will provide details on the traffic management to be implemented during construction to ensure road safety is not compromised and traffic flow is maintained.

Trenching across, Jerrabomberra Circle and Tompsitt Drive will be required to facilitate the water connection from Edwin Land Parkway into South Jerrabomberra. It was determined there would likely be a significantly less number of cars on a Saturday and these works are proposed to occur over several Saturdays as required. This would involve, closing one lane and trenching, and closing the remaining lane on the following weekend. This would still allow for steady traffic movement throughout the day. A traffic management plan would need to be prepared prior to these works being carried out. A further crossing will occur through Edwin Land Parkway, however this will be facilitated through trenchless methods.

A traffic count was carried out by VBC over a three hour period at the Jerrabomberra Roundabout on Saturday 12th of March. The traffic numbers collected averaged 500vph at various times of the day. These numbers are located in Appendix 10.

Without seeing a traffic management plan, Cardno have reviewed the traffic numbers collected and identified there is unlikely to be a major impact on the traffic operation and these numbers would not necessitate all four lanes being maintained while trenching is occurring.

3.7.2 Potential Impacts During Peak Operational Traffic

When in operation it is anticipated that the movements associated with operation and maintenance will be as follows:

- Delivery of chemicals for water treatment (medium rigid) approximately 1 movement each way per month.
- Council inspections (light vehicle) approximately 1 movement each way per day.

3.7 Extent of Works

The works will be generally limited to an approximate 5m wide corridor along the length of the proposed pipelines and the extent of earthworks associated with the water reservoir and pump station sites as shown on the drawings.

Any potential impacts from earthworks (including trench excavations) are considered to be minimal as any exposure of soils and stockpiling of spoil would be temporary and of a short duration. Notwithstanding this mitigation measures will be put in place. The contractor will be required to install sediment and erosion control measures in accordance with The *Managing urban stormwater: soils and construction (The blue Book)*.

The works include installation of pipelines across the Jerrabomberra Creek. It is proposed to install coffer dams in the Creek to manage any potential impacts on the creek from excavation works. There is a proposed bridge adjacent to the pipelines. The intention is to undertake these works concurrently to limit the duration and extent of works in the creek.

The implementation of appropriate sediment and erosion controls will mitigate any potential soil impacts.

4 STATUTORY PLANNING CONTEXT & ASSESSMENT

4.1 Location and Context

The South Jerrabomberra release area lies between the existing residential areas of Jerrabomberra to the east and the Australian Capital Territory (ACT) including the Hume industrial precinct to the west. The release covers an area of approximately 1,160 hectares.

South Jerrabomberra is located approximately 10 kms south west of the Queanbeyan Central Business District and 15 kms south of Canberra City in the ACT.

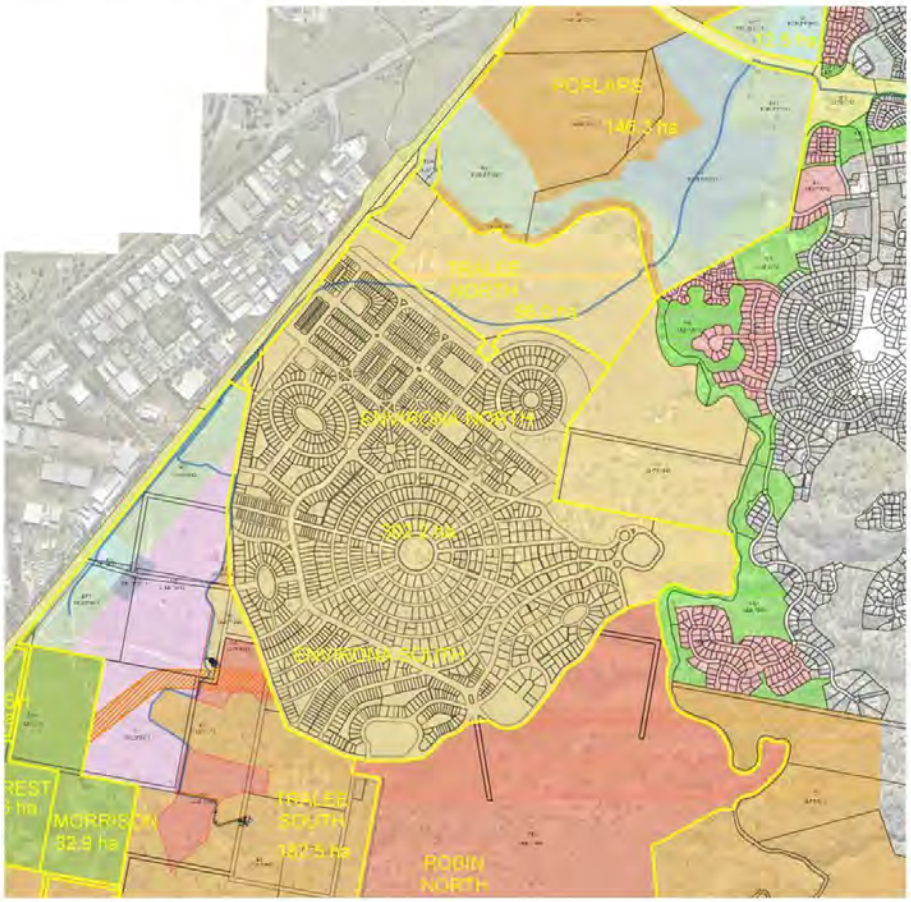

Figure 4. Context plan with current zoning

The location and context of the proposed works is also shown on the Sewer Concept Layout Plan (refer Plan C13085.1-R510) and also the Potable Water Supply Concept Plan (refer Plan C13085.1 R530) in Appendix 3.

The majority of the proposed trunk sewer and water mains will largely align with an existing and future road network extending from Tompsitt Drive in the existing neighbourhood of Jerrabomberra, and then southward via the Northern Entry Road through future land releases including the Poplars, Environa, North Tralee, and South Tralee.

These roads were recently the subject of concept (staged) approvals, as follows:

DA No.	Description	Date Consent Issued
DA 175-2013	*Staged Development: Construction of a road to service South Tralee (Concept Only)*	22nd October, 2014
DA 263-2013	*Staged Development for the conceptual development of South Tralee urban release area involving 5 stages, the road hierarchy and master plan for future subdivision for 1,348 dwellings (approx.), commercial and community facilities, open space and recreation areas and associated servicing.*	18th May, 2015

The majority of lands traversed by the proposed infrastructure are already zoned for urban purposes.

Those lands, which remain zoned for non-urban (rural) purposes include Tralee and Environa North. The proposed high level water reservoir in South Tralee is to occur within land zoned for environmental protection/conservation purposes.

4.2 Environmental Planning and Assessment Act, 1979 and Regulation

4.2.1. Approvals Pathway

The provision of potable water and sewer related infrastructure to South Tralee was previously the subject of a Heads of Agreement between the proponent (Canberra Estates Consortium No.4 or CEC4) and QPRC. The draft heads of agreement accompanied the Staged Development Application submitted to Council in December 2013 for the conceptual development of South Tralee (DA 263-2013).

As the trunk sewer and water infrastructure works will ultimately be dedicated to Council, CEC4 entered into a Local Planning Agreement with Council under which CEC4 agreed to Council having a substantial degree of control over and supervision of the carrying out of those infrastructure works.

Once executed CEC4 will be carrying out the infrastructure works on behalf of Council, for the purposes of the *State Environmental Planning Policy (Infrastructure) 2007*.

The proposal is not therefore considered to require consent under Part 4 of the EP&A Act and is not classified as State Significant Infrastructure under part 5.1 of the Act. Rather the development must be assessed under Part 5 of the EP&A Act if it may be carried out without development consent and is carried out, or approved, by a determining authority.

Under Part 5 a determining authority is defined as: *"...a Minister or public authority and, in relation to any activity, the Minister or public authority by or on whose behalf the activity is or is to be carried out or any Minister or public authority whose approval is required in order to enable the activity to be carried out..."*

The EP&A Act also defines a 'public authority' as:

(a) a public or local authority constituted by or under an Act, or
(b) a Public Service agency, or
(c) a statutory body representing the Crown, or
(d) a Public Service senior executive within the meaning of the Government Sector Employment Act 2013, or
(e) a statutory State owned corporation (and its subsidiaries) within the meaning of the State Owned Corporations Act 1989, or
(f) a chief executive officer of a corporation or subsidiary referred to in paragraph (e), or
(g) a person prescribed by the regulations for the purposes of this definition.

In this case QPRC will be both the proponent and the determining authority for the development under Part 5 of the EP&A Act, whereby CEC4 will undertake the works on its behalf.

Clause 111 of the EP&A Act requires the determining authority to 'examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity'.

This REF has therefore been prepared to assess the environmental impacts of the proposal and to determine if it is likely to have a significant impact on the environment. Factors that need to be taken into account when considering the likely impact of an activity on the environment are outlined in Clause 228 of the EP&A Regulations which are discussed in Appendix1.

If the determining authority (in this case QPRC) decides the proposal would likely significantly affect the environment an environmental impact statement (EIS) must be prepared.

Furthermore, if the proposed scheme were to be carried out on land that is critical habitat, or if a determining authority decide the proposal would be likely to significantly affect a threatened species, population or ecological community or its habitat then it must obtain and consider a species impact statement (SIS).

Provided the mitigation measures outlined in this REF and accompanying environmental assessments are satisfactorily implemented, the proposal is considered unlikely to have a significant impact on the environment and is unlikely to result in a significant impact on threatened species, population or ecological communities.

Accordingly, an EIS or SIS is not considered necessary in this particular instance.

This REF is considered to satisfy Section 111 of the EP&A Act and Clause 228 of the EP&A Regulations by:

- assessing the likely environmental impacts of the proposed water and sewer related infrastructure required to service the South Tralee release area;
- providing an opinion as to whether or not the construction and operation of the proposed infrastructure would have a significant impact on the environment; and
- identifying a range of measures to mitigate the impacts upon the environment.

4.3 State Environmental Planning Policies

4.3.1 State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP)

The aim of the State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) is to facilitate the timely and efficient delivery of infrastructure by public authorities throughout NSW. It does this by making certain infrastructure permissible with or without development consent.

Water Infrastructure:

Clause 125 of the ISEPP defines a water reticulation system as:

> *water reticulation system means a facility for the transport of water, including pipes, tunnels, canals, bores, pumping stations, related electricity infrastructure, dosing facilities and water supply reservoirs.*

The proposed works in South Jerrabomberra are to include pipes for the transport of water, pumping stations in addition to reservoirs and therefore are likely be defined as a 'water reticulation system' for the purposes of the ISEPP.

We note that 'water reticulation systems' are not permissible in many of the land-use zones traversed by the infrastructure. However the ISEPP prevails over local planning instruments (including LEPs) in the event of any inconsistency and makes such infrastructure permissible without consent if constructed for and on behalf of a public authority.

In particular, Clause 125(1) of the ISEPP states that '*development for the purpose of water reticulation systems may be carried out by or on behalf of a public authority without consent on any land.*'

Sewer Infrastructure:

The ISEPP defines a 'sewage reticulation system' as:

> *sewage reticulation system means a facility for the collection and transfer of sewage to a sewage treatment plant or water recycling facility for treatment, or transfer of the treated water for use or disposal, including associated:*

(a) pipelines and tunnels, and
(b) pumping stations, and
(c) dosing facilities, and
(d) odour control works, and
(e) sewage overflow structures, and
(f) vent stacks.

Having regard to the definition above, the proposed works (involving sewer pipelines, pumping stations and overflow structures) are considered to comprise a 'sewage reticulation system'.

Clause 106(3)(a) of the ISEPP also makes such infrastructure permissible without consent on any land if undertaken by or on behalf of a public authority. It states as follows:

(3) Development for the purpose of sewage reticulation systems may be carried out:

(a) by or on behalf of a public authority or any person licensed under the Water Industry Competition Act 2006 without consent on any land, and
(b) by any other person with consent on any land.

However, such development may be carried out on land reserved under the National Parks and Wildlife Act 1974 only if the development is authorised by or under that Act.

The land traversed by the infrastructure is not reserved under the NP&WS Act 1974.

4.3.2 State Environmental Planning Policy (State and Regional Development) 2011

State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) was reviewed to confirm the proposed scheme did not require approval under Part 5.1 of the EP&A Act.

Under Clause 8(1) of the SRD SEPP, development is declared State Significant Development for the purposes of the EP&A Act if:

(a) the development on the land concerned is, by the operation of an environmental planning instrument, not permissible without development consent under Part 4 of the Act, and
(b) the development is specified in Schedule 1 or 2.

The proposed sewer and water infrastructure is permissible without consent under the provisions of clause 106 of the ISEPP. Refer Section 4.3.2 above.

Under Clause 14(1) of the SRD SEPP, development is declared State significant infrastructure for the purposes of the EP&A Act if:

(a) the development on the land concerned is, by the operation of a State environmental planning policy, permissible without development consent under Part 4 of the Act, and
(b) the development is specified in Schedule 3.

On the basis that the proposed works are not characterised as development for the purpose of water storage or water treatment facilities (not including desalination plants) carried out by or on behalf of a public authority that has a capital investment value of more than $30million, then the proposed scheme is not listed under Schedule 3 of the SRD SEPP.

Accordingly the proposed scheme is not considered State Significant Infrastructure requiring approval under Part 5.1 of the Act.

4.3.3 State Environmental Planning Policy No.55 – Remediation of Land

State Environmental Planning Policy No.55 – Remediation of Land (SEPP 55) establishes a State wide planning approach to the remediation of contaminated land. SEPP 55 requires that a consent authority consider whether the land is contaminated, and in the case of contaminated land, whether it would be suitable either before or after remediation for the purposes of the proposed development.

Clause 7 of SEPP55 relates to the issue of contamination, the suitability of the land for the proposed 'development', and whether remediation is required to facilitate development. In this regard reference is made to the 'Detailed Site Investigation' undertaken by SMEC Consultants for South Tralee in Appendix 12.

On the basis of the desktop review of the available data (including, government searches and registered bore details), a site inspection and limited intrusive assessment, SMEC consider the site (being the sewer and water pumping station) suitable for the proposed land use with the following recommendations:

- Temporary fencing is erected around the adjacent structures identified to contain ACM or PACM forming a 10 m exclusion zone around adjacent site buildings ;
- The adjacent structures are suitably labelled to convey the risk of asbestos exposure. A prominent warning sign should be posted in the immediate vicinity of the off-Site buildings if it is not practical to directly label the asbestos containing material. All warning signs should comply with AS 1216 "Class Labels for Dangerous Goods" and AS 1319 "Safety Signs for the Occupational Environment" and the Safe Work Australia's Model Code of Practice How to manage and Control Asbestos in the Workplace;
- It is recognised that construction workers may be exposed to risk during works associated with redevelopment of the site. It is therefore recommended that a Construction Environmental Management Plan (CEMP) be prepared to include the following as a minimum:

  - Asbestos Management;
  - Dust & Noise Exposure;
  - Waste Management;
  - Other Contamination Management;
  - Procedure for uncovering unexpected contamination; and
  - Personnel Protective Equipment requirements.
  - HAZMAT

It is noted that similar investigations by SMEC have previously been undertaken for South Tralee (in support of applications made for the residential development of this area) in addition to the Northern Entry Road corridor, including:

- *South Tralee Detailed Site Investigation* (South Tralee Residential Development, Tralee, NSW) July, 2015.
- *Site Contamination Summary Report* (Northern Entry Road to the South Tralee Development Site), August 2013
- *Site Contamination Summary Report – South Tralee Development Site (Entry Road), August 2013*

They include a range of recommendations to appropriately manage the potential for contamination. Those recommendations should also be adhered to in undertaking the proposed infrastructure works.

Note further investigation of those areas (beyond the SPS) may be required.

4.3.4 State Environmental Planning Policy (Rural Lands) 2008

This policy primarily aims to facilitate the orderly and economic use and development of rural zoned lands for rural and related purposes, to reduce land use conflicts where they occur, and to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations.

The proposed infrastructure works including the sewer pump station will traverse rural zoned lands in North Tralee, which are currently zoned 1 (a) Rural A under Queanbeyan Local Environmental Plan 1998

- Part 2 - Rural Planning Principles:

The Rural Planning Principles contained in Part 2 of the Rural Lands SEPP seek to protect rural lands, natural resources and promote appropriate opportunities for rural housing. The infrastructure works are to occupy a very small percentage of the Rural 1A zoned land in North Tralee. Further the subject lands have been identified by Council for some time as a future employment precinct and have recently been the subject of an exhibited Planning Proposal to rezone the subject land from 1(a) (Rural A Zone) to employment and other appropriate uses.

- Part 3 - Rural subdivisions and dwellings:

This REF does not propose for the subdivision of the land zoned 1 (a) Rural A for the purposes of creating rural or residential allotments, nor does it propose dwelling construction in these areas but rather an ancillary infrastructure. As such, the provisions of this Part are not considered specifically relevant.

- Part 4 - State significant agricultural land:

The 1(a) Rural A zoned lands in North Tralee are not identified as being State significant agricultural land.

4.3.5. State Environmental Planning Policy 33 – Hazardous and offensive development

SEPP 33 establishes the procedures and requirements for the assessment and consideration of hazardous and offensive developments.

The proposed works are neither considered hazardous or offensive industry. Further it is noted that SEPP 33 primarily relates to applications made for potentially hazardous or potentially offensive development requiring consent under Part 4 of the EP& A Act.

The proposed infrastructure works are to be considered under Part 5 of the EP&A Act. Therefore the requirements of SEPP 33 are not considered to apply.

4.4 Local Environmental Plans

The proposed infrastructure works traverse a number of different Local Environmental Plans and also zonings.

They are shown on the accompanying plans entitled South Tralee Sewer & Water REF (Zone Plan Sheets 1 and 2) and described in the tables below.

Table 3: Permissibility of sewer and water related infrastructure under applicable LEP

LEP	ZONE	PERMISSIBILITY of SEWER & WATER INFRASTRUCTURE
Queanbeyan Local Environmental Plan 2012	*SP2 Infrastructure* *RE1 Public Recreation*	SP2 - Yes as infrastructure. RE1 - Prohibited
Queanbeyan Local Environmental Plan (Poplars) 2013	*B7 Business Park* *RE2 Private Recreation* *E2 Environmental Conservation*	B7 – Prohibited RE2 – Prohibited E2 – Prohibited
Queanbeyan Local Environmental Plan 1998	*1(a) Rural A* *7(b) Environmental Protection B*	1(a) - Yes, with consent as a utility undertaking whereby it is carried out by or by authority of any Government Department 7(b) – As above.
Queanbeyan Local Environmental Plan (South Tralee) 2012	*RE2 Private Recreation* *R1 General Residential* *E2 Environmental Conservation* *B1 Neighbourhood Centre*	RE2 – Prohibited R1 – Prohibited E2 – Prohibited B1 - Prohibited

Notwithstanding the prohibition of the proposed infrastructure works under each of the LEPs and zones traversed by the subject works, *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) prevails in the event of an inconsistency (between the ISEPP & another environmental planning instrument) and makes permissible the proposed works without consent where undertaken by or on behalf of a public authority.

Further it is noted that clause 5.12 of the Queanbeyan LEP 2012, Queanbeyan LEP (Poplars) 2013 and also Queanbeyan LEP (South Tralee) 2012 does not restrict or prohibit the carrying out of any development, by or on behalf of a public authority, that is permitted to be carried out with or without development consent under the ISEPP . It states as follows:

> *5.12 Infrastructure development and use of existing buildings of the Crown*
>
> *(1) This Plan does not restrict or prohibit, or enable the restriction or prohibition of, the carrying out of any development, by or on behalf of a public authority, that is permitted to be carried out with or without development consent, or that is exempt development, under State Environmental Planning Policy (Infrastructure) 2007.*
>
> *(2) This Plan does not restrict or prohibit, or enable the restriction or prohibition of, the use of existing buildings of the Crown by the Crown.*

4.5 Other State Environmental Legislation

4.5.1 National Parks and Wildlife Act, 1974

The National Parks and Wildlife Act, 1974 (NP&W Act) provides for the protection and management of Aboriginal heritage sites in NSW.

Under Section 86 of the Act, it is an offence to harm or desecrate an Aboriginal place or object unless authorised by an Aboriginal heritage impact permit, or where a proponent has reasonably determined that no Aboriginal object will be harmed.

The majority of the lands to be traversed by the proposed infrastructure have previously been the subject of detailed archaeological assessment as part of the applications made for both the Northern Entry Road corridor and also the urban development of the South Tralee release area.

A further heritage assessment has been prepared by Navin Officer Heritage Consultants Pty Ltd to satisfy the NSW Office of Environmental and Heritage Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales, for the purpose of the South Tralee Sewer and Water REF.

The findings of this assessment are discussed in detail within Section 6.9 of this report. Its key findings and recommendations are noted below.

- No Aboriginal sites will be directly impacted by the South Tralee Sewer and Water project.
- Six Aboriginal sites (PPS7, PPS8, TA2, TA3, TA4 and NER1) are located within 35m of the South Tralee Sewer and Water project area. These sites should be fenced for the duration of construction activities associated with the South Tralee Sewer and Water project.
- No further archaeological assessment is required for the South Tralee Sewer and Water project.
- The construction of fences around the sites indicated should be conducted with on-site advice from the project archaeologist.

- The location of sites should be clearly marked on all site plans utilised for the South Tralee Sewer and Water project.
- The protocols for the unanticipated discovery of archaeological material and suspected human remains (presented in Appendix 4 of Navin Officer's report) should be implemented if necessary.

Flora and Fauna:

Under Section 98 of the NPW Act, it is unlawful for a person to harm any protected fauna. Under Section 118A of the Act it is also an offence for a person to pick any plant that is of, or is part of, a threatened species, an endangered population or an endangered ecological community – where 'pick' includes gather, pluck, cut, pull up, destroy, poison, take, dig up, crush, trample, remove or injure the plant or any part of the plant.

However it is noted that Section 98 and 118A do not apply in relation to activities which are essential for the carrying out of an activity by a determining authority within the meaning of Part 5 of the EP&A Act if the determining authority has complied with that Part. QPRC will be the determining authority for the proposed scheme under Part 5 of the EP&A Act.

Notwithstanding the above, a detailed flora and fauna impact assessment of the proposed works was undertaken by consultants Kevin Mills & Associates to satisfy its obligations under Part 5. A summary of the findings are contained in Section 6.5.

4.5.2. Heritage Act, 1977

The *Heritage Act, 1977* (Heritage Act) makes provision to conserve the State's environmental heritage. It provides for the identification and registration of items of State and local heritage significance, provides for the interim protection of items of State heritage significance, constitutes the Heritage Council of New South Wales and confers on it functions relating to the State's heritage.

In accordance with Section 60 of the Heritage Act, approval must be gained from the Heritage Council when making changes to a heritage place listed on the State Heritage Register or covered by an interim heritage order (IHO).

There are no known items occurring within South Jerrabomberra that are listed on the State Heritage Register, nor subject to an interim or permanent conservation order under the Heritage Act.

The proposed road alignment (within which the proposed infrastructure is to occur) is located immediately to the south of the former open air motorsport track. Given the listing of the motorsport track (Item H2) in Schedule 4 of QLEP 1998 consideration of the item has been undertaken and addressed in the heritage assessment by Navin Officer.

It is noted that the Frazer Park Raceway Complex (Site H1) has already been approved for demolition by Council. An archival recording has also been undertaken and accompanied the Development Application recently submitted to Council for Stage 2 of the Northern Entry Road (Southern Section).

Section 139 of the Heritage Act, 1977 also prohibits the disturbance or excavation of land on which there is situated a relic. For example, a person must not disturb or excavate any land on which the person has discovered or exposed a relic except in accordance with an excavation permit.

The accompanying assessment by Navin Officer Heritage Consultants Pty Ltd (refer Appendix 9) considered the existence of non-aboriginal heritage within the investigation area. Key findings include the following;

- No historical sites will be directly impacted by the South Tralee Sewer and Water project.
- Two European sites (H7 and H9) are located within 35m of the South Tralee Sewer and Water project area. Site H7 (main) should be fenced for the duration of construction activities associated with the South Tralee Sewer and Water project. No further action is required for site H9 (Tralee Landing Ground).
- No further archaeological assessment is required for the South Tralee Sewer and Water project.
- The construction of fences around the sites indicated should be conducted with on-site advice from the project archaeologist.
- The location of sites should be clearly marked on all site plans utilised for the South Tralee Sewer and Water project.
- The protocols for the unanticipated discovery of archaeological material and suspected human remains (presented in Appendix 4 of Navin Officer's report) should be implemented if necessary.

4.5.3 Water Management Act, 2000

The Water Management Act 2000 (WM Act) controls the carrying out of activities in or near water sources in NSW. 'Water sources' are defined very broadly and include any river, lake, estuary or place where water occurs naturally on or below the surface of the ground.

If a 'controlled activity' is proposed on 'waterfront land', an approval is ordinarily required under the WM Act (Section 91E). Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary.

The proposed infrastructure works will involve the trenching and burying of the water and sewer mains below Jerrabomberra Creek. Accordingly the works would ordinarily be deemed a controlled activity under the WM Act. The NSW Office of Water administers the WM Act and assesses the impact of any proposed controlled activity to ensure that no more than minimal harm will be done to waterfront land as a consequence of carrying out the controlled activity.

However, pursuant to Clause 38 of the Water Management (General) Regulation 2011, public authorities are exempt from the requirements of Section 91E of the WM Act. As QPRC is a public authority, approval is not required under Section 91E of the WM Act.

As noted in the accompanying ecological assessment by Kevin Mills & Associates (refer Appendix 7), a number of guidelines produced by the NSW Office of Water provide direction where creek crossings are contemplated including *Guidelines for watercourse crossings on waterfront land* (NSW Office of Water 2012).

The Guidelines for Watercourse Crossings state that "the design and construction of works or activities within a watercourse or adjoining waterfront land should protect and enhance water flow, water quality, stream ecology and existing riparian vegetation. Impacts on the hydrologic, hydraulic and geomorphic functions of a watercourse should also be minimised."

The options of trenching and burying the water and sewer mains below Jerrabomberra Creek will have the potential to temporarily impact the channel, banks and riparian corridor of the watercourse. The Guidelines noted above list the matters that the design and construction of crossing structures should consider.

Kevin Mills & Associates states that careful construction and rehabilitation following construction will be required to ensure that there is no unacceptable impact in the long term. The documents *Guidelines for Riparian Corridors on Waterfront Land* (Office of Water 2012) and *Guidelines for watercourse crossings on waterfront land* (Office of Water 2012) as well as *Guidelines for laying pipes and cables in watercourses on waterfront land (Office of Water 2012)* should be adhered to when designing and undertaking construction within and along Jerrabomberra Creek.

With regards to the proposed sewer pumping station, it is to be located approximately 200 metres from Jerrabomberra Creek.

In accordance with the advice received from Lindsay Taylor Lawyers (Appendix 13) the only approval that is required is a 'water supply works approval' under s90(2) of the Water Management Act 2000.

4.5.4. Fisheries Management Act, 1994

The Fisheries Management Act 1994 (FM Act) provides for the conservation of the State's aquatic resources and is administered by the Department of Primary Industries (DPI). The FM Act requires that possible impacts on threatened species and aquatic habitat be addressed during the environmental planning and assessment process.

A flora and fauna assessment was conducted as part of the REF (refer Appendix 7) and identified no threatened aquatic species or habitat in the subject creek environment. It concludes that the infrastructure development for South Tralee is not likely to have a significant effect on any threatened species, populations or communities listed under the Fisheries Management Act 1994, or their habitats.

Notwithstanding the above, it is a recommendation of this report and the accompanying ecological assessment by Kevin Mills & Associates that all relevant guidelines by the NSW Office of Water are adhered to during the construction phase and to ensure no significant longer term impacts on the wider creek environment.

4.5.5 Roads Act, 1993

The Roads Act 1993 is administered by NSW Roads and Maritime Services (RMS), relevant Councils or the Department of Lands.

Typically the RMS has jurisdiction for classified roads, council for non-classified roads and the Department of Lands for road reserves or Crown roads. Under Section 138, Part 9, Division 3 of the Roads Act 1993, a person must not impact or carry out work on or over a public road otherwise than with the consent of the appropriate roads authority.

It is understood that Tompsitt Drive is under the care and control of QPRC. Clause 5 of Schedule 2 of the Roads Act 1993 relates to the application of Section 138. Section 138 does not require a public authority to obtain a roads authority's consent to exercise its functions in, on or over an unclassified road other than a Crown road.

Accordingly Council is not obligated to obtain approval under Section 138 with regards the undertaking of the infrastructure works along the Tompsitt Drive road reservation.

However, this review has considered the potential impact of the proposed infrastructure and concluded there is little likelihood of any significant impacts arising from these works. As noted in the accompanying Ecological Assessment by Kevin Mills & Associates (refer Appendix 7), the road reserve contains little natural vegetation, partly because it was highly modified in building Tompsitt Drive and infrastructure already exists in the road reserve. Except for a line of small trees along the southern road frontage, planted and natural, the area is mown exotic grassland.

The Construction Management Concept Plan in Appendix 3 (refer Plans C13085.1-R601) also identifies a number of measures to be employed during the excavation, construction and rehabilitation phase along Tompsitt Drive and Edwin Land Parkway, including traffic and pedestrian control in accordance with QPRC protocols.

4.5.6 Threatened Species Conservation Act, 1995

The New South Wales Environmental Planning and Assessment Act 1979 (EP&A Act), as amended by the Threatened Species Conservation Act 1995 (TSC Act) and the Threatened Species Conservation Amendment Act 2002 (TSC Amendment Act), requires that various factors of assessment be taken into account in deciding whether a proposed action, development or activity is likely to have a significant effect on threatened species, populations or communities, or their habitats and, hence, whether the preparation of a Species Impact Statement (SIS) is warranted.

The accompanying Ecological Assessment by Kevin Mills & Associates (refer Appendix 7) has addressed the requirements of the Act. It notes the only matters listed under the TSC Act and that are relevant to the proposed infrastructure are:

- small remnants of Box - Gum Woodland;
- woodland birds.

All other matters assessed are avoided by the infrastructure; this most particularly applies to the listed species Pink-tailed Worm Lizard and Golden Sun Moth that occur nearby on the Environa property.

An assessment under Section 5A of the EP&A Act was also undertaken to assist in determining whether the proposed development/activity is likely to have a significant effect on species, populations and communities (and their habitats) listed under the TSC Act and FM Act.

The factors were interpreted and applied in accordance with the Department of Environment and Climate Change's "Threatened Species Assessment Guidelines; the Assessment of Significance" (DECC 2007). The detailed assessment is contained within the ecological report and it concludes that 'the infrastructure development for South Tralee is not likely to have a significant effect on any threatened species, populations or communities listed under the Threatened Species Conservation Act 1995 and the Fisheries Management Act 1994, or their habitats, and the preparation of a Species Impact Statement (SIS) is not warranted.'

4.5.7 Contaminated Land Management Act 1997

The objective of the *Contaminated Land Management Act 1997* is to establish a process for investigating and (where appropriate) remediating land that the EPA considers to be contaminated significantly enough to require regulation under Division 2 of Part 3 (Lands declared as significantly contaminated by the EPA). Sites not regulated by the EPA are managed by local councils through land-use planning processes.

One particular object of the act in Section 3 (2) (d) is to 'ensure that contaminated land is managed with regard to the principles of ecologically sustainable development'.

Reference is made to Section 4.3.3 of this report. It summarises the findings of a contamination assessment undertaken by SMEC Consultants in relation to the pumping station, and also those measures to be employed with regards to soil contamination.

4.5.8 Native Vegetation Act 2003

The *Native Vegetation Act 2003* (NV Act) controls the clearing of native vegetation on all land in the State except for certain lands listed in Schedule 1 of the NV Act. Under Schedule 1 of the NV Act excluded land including National Parks, State forests and reserves, and also urban areas.

Specifically, urban areas, which are excluded, include areas zoned residential (but not rural residential), village, township, industrial or business. This means that the majority of land in South Tralee and also the Poplars is not covered by the Act. Similarly, the Crown road that is Territory Parade is excluded from the operation of the Act.

The accompanying Ecological Assessment by Kevin Mills and Associates in Appendix 7 notes that in terms of groundcover, native vegetation is where there is greater than 50 percent native plant cover. The most diverse native grassland in Environa is avoided by the road corridor and the proposed infrastructure including the pumping station. Some areas of grassland near the railway line on South Tralee fall into the category of 'native vegetation'. This area was assessed during a site inspection with the Local Land Services (LLS) office (Queanbeyan). The LLS indicated that in their opinion the small areas of native grassland on South Tralee were not important and covered far less than 15 percent of the land so there were no implications under the Act.

The clearing of all vegetation is to be minimised wherever possible during the detailed design and construction planning phases, and if unavoidable the area is to be rehabilitated and landscaped.

However, it is noted that approval under the NV Act is not required to clear native vegetation because the proposed infrastructure is to be assessed under Part 5 of the EP&A Act.

Clause 25 of the NV Act provides that "*This Act does not apply to the following types of clearing of native vegetation: (g) any clearing that is, or is part of, an activity carried out by a determining authority within the meaning of Part 5 of the EP&A Act if the determining authority has complied with that Part*".

4.5.9 NSW Wilderness Act, 1987

Wilderness areas represent the largest, most pristine areas in the state's reserve system. The Wilderness Act 1987 affords declared wilderness the most secure level of protection, requiring it to be managed in a way that will maintain its wilderness values and pristine condition by limiting activities likely to damage flora, fauna and cultural heritage. Nearly all declared wilderness is within national parks and nature reserves.

There are no declared wilderness areas near the subject works, nor Jerrabomberra.

4.5.10 Protection of the Environment Operations Act 1997

The Protection of Environment Operations Act 1997 (POEO Act) focuses on protecting, restoring and enhancing the environment within New South Wales through the use of various mechanisms, reduce potential risks to human health and the environment. It aims to provide opportunity for increased public involvement and access to information regarding environmental protection.

Under Part 3.2 of the POEO Act, an activity is declared to be a scheduled activity if a sewage treatment system has a processing capacity that exceeds:

a) 2,500 persons equivalent, as determined in accordance with guidelines established by an EPA Gazettal notice, or

b) 750 kilolitres per day.

However this clause applies to 'sewage treatment', meaning the operation of sewage treatment systems (including the treatment works, pumping stations, sewage overflow structures and the reticulation system) that involve the discharge or likely discharge of wastes or by-products to land or waters.

It is noted that the infrastructure works do not propose to treat sewage rather it will be transported by way of pipe networks and a pumping station to an existing STP in Queanbeyan.

4.5.11Waste Avoidance and Resource Recovery Act 2001

The purpose of the Waste Avoidance and Resource Recovery Act 2011 (WARR Act) is to 'minimise the consumption of natural resources and final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste'

Waste generation and disposal reporting would be undertaken during the construction and operation of the proposed scheme.

4.6 Commonwealth Legislation

4.6.1 Environment Protection Biodiversity and Conservation Act 1999

The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) provides for the environmental assessment, biodiversity conservation and management of protected areas and species, populations and communities, and heritage items.

Approval under the EPBC Act is required for:

- An action which has, will have or is likely to have a significant impact on 'matters of national environmental significance'.
- An action on Commonwealth land which has will have or is likely to have a significant impact on the environment.
- An action by the Commonwealth or a Commonwealth agency which has, will have or is likely to have a significant impact on the environment.
- An action, which has, will have, or is likely to have, a significant impact on the environment on Commonwealth land, no matter where it is to be carried out.

Where the proponent considers that an action will have or is likely to have a significant impact on matters of national environmental significance, or on Commonwealth land, a referral is made to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC).

If it is determined through this referral process that a project is likely to have a significant impact on a matters of national environmental significance, then the project is a controlled action and approval from the Commonwealth would be required.

The Ecological Assessment prepared by consultants Kevin Mills & Associates in Appendix 7, considered the impact of the proposed works upon of matters of national environmental significance (NES).

It noted that matters of NES present in the locality are two listed threatened ecological communities, namely Box - Gum Woodland and Natural Temperate Grassland. The remnants of these communities are of very low quality and do not meet the minimum criteria established for the Commonwealth listings.

Further, no Commonwealth listed threatened plant or animal species is known to occur on the areas involved in the proposed infrastructure. The habitat of two species, namely Pink-tailed Worm Lizard (vulnerable) and Golden Sun Moth (critically endangered) occur nearby and are avoided, as discussed above.

Listed migratory species are contained on schedules attached to international agreements that have been signed by Australia. A review of the list provided by the Commonwealth department responsible

shows that no listed migratory species is likely to find important habitat in the study area nor is there likely to be an ecologically significant proportion of a population of a migratory species.

In the opinion of the ecological consultants, the proposed infrastructure development for South Tralee is not likely to have a significant impact on matters of national environmental significance listed under the Environment Protection and Biodiversity Conservation Act. In their view, referral to the Commonwealth Minister for the Environment for assessment and approval is therefore not warranted.

4.6.2 Native Title Act, 1993

The Native Title Act 1993 recognises native title rights and establishes basic principles in relation to native title in Australia.

Under Section 228 of the Native Title Act, an act affects native title *"if it extinguishes the native title rights and interests or if it is otherwise wholly or partly inconsistent with their continued existence, enjoyment or exercise"*.

A review of the native title claims maps published by the National Native Tribunal, (sourced on 21 April 2017) indicates that there are no native title claims affecting the subject land.Regional Planning Strategies

4.7.1 South Jerrabomberra Structure Plan (2013)

The *South Jerrabomberra Structure Plan* (2013) applies to South Jerrabomberra and in particular the Poplars, North and South Tralee, Environa, Forrest Morrison and part of Tralee Station.

It has been prepared with the input of the Department of Planning and Environment. The purpose of the Structure Plan is to inform the development of South Jerrabomberra over a 25 year period, specifically in its provision of all types infrastructure necessary to support a new community, and to aid it being delivered in a logical and efficient manner.

It outlines Council's preferred means of servicing the South Jerrabomberra release. An extract from the plan is provided below in Figure 5.

Whilst the structure plan map is indicative and conceptual in nature, the proposed extent and location of the sewer and water related infrastructure (subject of this REF) is generally consistent with that shown.

The structure plan identifies a preferred means to service the release in terms of both water and sewer systems. The discussion in the document was largely derived from earlier servicing reports prepared by Calibre (Browns) Consulting, who are the authors of the scheme now proposed by this REF.

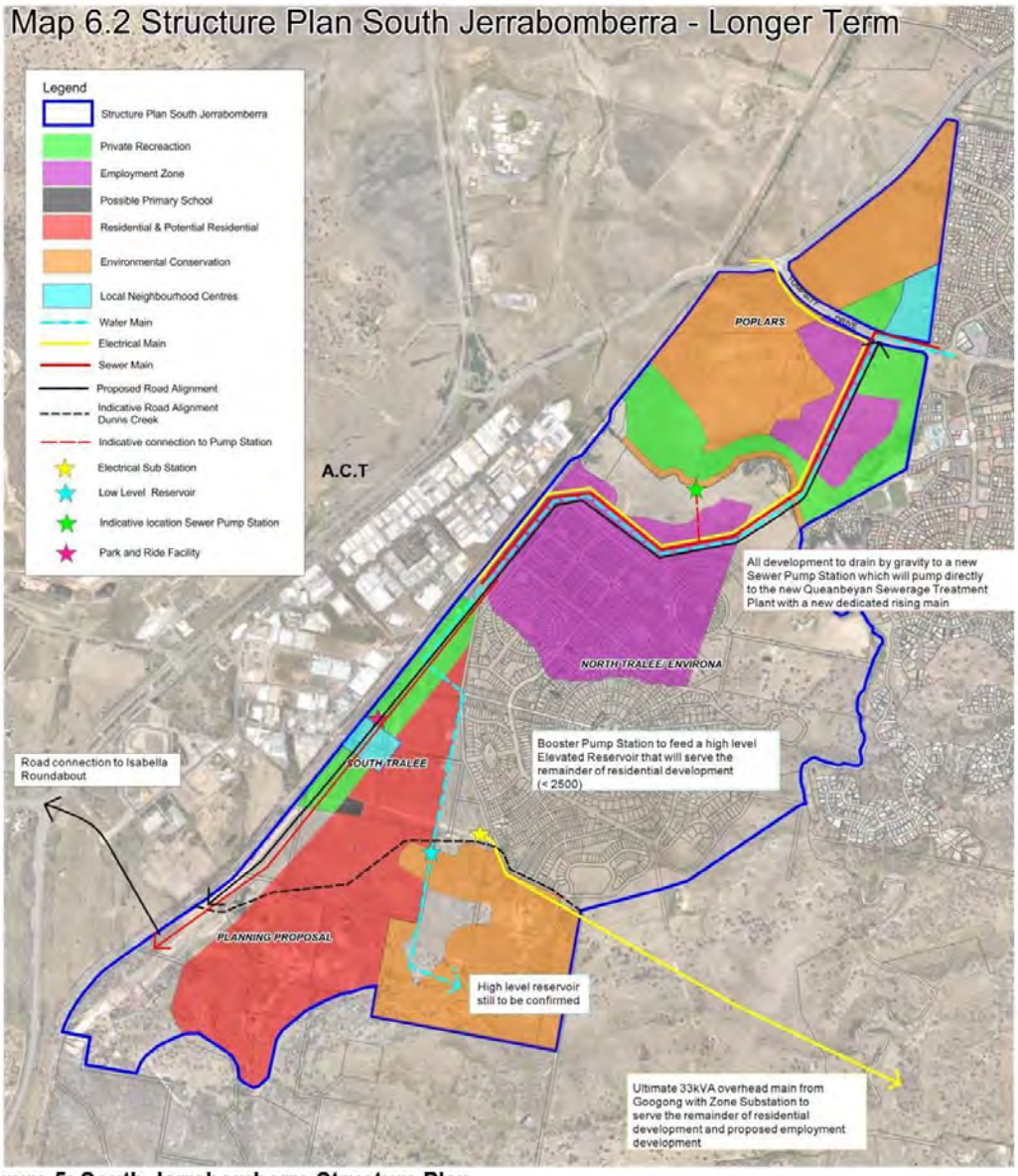

Figure 5: South Jerrabomberra Structure Plan

In terms of water supply the structure plan notes that in order to connect into the Queanbeyan supply system the Brown report identifies two options –

1. A connection from the 1st Queanbeyan offtake on Edwin Land Parkway.
2. A connection from the existing 450 mm main in Jerrabomberra Parkway.

This REF proposes for the existing 1st Queanbeyan Offtake at Edwin Land Parkway as the preferred connection point for the South Jerrabomberra Water Supply Catchment.

With regards sewerage the structure plan states that Council's preferred long term option for the full development is:

1. *Sewer network draining to one new sewage pump station at South Jerrabomberra at a low point in North Tralee clear of flood prone land.*
2. *New sewage pump station to either:*

   i. *Pump directly to the Queanbeyan Sewerage Treatment Plant (STP) with a new dedicated rising main.*

   ii. *Pump to the existing Bayside sewage pump station and upgrade the existing rising main to the Queanbeyan STP to accommodate the higher flows.*

The works proposed by Calibre Consulting (refer Appendix 3) are for sewer flows to be conveyed to a proposed pump station adjacent Jerrabomberra Creek and to be pumped directly to a high point adjacent to the Queanbeyan Network, whereby flows will then gravitate into the existing 600mm gravity main before entering the QSTP.

Having regard to the above, the proposed infrastructure will be undertaken generally in accordance with that envisaged by Council's structure plan for South Jerrabomberra.

4.7.2 Sydney to Canberra Corridor Regional Strategy (2008)

The Sydney-Canberra Corridor Regional Strategy 2006-2031 prepared by the Department of Planning & Infrastructure in 2008 establishes a 25 year land-use strategy for the region including the Local Government Area of Queanbeyan. In particular, the strategy identifies the need for 10,000 new dwellings in Queanbeyan whereby the capacity to meet this demand is provided through Greenfield sites in Googong and South Jerrabomberra.

4.7.3 Queanbeyan Residential and Economic Strategy, 2031

The Queanbeyan Residential and Economic Strategy 2031 was prepared and endorsed by Council in 2007 with an addendum report endorsed by the Director General of the NSW Department of Planning & Infrastructure in 2008. It contains a 25 year residential and employment lands strategy for Queanbeyan including those precincts to be serviced by the proposed water and sewer infrastructure.

The proposed works will give effect to the specific housing and employment targets contained in both strategy documents, by facilitating the development of land in South Jerrabomberra in particular by providing essential services (sewer and water reticulation connections) between the existing urban areas of Queanbeyan and South Tralee.

4.7 Local Planning Policy

4.8.1 South Jerrabomberra Development Control Plan 2015

This South Jerrabomberra Development Control Plan (SJDCP) provides a framework of development controls to guide future development in the new land release areas of South Jerrabomberra. This DCP establishes urban design guidelines to achieve objectives for the whole South Jerrabomberra area as a new sustainable community and growth area of Queanbeyan.

The SJDCP is primarily concerned with urban development including residential and business development in existing release areas including South Tralee and the Poplars. It does provide specific controls for infrastructure works (such as that proposed), however it noted that the location and extent of the proposed sewer and water network is consistent with that shown in the Master Plan contained in Part 3 of the SJDCP.

In terms of servicing, the Master Plan notes the following:

c) Timing of Infrastructure Provision
Much of the land subject to this DCP is currently 'greenfield' and un-serviced land. Accordingly, the installation of infrastructure including roads, water supply, stormwater, sewerage treatment, energy and communication facilities is required to service any uses.

Council is required to ensure that satisfactory arrangements have been made to ensure that public utility infrastructure essential for the anticipated development is available or that adequate arrangements have been made to make that infrastructure available when it is required.

A Neighbourhood Structure Plan must include sufficient detail on the provision of essential services including sequencing or timing for provision, connectivity, design thresholds and catchments relevant to each essential service prior to its approval.

Having regard to the above, the works subject of this REF is considered to facilitate and satisfy many of the aims and objectives of the Master Plan.

4.8 Airport Obstacle Limitation Zone

The majority of works proposed in the Sewer and Water REF are below the Canberra Airport Obstacle Limitation Zone (OLZ) height requirements except the high level reservoir in the south west corner of South Tralee. In this location, anything that exceeds the 720.0m AHD contour requires an application to be submitted to Canberra Airport for approval.

The high level reservoir and access track exceeds the OLZ by a maximum of 55m and will require the necessary referrals and applications to be made to the Commonwealth Department of Infrastructure and Regional Development and/or Canberra Airport.
Ambidgi Group Pty Ltd has prepared some words below, outlining the process for the Application and where it is currently at. Airspace Assessment for the high zone reservoir at South Tralee is being

undertaken. This involves determining the heights of the various Prescribed Airspaces applicable to the Canberra Airport, and if the proposed reservoir and construction crane heights will penetrate the airspaces. The Prescribed Airspaces include:

OBSTACLE LIMITATION SURFACES (OLS)
These are normally published by the Airport Operator, often in the Airport Master Plan. However the published OLS charts for Canberra Airport contain a warning that the chart should not be relied on for planning purposes as it is subject to change, and that the Airport should be contacted for the latest information. When contacted, the Airport advised that the chart was still being reviewed.
Therefore the consultants are preparing OLS surfaces in the vicinity of the reservoir site to determine the surface height/s and if any penetration of the surface/s will occur.

PANS-OPS SURFACES
These are also normally published by the Airport Operator, however the PANS-OPS charts are subject to the same limitations in use as the OLS charts.
There are numerous approach and departure PANS-OPS procedures in the vicinity of the reservoir site, and as some of these are proprietary protected, the consultants have requested Airservices Australia (which publishes these procedures), to advise the lowest PANS-OPS surface height at the site.

PROTECTION of the PERFORMANCE of NAVIGATION AIDS and AIRSPACE SURVEILLANCE SENSORS
The consultants are calculating the clearance planes for the Navigation Aids on the airport and for the Church Creek NDB, as well as those for the Mt Majura Radar Sensor and air traffic control communications systems, to determine if the reservoir will have any impact on performance.

APPROVAL PROCESS
The aeronautical impact assessment report being prepared by the consultants will determine potential impacts on prescribed airspace, navigational aids and communications facilities and air traffic control radar. Any identified potential impacts will require the approval of, or appropriate modifications to make such impacts acceptable to, the aviation agencies; i.e. Canberra Airport, Airservices Australia, the Civil Aviation Safety Authority and the Department of Infrastructure and Regional Development.

The assessment has been finalised and is currently being reviewed by aviation agencies. As part of that assessment process, the Canberra Airport have asked that an alternative location, within or near the quarry, for the high water reservoir be considered. Calibre Consulting have looked this alternative location and have advised as follows:

> "We have considered the alternative location for the reservoir as suggested by the Canberra Airport and have confirmed that the quarry is not at a suitable elevation to service the development to meet QPRC required serviceable pressures.
>
> To relocate the high level reservoir within or next to the quarry, would require location of the reservoir at an RL of around 770-775m AHD to ensure sufficient pressures within the development.
>
> The quarry is located at around RL800m AHD, therefore excessive cut will be required to service South Tralee making the suggested location impractical."

This information has been forwarded to the Canberra Airport and their assessment of the application is proceeding.

5 EXISTING ENVIRONMENT, IMPACTS AND MITIGATION MEASURES

5.1 Topography

5.1.1. Existing environment

The topography of South Tralee is mostly gentle slopes across the northern section, with it becoming steeper to the South towards the proposed Stage 2 subdivision in South Tralee. Some steeper slopes existing along the banks of the Jerrabomberra Creek in the north and Dog Trap Gully to the south.

5.1.2. Impacts

No major changes to the existing topography are proposed in the Sewer and Water REF scope. The majority of sewer and water mains will be underground and located in the proposed road reserves, and will not require any major earthworks. The design has utilised the change in slope to the south by placing the high level reservoir in the E2 lands near the Stage 2 subdivision.

5.1.3. Mitigation Measures

No specific mitigation measures are required.

Excavation and stockpiling of soils and/or rock would be temporary. Any areas of site disturbance are to be appropriately reinstated. For example, trench excavation is to be backfilled to existing surface levels and compacted to provide a solid, even travelling surface.

5.2 Geology and Soil

5.2.1. Existing environment

A geotechnical investigation report, dated October 2015, has been prepared by Douglas Partners Pty Ltd for the purpose of the proposed sewer pump station and water storage reservoirs at South Tralee. This report provides information on subsurface conditions at four sites relating to the following: A sewer pumping station wet well; Emergency sewerage storage tanks located adjacent to the pumping station; a low zone water storage reservoir; and a high zone water storage reservoir.

5.2.2. Impacts

The findings form the investigation have been summarised below, along with comments and recommendations provided by Douglas Partners, in regard to: excavation conditions and support; re-use of excavated materials; groundwater control; earth pressures on buried structures; drainage; and bearing pressures for structure foundations.

5.2.3 Sewer pumping station and Emergency Storage Tanks

- *The alluvial soils at this site could be expected to be excavated using conventional earthmoving plant, though groundwater inflows and unstable, collapsing sides in wet or saturated sand and gravel beds should be anticipated. Bedrock could be encountered at shallower depth than the 8.1 m depth indicated by Bore 5, possibly within 6 m depth of existing ground surface level. Based on the presence of nearby outcropping rock, the bedrock level may be highly varied.*

- *Perched groundwater seepages should be expected to be present at various levels within the alluvial soils and in underlying fractured rock. Though a depth to standing groundwater of 2.4 m was noted in Bore 5, groundwater intercepted in excavations could rise to higher levels as groundwater conditions are affected by weather conditions, soil permeability and other factors and can vary with time. Groundwater flows would be controlled by gravity draining to a collection sump point and continuously pumped out of the excavation. Consideration should be given to installation of diversion drains to minimise surface and subsurface water entering the excavation.*

- *Permanent excavation batters are not expected to be required at the site. For temporary excavation it is recommended that sides in soil and EW and EW/HW, extremely low to low strength rock be battered at no steeper than 1(H): 1(V) to prevent loose soil or rock falling from the sides and posing a safety hazard for workers, the sides could be draped with a lightweight flexible steel mesh, pinned along the top and at suitable horizontal and vertical spacings in the batter face. Alternatively the batters could be provided with say 1.5 m wide benches at about 2 m depth interval.*

- *Excavated alluvial soils would be considered suitable for reuse in engineering filling provided any wet material is spread to dry and/or mixed with drier soil and/or weathered rock. The weathered tuff bedrock would also be suitable for reuse and is expected to break down to a well graded sandy clayey gravel or gravelly sandy clay with about 15 – 25 % of low plasticity fines.*

- *Due to the presence of groundwater seepage possibly at less than 2 m depth below the current ground surface, it is considered that the design of all structures, pipes and slabs must take into consideration the uplift forces exerted by the groundwater. Any submerged structures are likely to be required to be tanked to restrict groundwater seepages. A drainage system will be required to be incorporated into the design in order to facilitate the disposal of any rising groundwater in a controlled manner.*

- *All footing systems should be designed and constructed such that structures are founded in a uniform bearing stratum and outside the zone of influence of any adjacent structure or excavation. Particular care should be taken for structures that are sensitive to movements; hence, a suitably qualified geotechnical engineer should inspect all footing excavation prior to placement of reinforcing steel and pouring of concrete to confirm the design bearing pressures.*

- *It is likely that the underground storage tank structures will found in soil, whereas the sewer pump station would be founded in bedrock. Furthermore, tanks closer to the pump station wet well may found in backfill material following the excavation and construction of the wet well structure. Consideration should be given for potential differential settlements between tanks.*

- *For preliminary sizing of footings, allowable base bearing pressures for the various soil strata encountered are given below:*

- *Compacted backfilling: 100 kP a*
- *Stiff / medium dense alluvial soil: 100 kPa*
- *Extremely low to low strength bedrock: 500 kPa*
- *Medium strength bedrock: 1500 kPa*

5.2.4 Low zone water storage reservoir

- *The site soils could be expected to be removed using conventional earthmoving plant though tracked plant may be required if the upper un-cemented silty sand slopewash is wet and boggy at the time. Difficult digging may be encountered in cemented slopewash which in Pit 2 was encountered at 1.3 m depth.*

- *Perched groundwater seepages should be expected to be present at varying depth in the slopewash strata, commonly found within much of slopewash and/or alluvial soil profiles in the Hume area. Seepages are often present above cemented zones, and the occurrence and rates of flow are influenced by precedent rainfall. Seepages into excavations should be readily controllable by pumping, but some form of permanent subsurface drainage may be required as seepage build up in the tank excavation during and after construction may soften the foundation.*

- *Excavation sides in the soils should be battered at not steeper than 1(H) : 1(V) for temporary excavations, and not steeper than 2(H) : 1(V) for permanent unsupported sides.*

- *The silty sand slopewash is generally not suitable to be used in engineered filling constructions as it is difficult to properly compact and its strength is relatively sensitive to change in moisture content. Excavated silty/sandy soil could however be mixed and blended with clayey soil, and/or with very weathered rock materials that contain some clay, to produce a material suitable for inclusion in engineered filling.*

- *Design for the tank structure could be based on an allowable base bearing pressure of 100 kPa if founded on soil of at least stiff/medium dense consistency and must allow for the provision of a uniform bearing stratum to prevent long and short term differential settlement issues. It is noted that loose, wet or saturated soil was present in Pit 2 at the approximate proposed foundation depth for the tank. Footings would need to be founded in very stiff or hard clayey soils, or in cemented strata, below wet or weak sections. A geotechnical engineer should inspect all footing excavations prior to placement of reinforcing steel and to pouring of concrete to confirm that a suitable founding stratum has been obtained.*

5.2.5 High zone water storage reservoir

- *The site surface is rough and somewhat uneven due to outcropping and detached rock. The topsoil and silty/sandy slope wash soil is likely to be boggy following wet weather. Due to these expected conditions, tracked excavators would be best suited for stripping the soil prior to bulk excavation in the rock.*

- *Large excavators fitted with toothed buckets, single tyne rippers and pneumatic hammers will be required to excavate the high strength rock expected at shallow depth. The excavatability of the rock*

will be largely dependent on the degree of fracturing and jointing within the rock mass and the extent of weaker zones. Slow production rates must be anticipated.

- *Perched groundwater could be encountered in the slope wash and in fractured rock though seepage into the expected maximum 2.0 m deep excavation however would likely be of a minor and temporary nature.*
- *The sides of excavations to 2.0 m depth in the medium or higher strength rock should be battered not steeper than 0.5 (H): 1 (V) for both temporary and permanent batters.*
- *Excavation within medium or higher strength rock is likely to produce cobble and boulder sized rock fragments, which would need to be crushed to a general maximum particle size of 75 mm prior to being suitable for inclusion in engineering filling. Due to the high strength of the rock, the use of a crushing plant may be required. It is expected that minimal fines would be created during the crushing process and that blending with approved soil may be required if a suitable, well graded filling material is to be obtained.*
- *Design for the tank structure could be based on an allowable base bearing pressure of 2000 kPa for at least medium strength rock and must allow for the provision of a uniform bearing stratum to prevent long and short term differential settlement issues. A geotechnical engineer should inspect all footings excavations prior to placement of reinforcement steel and to pouring of concrete to confirm that a suitable founding stratum has been obtained.*

5.2.3. Mitigation Measures

Mitigation measures for the specific areas have been mentioned above. Further assessment will need to be carried out by Douglas Partners as the design progresses through to construction.

The report also recommends that Douglas Partners review the geotechnical aspects of the proposed design to assess any potential risk areas and provide commentary on any treatment measures.

5.3 Contamination

5.3.1. Existing environment

A Preliminary Site Investigation (PSI) with limited intrusive assessment was undertaken by SMEC Australia Pty Ltd, in order to assess the potential for contamination of the existing site and its suitability for development as a sewer and water pumping station.

It is noted that SMEC has previously undertaken investigations in relation to the Northern Entry Road, the staged (concept) development application for South Tralee in addition to the detailed site investigation for South Tralee in preparation for the Stage 1 subdivision application.

5.3.2. Impacts

Outlined below are the conclusions drawn from the investigations key findings and recommendations.

On the basis of the desktop review of the available data (including, government searches and registered bore details), a site inspection and limited intrusive assessment, SMEC consider the site suitable for the proposed land use (sewer and water pumping station) with the following recommendations:

- *Temporary fencing is erected around the adjacent structures identified to contain ACM or PACM (see Figure 1) forming a 10 m exclusion zone around adjacent site buildings ;*
- *The adjacent structures are suitably labelled to convey the risk of asbestos exposure. A prominent warning sign should be posted in the immediate vicinity of the off-Site buildings if it is not practical to directly label the asbestos containing material. All warning signs should comply with AS 1216 "Class Labels for Dangerous Goods" and AS 1319 "Safety Signs for the Occupational Environment" and the Safe Work Australia's Model Code of Practice How to manage and Control Asbestos in the Workplace;*
- *It is recognised that construction workers may be exposed to risk during works associated with redevelopment of the site. It is therefore recommended that a Construction Environmental Management Plan (CEMP) be prepared to include the following as a minimum:*
  - *Asbestos Management;*
  - *Dust & Noise Exposure;*
  - *Waste Management;*
  - *Other Contamination Management;*
  - *Procedure for uncovering unexpected contamination; and*
  - *Personnel Protective Equipment requirements.*

Following the completion of these recommendations the site is considered suitable for the proposed land use.

Reference is also made to the previous investigations by SMEC for South Tralee (in support of applications made for the residential development of this area) in addition to the Northern Entry Road corridor, including:

- *South Tralee Detailed Site Investigation* (South Tralee Residential Development, Tralee, NSW) July, 2015.
- *Site Contamination Summary Report* (Northern Entry Road to the South Tralee Development Site), August 2013
- *Site Contamination Summary Report – South Tralee Development Site (Entry Road), dated August 2013*

They include a range of recommendations to appropriately manage the potential for contamination. Those recommendations should also be adhered to in undertaking the proposed infrastructure works.

5.3.3. Mitigation Measures

A Construction Environmental Management Plan (CEMP) should also be prepared prior to any works on the site.

5.4 Water Quality, Drainage and Flooding

5.4.1. Existing environment

Jerrabomberra Creek runs though the northern part of the subject South Jerrabomberra area. The proposed pump station will be located approximately 250m from the Creek. The pump station has been designed to sit outside the Q100 line to avoid any impacts from flooding.

5.4.2. Impacts

There is potential for failure at the sewer pump station i.e. a power failure or mechanical failure of a pump resulting in the need for storage of incoming wastewater to avoid any impacts on the downstream environment.

5.4.3. Mitigation measures

To avoid any potential impacts from a failure at the sewer pump station the following are proposed:

- Emergency storage tanks to store any overflow with a capacity of 8 hours of dry weather storage. This is a standard volume for emergency storage tanks and will provide adequate time for QPRC to respond to the failure e.g. arranger for suckers trucks to pump out the wet well, and/or in the event of a power failure have the power failure fixed or a generator deliver to site.

A fixed generator is to be installed on site. This would allow for a reduction in the volume of required emergency storage and reduce the risks associated with power failures.

According to Calibre Consulting, the above measures will ensure there are no operational impacts from a failure of the sewer pump station.

Calibre also notes there is a potential risk of an overflow from the water reservoir tanks i.e. discharging of treated potable water into the environment. Any overflows will be treated (dechlorinated) prior to release to the environment to mitigate any potential impacts.

The proposed works will have no impact on potential flooding. The proposed pipelines will be laid under Jerrabomberra Creek (and concrete encased). These pipelines will have no impact on potential creek flooding.

The proposed sewer pump station is located on the limit of the 100 year flood extent of the Jerrabomberra Creek. To mitigate any potential impacts from the Creek flooding the sewer pump station covers will have adequate freeboard to any flood levels in accordance with the appropriate standards.

The CEMP should incorporate control measures to minimise short term impacts on water quality during construction, and includes a site rehabilitation plan for the Jerrabomberra Creek crossing which outlines strategies to ensure long term streambed and streambank stabilisation and revegetation following trenching. Further design of bank stabilisation works may be required. Bank stabilisation

plans should ensure that erosion in adjacent areas is not exacerbated, and should take into account future requirements for landscaping and stabilisation along Jerrabomberra Creek.

5.5 Flora and Fauna Ecological

5.5.1. Existing environment

Kevin Mills and Associates were engaged to undertake and site assessment of the land identified as being affected by the sewer and water infrastructure mains (northern entry road, South Tralee subdivisions, and connection to existing water supply on Edwin Land Parkway across Jerrabomberra Circle), the pump station site and the high and low level reservoirs. As identified by Kevin Mills on previous assessments for South Jerrabomberra, there are a number of native vegetation and box gum woodland areas present across the site.

5.5.2. Impacts

Kevin Mills has reviewed the pump station design and has determined no native grasslands will be impacted by the proposed location.

Within South Tralee, a small area of native grasslands will be affected near the railway line and south east of Stage 2, but this was identified as not significant in Kevin's earlier studies (KMA 2013, 2014)

The proposed access track up to the high level reservoir site will traverse native grasslands, however this track will cross through non-development zoned land. The majority of the route to the low level reservoir is exotic grasslands.

All of the associated Sewer and Water infrastructure require removal of eighteen (18) live trees and one (1) dead tree. None of these trees are of high value. Six of these trees are located at the high level reservoir site, whilst another 12 are to be removed across the existing Jerrabomberra Circle. The 12 at the Jerrabomberra Circle have been planted and are not remnant.

In South Tralee, Kevin Mills identified where the services will cross, it is mostly supported by exotic vegetation. There are a few Acacias close to the creek crossing, however these will not be affected by the sewer and water works. No major vegetation is being removed as part of these infrastructure works.

5.5.3 Mitigation measures

There are few features within the land investigated for the proposed infrastructure that require special consideration. The areas involved primarily support treeless exotic grassland. The following areas contain the only features that have higher value as habitat or have legislative implications.

The Poplars - South of Tompsitt Drive:
This area contains scattered woodland trees and some native grassland. The area has previously been assessed as of minor habitat value and is zoned for development. The habitat on the land to be reserved on The Poplars is of much higher habitat value. The loss of these trees and native grassland is assessed as not significant.

The Poplars - Jerrabomberra Creek crossing:

If the option to attach the water and sewer mains to the bridge structure was used, there would be little to no impact on the watercourse cannel or banks. As the design now proposes to have the mains buried below the channel, there is some potential to have environmental impact if appropriate measures are not put in place. Careful construction and rehabilitation following construction will be required to ensure that there is no unacceptable impact in the long term. The documents *Guidelines for Riparian Corridors on Waterfront Land (Office of Water 2012) and Controlled Activities and Guidelines for Watercourse Crossings (Office of Water 2012) as well as Guidelines for laying pipes and cables in watercourses on waterfront land (Office of Water 2012)* should be considered when designing construction techniques around Jerrabomberra Creek.

North Tralee:

The small stand of woodland trees south of the road bridge crossing of Jerrabomberra Creek is avoided by the road corridor and hence the proposed infrastructure.

Environa:

The area of native grassland and rocky habitat in the far north-western corner of Environa is avoided by the road corridor as is the entire proposed infrastructure, such as the mains to and from the proposed sewer pump station.

Water reservoir and access road:

The access road traverses exotic grassland except for the very upper section, which is not and has never been Box-Gum Woodland. One tree would be removed by the road's construction. The reservoir site supports several trees and a native grassland ground cover, part of the dry ridge woodland community; this is not Box-Gum Woodland. Five live trees and one dead tree would need to be removed from this site. This is assessed as not significant.

This investigation has assessed the potential to impact upon species, populations and communities listed under the Threatened Species Conservation Act 1995 (NSW) and the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth). It is concluded that the preparation of neither a Species Impact Statement, as provided for under the TSC Act, nor referral to the Commonwealth Minister for assessment and approval under the EPBC Act, are warranted.

KMA concludes that the construction of the proposed infrastructure for the South Tralee development will not have a significant impact upon environmental values. The land that is traversed contains very few natural features and those that are identified have been avoided and will be retained.

Crossing of Jerrabomberra Circle

The proposed water supply connects into the existing supply on Edwin Land Parkway. In order to do this, the line will have to be trenched. The proposed route traverses areas containing little existing vegetation, however it will require the removal of 12 small trees within the round a bout. These small trees have been assessed and were planted as part of previous road constructions. The loss of these trees is not considered to be significant.

5.6 Air Quality

5.6.1. Existing environment

The existing environment is currently not affected by any impacts on air quality as it is mainly utilised for farming purposes. The proposed pump station design has been reviewed by Wilkinson Murray for potential odour effects on existing and proposed residences in the South Jerrabomberra area.

5.6.2. Impacts

Potential impacts of the pump station were reviewed by Wilkinson Murray and they have determined that any odour from the proposed pump station would be contained by the proposed surrounding structure. As the structure will be fully enclosed including emergency storage tanks, and all the sewer mains will be underground (inclusive of the pipe crossing Jerrabomberra Creek) there will not be any impacts on existing air quality in the South Jerrabomberra area.

A vent stack will be required near the Sewer Pump Station and an educt and induct at the discharge manhole along the northern entry road. Both the vent stack and educt and induct are not considered to have a significant odour impact.

5.6.3. Mitigation measures

The design of the pump station has considered any potential odour impacts and has determined the best possible solution for the site.

If there is any odour coming from the sewer vent stack, a filter can be added to the vent to further mitigate any odour.

5.7 Noise and Vibration

5.7.1. Existing environment

There are currently no noise impacts from the use of the land in South Jerrabomberra. There will not be any major noise impacts from the proposed sewer and water infrastructure except some minor operational noise from the main sewer pump station and the two booster pumps associated with the reservoir sites.

5.7.2. Impacts

Wilkinson Murray has reviewed all of the pump station sites associated with the REF application. They have determined that both the reservoir sites and the sewer pump station are far enough away from any existing or proposed residential development to have any noise impacts on residents. The design of the main sewer pump is submersible and located under water as any noise will be contained within the wells as the pump will be covered. The reservoir booster pumps are location in concrete pits with aluminium access panels significantly minimising any potential noise.

There will be potential temporary construction noise for the period in which the sewer and water infrastructure is to be carried out. In particular, the existing residents along Edwin Land Parkway may be affected by construction noise whilst the new water main is being installed. These residents are located approximately 10-15m away from the proposed line.

5.7.3. Mitigation measures

The design of the pump station has considered any potential noise impacts and has tried to mitigate noise as much as possible.

To mitigate any noise impacts from the proposed construction of the sewer/water infrastructure, standard hours of construction must be adhered to. Along Edwin Land Parkway in close proximity to the existing housing, Wilkinson Murray recommend to manage construction noise by utilising equipment with the lowest practicable noise levels to facilitate construction , liaising with the community to advise of construction activities for what, when and how long they will occur.

5.8 Waste Management

5.8.1. Existing environment

No waste management is required on the site as it is currently used.

5.8.1 Potential construction impacts and mitigation measures

To minimise the potential for environmental impact of wastes generated on site from construction activities the following waste management strategy, as shown in the table below, will be implemented.

MANAGEMENT REQUIRED	ACTION	RESPONSIBILITY
Minimise impact on surrounding environment.	For the duration of the construction period portable toilet facilities will be provided. These portable toilet facilities will be serviced by the supplier as required. At a minimum there must be one toilet for every 20 personnel onsite.	Principal Contractor
	The following Waste Management principal will be implemented onsite • Reduce – only order the material that you require. • Reuse – Reuse what material you can, prior to placing an order for more. • Separate – Don't pile all the rubbish into one bin. Ensure that a bin/skip management plan is in place. • Recycle – Ensure that recyclable materials are sorted from general waste and placed in the appropriate containers onsite.	Principal Contractor
	All waste materials from the construction phase	Principal Contractor

MANAGEMENT REQUIRED	ACTION	RESPONSIBILITY
	will be regularly cleaned from the site and disposed of offsite in accordance with relevant regulatory requirements.	
	All waste materials to be removed off site will be contained on site prior to disposal, using appropriate storage containers or facilities until removed off site, including the covering of containers/facilities to prevent litter escaping from the site.	Principal Contractor
	Maintain a high quality of housekeeping and ensure that materials are not left where they can be washed or blown away.	Principal Contractor
	Provide general waste and recycling bins for workers and staff at locations where they consume food. Encourage recycling of building products, steel, plastics, and vegetation etc.	Principal Contractor
Monitoring	Property boundaries will be inspected on a regular basis.	Principal Contractor
	All waste containment and disposal activities will be logged, including type and volumes of materials and location of licensed receivable facility. Receipts of disposal are to be maintained for auditing purposes.	Principal Contractor
Reporting:	Noncompliance and complaint details will be forwarded to Construction Superintendent as soon as practicable.	Principal Contractor
Corrective and Preventative Action:	In the event of noncompliance, containment and clean up action will be undertaken as soon as practicable.	Principal Contractor
	If litter has escaped form the site or is negatively impacting the boundary, the litter will be immediately collected and appropriately contained for disposal off site.	Principal Contractor
	The location of waste bins should be reviewed to ensure convenient location.	All Parties
	Onsite personnel identified as littering will be retrained in site rules and disciplined appropriately.	Principal Contractor

5.9 Aboriginal Heritage & Non-Aboriginal Heritage

5.9.1. Existing environment

A Heritage assessment report, dated October 2015, has been prepared by Navin Officer Heritage Consultants Pty Ltd to satisfy the NSW Office of Environmental and Heritage *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*, for the purpose of the South Tralee Sewer and Water REF.

Previous heritage assessments in the local area have indicated there are no landscape types in the South Tralee area that would not have been visited and occupied by prehistoric Aboriginal people. Therefore, the South Tralee – Sewer and Water project area is located within landscape features that indicate the presence of Aboriginal objects.

It is noted that no separate field inspections were conducted for this Due Diligence assessment as all of the lands affected by the South Tralee Sewer and Water works have been included in previous heritage assessments undertaken in relation to the Northern Entry Road, South Tralee and the Stage 1 Development Application.

5.9.2. Impacts

A summary of the findings and potential impacts are listed below:

- No Aboriginal sites will be directly impacted by the South Tralee Sewer and Water project.
- No historical sites will be directly impacted by the South Tralee Sewer and Water project.
- Six Aboriginal sites PPS7, PPS8, TA2, TA3, TA4 and NER1 are located within 35 metres of the South Tralee Sewer and Water project.
- Two European sites H7 and H9 are located within 35 metres of the South Tralee Sewer and Water project.

5.9.3. Mitigation measures

The recommendations and mitigation measures with regards non-Aboriginal and Aboriginal heritage sites are also summarised below.

- No further archaeological assessment is required for the South Tralee Sewer and Water project.
- Aboriginal sites PPS7, PPS8, TA2, TA3, TA4 and NER1 should be fenced for the duration of construction activities associated with the South Tralee Sewer and Water project.
- The construction of the fence should be conducted with on-site advice from the project archaeologist.
- Historical site - H7 (main) should be fenced for the duration of construction activities associated with the South Tralee Sewer and Water project.
- The construction of the fence should be conducted with on-site advice from the project archaeologist.
- No further action is required for Historical site H9 (Tralee Landing Ground)
- The location of sites should be clearly marked on all site plans and maps utilised for the South Tralee Sewer and Water project.

- The protocols for the unanticipated discovery of archaeological material and suspected human remains (presented in Appendix 4) should be implemented if necessary.

5.10 Traffic and Access

5.10.1. Existing environment

The existing South Jerrabomberra area currently has minimal road access to cater for only a small number of existing dwellings (6). A concept approval has been granted by QPRC for the design of a Northern Entry Road which will service the Poplars, North Tralee, South Tralee and Forrest/Morrison lands. The proposed sewer and water infrastructure will align with the Northern Entry Road as it travels south to the South Tralee residential area. The new water main will be connected into the existing supply to the north of Edwin Land Parkway. In order to do this, the water main will require crossing the road three times before heading into the project area.

5.10.2. Impacts

The Northern Entry Road will only be operational once the South Tralee residential area is in use. For this reason, a traffic report has not been undertaken as part of this REF, however. Cardno have provided some preliminary advice on the likely traffic impacts of crossing Edwin Land Parkway, Jerrabomberra round a bout and Tompsitt Drive. The water main crossing across Edwin Land Parkway will be installed via trenchless methodologies. It should be noted the alignment of the water and sewer mains to be trenched are across carriageways that are proposed to be demolished as part of a future upgrade of the Jerrabomberra Intersection.

The installation of proposed water and sewer mains along the existing Tompsitt Drive will result in some interruption of existing traffic movements as the majority of proposed works will be located within the existing road reserve. Traffic control will however be required as the works traverse (cross) Tompsitt Drive and Jerrabomberra Circle and this will be included as part of more detailed construction management plans. These crossings will all be trenched and carried out on weekends to avoid major impacts to larger volumes of traffic. Works across the Jerrabomberra Circle will also be limited to one land only i.e only one lane of traffic will be closed at any one time. No road closures will be required. By limiting the works to one traffic lane at a time and to weekends, the impacts on traffic will be minor.

In terms of construction vehicle access, this should be documented in a traffic management plan to incorporate proposed points of construction ingress and egress, restrictions on number of vehicle movements, measures to minimise emissions (including noise and dust), and also means to ensure existing residents can suitably access their properties during the construction period.

5.10.3. Mitigation measures

Construction management plans have been provided with the Engineering drawings (Appendix 3). Traffic Management Plans will be produced with the Sewer and Water REF Construction Drawings. Any trenching across existing roads will be carried out on weekends to minimise impact on surrounding residents.

5.11 Bushfire Risk

5.11.1. Existing environment

The sewer and water infrastructure works traverse many parcels of land in South Jerrabomberra. Some of these are identified as bushfire prone land as shown on the Constraints Plan (Appendix 2)

5.11.2. Impacts

Bushfire consultant Graham Swain of ABPP has reviewed the design of the trunk sewer and water mains, the sewer pump station and both reservoir sites. As only underground works are proposed on the bushfire prone land, ABPP has determined there is no potential bushfire threat. The pump station and reservoir sites are not located in bushfire prone land however; ABPP has still reviewed the designs and identified some mitigation measures put in place in case of a bushfire incident. Some concern was raised over the potential for explosive activity occurring around the pump station. The pump manufacturers, QMAX, have determined the only potential issue would be if the vents in the pump station became blocked and gases built up in the wet well. In normal operation of the pump station, any gases released into the environment would be minimal and would be quickly dispersed into the atmosphere. As methane gas is lighter than air, it is unlikely there would be an issue with gases lingering around the pump station in an extreme or catastrophic event.

5.11.3. Mitigation measures

ABPP has determined that the pump station building should be constructed to BAL12.5 standard. This has been noted on the engineering drawings, for the pump station and proposed reservoir structures.

Management of a 10m defendable space around the pump station and reservoir sites will also be required. This will include keeping grasses during the bushfire danger period (between 1st October – 31st March) around the sites to a minimum to ensure no bushfire risk.

Maintenance of the pump station is important to ensure the vents to the wet wells remain unblocked and methane gases cannot become trapped inside.

5.12 Visual Impacts

5.12.1. Existing environment

The majority of the proposed Sewer and Water Infrastructure works will be underground and will not be seen and therefore a visual impact assessment has not been prepared as part of this REF. The pump station and reservoir sites will however be above ground and will have some visual impact.

5.12.2. Impacts

The pump station and reservoir sites may impact views for existing and future residents.

5.12.3. Mitigation measures

To ensure the pump station does not result in any adverse visual impacts within the current non-urban (rural) setting, screen planting will be provided around the perimeter of the pump station.

The high and low level reservoirs will be neutral in colour which is sympathetic with the surrounding environment thereby minimising its visual impact.

5.13 Human Health

5.13.1. Existing environment

There are currently no water and sewerage systems within South Jerrabomberra that would be sufficient to cater for the scale of proposed development at South Tralee.

5.13.2 Impacts

Construction work sites would be strictly supervised and maintained to ensure that the general public is not exposed to any potential health risks associated with the proposed scheme.

During construction it is possible that material would be encountered that has been contaminated by poorly performing on-site systems or fuel/oil leaks. Potential impacts on human health associated with contaminated soils and other waste materials would be managed by implementing mitigation measures outlined in this Section.

5.13.3 Mitigation measures

Mitigation measures applicable during construction of the proposed scheme are presented below and would be incorporated into the Environmental Management Plan and/or the CEMP.

- *Prepare a Project Safety Plan outlining how occupational health and safety issues are to be managed for the duration of scheme construction and operation. The plan would consider project specific occupational health and safety issues and outline appropriate management controls.*
- *All contractors, sub-contractors and visitors must comply with the requirements of the Project Safety Plan.*
- *Adhere to all relevant occupational health and safety legislation and regulations during the construction and operation of the proposed scheme.*

All chemicals used for odour control and water treatment would be stored in sealed vessels within bunded areas. Chemical storage areas would not be accessible to the public. All storage, transport and handling of dangerous goods by operators would be handled in accordance with the relevant Australian Standards and guidelines.

Maintenance and operation of the proposed scheme would be undertaken in line with Australian Standards and guidelines, and council's existing maintenance procedures. Procedures would minimise potential for human health impacts. No additional mitigation measures are applicable during operation of the proposed scheme.

5.14 Hazards and Risks

5.14.1 Potential Construction impacts and mitigation measures

During construction small quantities of fuels and chemicals may be stored on site for construction use. There is a potential impact from a spill into the surrounding environment during use of these i.e. refuelling activities, and/or transport and delivery.

Mitigation measures will be the implementation of safe working practices and appropriate environmental management practices by the civil contractor in accordance with the relevant standards. These will include storage and handling practices along with emergency response plans.

5.14.2 Potential Operational impacts and mitigation measures

Emergency storage and an overflow basin are included to mitigate any potential impacts from a failure of the sewer pump station.

The operation of the sewer and water reticulation is unlikely to pose any significant risk to the community or environment. Chemical storage is required on site however and there is therefore a potential risk of a spill in to the environment. This risk is mitigated by requiring all goods to be stored, transported and handled in accordance with relevant Australian Standards and guidelines.

The water reservoir sites will include a bunded area for the storage of chemicals. The reservoir sites will also include a bunded vehicle delivery area. These areas will be sized to be a minimum of 110% of the storage tank sizes to ensure any spill will be fully contained on site.

In addition to the above all works will be remotely monitored, including alarms. This further mitigates any operational impacts by providing Council Staff with immediate advice on any operational failures and the opportunity to respond accordingly.

5.15 Summary of Mitigation Measures

The following table provides a summary of all the measures to be carried out to mitigate any potential environmental impacts from works proposed in this REF.

ASPECT	MITIGATION MEASURES
Topography	• No mitigation measure required
Geology and Soils	• Further assessment required from Douglas Partners as the design progresses through to construction. **Sewer Pump Station and Emergency Storage Tanks** • Excavations to alluvial soils will occur with conventional earthmoving plant. • Ground water seepages are expected when excavating. This will be controlled by gravity draining to a collection sump point and continuously pumped out of the

ASPECT	MITIGATION MEASURES
	excavation. Installation of diversion drains is also a consideration. • Permanent excavation batters will not be required. To prevent loose soil or rock falling from sides of trenches, lightweight flexible steel mesh can be pinned on. • Design of all structures including pipes and slabs must take into consideration groundwater seepages. A drainage system will be required to be incorporated into the design to facilitate the disposal of any rising groundwater. • A suitably qualified geotechnical engineer should inspect all footing excavation prior to placement of reinforcing steel and pouring concrete to confirm design bearing pressures. • Consideration should be given to the potential differential settlements of soil between tanks (the storage tank structures and sewer pump station) **Low zone water storage reservoir** • Recognition has been given to the fact that there may be some difficulty removing the site soils using conventional earthmoving plant and tracked plant may be required. • Perched groundwater seepages are expected and can be controlled by pumping, but some permanent subsurface drainage may be required. • Excavations sides in the soils should be battered at not steeper than 1(H) : 1(V) for temporary excavations, and not steeper than 2(h): 1(V) for permanent unsupported sides. • If silty sand slope wash is excavated, it is generally not suitable to be used in engineered filling constructions as it is difficult to properly compact however can be mixed and blended with clayey soil and/or very weathered rock materials that contain some clay. • A geotechnical engineer should inspect all excavations for footings for the tank structure prior to placement of reinforcing steel and to pouring of concrete to ensure a suitable founding stratum has been obtained. **High zone water storage reservoir** • Tracked excavators are best suited for the high level reservoir due to the rough outcropping and detached rock. • Large excavators fitted with toothed buckets, single tyne rippers and pneumatic hammers will be required to excavate high strength rock expected. • Perched groundwater could be encountered in the slope wash and in fractured rock however it is considered it will be minor. • The sides of excavations to 2.0m depth in the medium or higher strength rock should be battered and not steeper than 0.5(H): 1(V) for both temporary and permanent batters. • Excavation within medium or higher strength rock is likely to produce larger sized rock fragments and will need to be crushed to a general maximum particle size of

ASPECT	MITIGATION MEASURES
	75mm prior to being suitable for inclusion in engineering filling. • A geotechnical engineer should inspect all excavations for footings for the tank structure prior to placement of reinforcing steel and to pouring of concrete to ensure a suitable founding stratum has been obtained.
Contamination	• A Construction Environmental Management plan (CEMP) will be prepared to address any contamination issues prior to works on the site.
Water Quality, Drainage and Flooding	To avoid any potential impacts from a failure at the sewer pump station the following are proposed: - Emergency storage tanks to store any overflow with a capacity of 8 hours of dry weather storage. This is a standard volume for emergency storage tanks and will provide adequate time for QPRC to respond to the failure e.g. arrange for suckers trucks to pump out the wet well, and/or in the event of a power failure have the power failure fixed or a generator delivered to site. With regards to the proposed installation of the sewer and water mains below Jerrabomberra Creek, the following principles and measures are to be employed. - Careful construction and rehabilitation following construction will be required to ensure that there is no unacceptable impact in the long term. - The documents Guidelines for Riparian Corridors on Waterfront Land (Office of Water 2012) and Controlled activities. Guidelines for watercourse crossings (Office of Water 2012) and Guidelines for laying pipes and cables in watercourses on waterfront land (Office of Water 2012) should be considered when designing construction techniques around Jerrabomberra Creek. The CEMP should document the proposed excavation techniques, and management of the stream regime and flows during construction, as well as proposed remediation of the creek environment post construction.
Flora and Fauna	• No major impacts to flora and fauna are proposed with this REF. Further investigation/advice may be required for the where the sewer and water mains to cross under the Jerrabomberra Creek.
Air quality	• The design of the pump station and other sewer and water infrastructure is not considered to have any potential odour impacts.
Noise and Vibration	• The design of the pump station and other sewer and water infrastructure is not considered to have any potential acoustic impacts. • There may be some noise impacts from the installation of the water main to those residents located along Edwin Land Parkway. Construction hours will be adhered to and notification will be given to these residents prior to the works being carried out.
Waste	• Measures will be put into place prior to construction to avoid impacts from waste

ASPECT	MITIGATION MEASURES
Management	generated onsite.
Aboriginal Heritage & Non Aboriginal Heritage	• The sewer and water REF works are not directly impacting on any Aboriginal or Non Aboriginal Heritage sites. Any sites within 35m of the proposed sewer and water infrastructure will be fenced during construction.
Traffic and Access	• Some traffic will be impacted during the construction of sewer and water mains along Tompsitt Drive. Construction management plans have been provided with the Engineering drawings (Appendix 3) to address site access and Traffic Management Plans will be produced with the Sewer and Water REF Construction Drawings. Trenching across existing roads will be carried out on weekends on one lane at a time to only have minimal impacts to the existing traffic flow.
Bushfire Risk	• To avoid any potential bushfire risk, the pump station building will be constructed to 12.5 BAL standards. A defendable space of 10m around the pump station and reservoir sites will be required during the bushfire danger period of 1st October-31st March to ensure there is no bushfire risk. • To ensure there is no potential for gases to be present around the sewer pump station in an extreme or catastrophic event, regular maintenance of the pump station should occur. This will ensure the vent wells do not become blocked and potentially conceal any gases produced (methane) inside the vent wells.
Visual Impacts	• To ensure the pump station is not visually impacting the area surrounding its location, screen planting will be provided around the perimeter of the pump station. The high and low level reservoirs will be a colour which blends in with the surrounding environment making it have minimal visual impact.
Human Health	Mitigation measures will be required at construction stage including; • Preparation of an environmental management plan prior to construction. • Appropriate storage of chemicals used for odour control and water treatment • Maintenance and operation of proposed scheme will be undertaken in line with Australian Standards and Guidelines and Councils existing procedures to minimise potential for human health impacts.
Hazards and Risks	Emergency storage and an overflow basin are included to mitigate any potential impacts from a failure of the sewer pump station. The operation of the sewer and water reticulation is unlikely to pose any significant risk to the community or environment. Chemical storage is required on site however and there is therefore a potential risk of a spill in to the environment. This risk is mitigated by requiring all goods to be stored, transported and handled in accordance with relevant Australian Standards and guidelines. The water reservoir sites will include a bunded area for the storage of chemicals. The reservoir sites will also include a bunded vehicle delivery area. These areas will be sized to be a minimum of 110% of the storage tank sizes to ensure any spill will be fully contained on site. In addition to the above all works will be remotely monitored, including alarms. This further mitigates any operational impacts by providing Council Staff with immediate advice on any operational failures and the opportunity to respond accordingly.

5.16 SMEC Peer Review of mitigation measures

As mentioned in the introduction of this REF document, a peer review was carried out by SMEC on the draft document. Below is a summary of recommendations provided by SMEC which they considered should be addressed. A response has been provided for each of the recommendations provided by SMEC.

	ENVIRONMENTAL CONSTRAINT	REF RESPONSE
	Topography: *No recommendations*	No response required
	Geology and Soil: *Further consideration of potential geotechnical constraints in the proposed creek crossing is warranted in the REF, including substrate and stream bank stability both during construction and in the long term. This may comprise of a commitment to further assessment by a qualified specialist prior to construction commencing to inform the CEMP.* *We also recommend that specific design of the crossing site take into consideration the NSW Government 'Guidelines for laying pipes and cables in watercourses on waterfront land' which recommend that pipes or cables be located on the downstream side of channel bedrock outcrops and through the drop deposit zone if a plunge pool is present.* *In general measures which must be included in the CEMP should be clearly stated, and elements of the design, which require further geotechnical assessment, should be defined.*	Further consideration into the potential geotechnical constraints can be addressed prior to construction commencing to inform the CEMP. Reference has been made to the 'Guidelines for laying pipes and cables in watercourses on waterfront land' throughout the REF document.
	Contamination: *We recommend that all relevant contamination reports should be reviewed to determine which AECs are relevant to the project. Based on a preliminary review of previous SMEC reports, detailed Site Investigations have been conducted for the majority of AECs along the alignment. AEC2 (Poplars – Sheep Yard), AEC 3 (South Tralee – Homestead and surround) and AEC 7 (South Tralee – Borrow Pit) have been assessed as not being contaminated and are no longer considered AECs, while AEC 4 (South Tralee – Woolshed and stockyards), AEC 5 (South Tralee – Sheep dip) and AEC 6 (South Tralee – Hanger) are determined to be potential sources of contamination and appropriate construction controls would be required. The preliminary site investigation for the sewer and water pump station largely addresses issues associated with AEC 9; however, further assessment may be required along the alignment. Detailed investigation of AEC 15 (Rail Corridor Access Road) has not been*	The relevant Contamination reports have been referenced in the REF Section 4.3.3 as well as Section 5.3. Those assessments relevant have been included as part of the REF Appendices.

	undertaken and may be required. An updated Constraints map should be prepared incorporating all current AECs and excluding AECs assessed as not contaminated by relevant detailed assessments. The Constraints map (Appendix 2) should be updated to reflect the current assessment of AECs and the sources of the AECs identified on the Constraints map should be clearly identified. All relevant contamination site investigation reports should also be included as Appendices to the REF. Section 5.3.2 should provide a summary of the potential risks identified in the contamination assessments which are relevant to the project. To clearly highlight AECs relevant to the proposed sewer and water mains alignment, and inform CEMP preparation, a summarised table of AECs identified along the alignment should be included in the main text of the REF, along with assessment of the identified potential risks and outcomes of preliminary site investigations already undertaken. *Section 5.3.3 should contain a summary of how environmental risks associated with contamination would be mitigated. The recommendations of ALL relevant contamination assessments should be reviewed and integrated with reference to the CEMP. Any actions outside the scope of the CEMP, such as any further assessment, should be clearly identified.*	
	<u>Water Quality, Drainage and Flooding:</u> *Potential impacts on water quality and riparian corridors, should be expanded in Sections 5.4.2 and 5.4.3 of the REF to demonstrate that potential impacts and risks have been comprehensively considered and appropriately addressed. Impact and mitigation measures should be separated according to the sections. In particular, potential adverse impacts and risks with the Jerrabomberra Creek crossing should be addressed. Examples of potential adverse impacts include destabilisation of the creek bank (i.e. both during and post construction), and the risk of sewerage leakage or overflow into watercourses reducing water quality and threatening human and animal health. Section 5.4.2 should include a summary of mitigation measures applied both in design and construction.* *Relevant recommendations contained in the NSW Government guidelines for minimising impacts on the hydrologic, hydrological and geomorphic functions of the watercourse should be included in the CEMP. As the pipes would be trenched across Jerrabomberra Creek, the most relevant NSW government guideline is 'Controlled activities on waterfront land: Guidelines for laying pipes and cables in watercourses on waterfront land'. This guideline outlines strategies to avoid and minimise potential adverse impacts resulting from for trenching across watercourses, which should be considered in Section 5.4.2 of the REF for inclusion in the CEMP, including:* • *prepare rehabilitation plans for disturbed bed and banks* • *ensure backfilling restores the channel shape and bed level to the preconstruction condition*	Commentary has been added to under Section (5.4.3) to ensure the CEMP includes control measures to minimise short term impacts on water quality during construction and to include a site rehabilitation plan for the Jerrabomberra Creek Crossing.

	• *ensure a trench is open for the minimal length of time* • *avoid stopping the flow of a permanent watercourse by staging the trench across the channel or minimising the time involved in stopping or intercepting flows* • *address additional disturbances from temporary coffer dams or diversion of flows around the work site, vehicle or machinery access and crossings, and material stockpiles* • *prevent potential water quality issues such as turbidity or spills* • *address the recovery and removal of construction plant and materials.* *We recommend that the Section 5.4.3 Mitigation Measures clearly state that the CEMP incorporates control measures to minimise short term impacts on water quality during construction, and includes a site rehabilitation plan for the Jerrabomberra Creek crossing which outlines strategies to ensure long term streambed and streambank stabilisation and revegetation following trenching. Further design of bank stabilisation works may be required. Bank stabilisation plans should ensure that erosion in adjacent areas is not exacerbated, and should take into account future requirements for landscaping and stabilisation along Jerrabomberra Creek.*	
	<u>Ecology:</u> *As the pipes would be trenched across Jerrabomberra Creek, the most relevant NSW government guideline is 'Controlled activities on waterfront land: Guidelines for laying pipes and cables in watercourses on waterfront land'. This guideline outlines strategies to avoid and minimise potential adverse impacts resulting from for trenching across watercourses, which should be considered for inclusion in the CEMP as discussed in relation to the Water Quality and Riparian section of the REF.* *We recommend that the extent of defendable spaces be presented on design drawings and potential overlap with areas of ecological significance reviewed along with the nature of fuel management requirements to determine the nature of potential adverse impacts, if any. If potential adverse impacts may occur due to the requirement for defendable space, the REF should demonstrate how these potential impacts are avoided, minimised or mitigated.* *We recommend that a weed management plan, including a construction vehicle weed hygiene protocol, and a revegetation plan be incorporated into the CEMP to ensure that all exposed earth along the alignment and around the reservoirs is revegetated and stabilised with suitable vegetation.*	Defendable spaces proposed consist of 10m to the surrounds of the sewer pump station and reservoir sites. No physical works are proposed in any significant native grasslands identified by Kevin Mills and Associates. The detail design of the sewer and water scheme should ensure any concerns with the defendable space/native grasslands are addressed.
	<u>Air Quality:</u> *Air quality and odour standards relevant to the proposed*	Air quality standards have been referenced in the Odour/Acoustic assessment prepared by Wilkinson

	sewerage infrastructure should be identified. *Any protocols for monitoring and responding to issues should be outlined.* *Standard CEMP controls should be implemented to minimise air quality impacts, including dust control and vehicle maintenance protocols.*	Murray. Protocols for the monitoring and responding to issues have been outlined in the Wilkinson Murray assessment (Appendix 8)

5.17 Construction Environmental Management Plan

Following endorsement of the proposed infrastructure scheme by QPRC it is recommended that prior to construction commencing, a Construction Environmental Management Plan (CEMP) would be prepared to ensure that appropriate environmental protocols are adhered to during the construction period.

The CEMP should include specific details pertaining to the following matters:

- potential environmental issues and objectives
- the statutory framework including any required approvals and licences, for example any environment protection licenses required under the Protection of the Environment Operations Act, 1997
- the organisational structure including key environmental roles and responsibilities, and any necessary training requirements
- monitoring, inspection, auditing and reporting requirements
- documentation of emergency planning and response procedures in addition to non-conformances and corrective actions
- specific measures to minimise and/or manage potential environmental impacts during the construction activity including noise, vibration, dust, construction vehicle movements, access disruptions (primarily along Tompsitt Drive), erosion and sedimentation, vegetation removal/protection, and storage of waste and its removal.
- environmental management plans incorporating as a minimum the construction mitigation measures identified in this REF and accompanying servicing strategy by Calibre Consulting
- environmentally sensitive area work plans, clearly marking sensitive sites such as trees for retention within the work zones, historic (Aboriginal and Non-Aboriginal) sites, areas containing native vegetation and so on.
- environmental work method statements (EWMS) and/or erosion and sedimentation control plans that clearly identify site specific safeguards for compliance with the CEMP.
- Outline any potential bank stability for Jerrabomberra Creek that may be required prior to construction.

5.18 Operational Environmental Management Plan

It is expected that QPRC would also employ (or amend as required) its existing environmental management protocols relating to its existing urban water and wastewater network. That is, to reflect and/or extend the protocols to encompass the planned infrastructure for South Jerrabomberra.

As with other service providers such as Sydney Water, the plans and procedures would address the operational, safety, and environmental management requirements for the proposed reticulation network, pumping stations, reservoirs and associated utilities including:

- site incident procedures
- standard operating procedures including the protocols for overflow incidents
- chemical storage and handling procedures
- standard safety procedures
- maintenance regime
- environmental reporting and monitoring requirements
- a post-commissioning water quality investigation would be carried out to identify the benefits of the scheme on local water quality
- auditing requirements including for example reports after 2 and 5 years of scheme operation.

5.19 Clause 228 Environmental Factors – Summary of Impact

Clause 228 of the EP&A Regulation lists the factors that an authority must take into account when assessing the impact of the proposed activity on the environment. Appendix 1 lists these factors and summarises the findings of the REF.

6 CONCLUSION

This REF has sought to identify the potential environmental impacts of proposed trunk water supply and sewer infrastructure required to service future development within South Jerrabomberra, in particular the South Tralee urban release area.

The works are to be facilitated by the proponent for the South Tralee release (Canberra Estates Consortium No.4) on behalf of QPRC.

The proposed infrastructure is considered essential to the future release and development of land in South Jerrabomberra. It will have significant social and economic benefits by connecting currently un-serviced lands with Council's existing reticulated wastewater and potable water supply network.

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) allows for QPRC to undertake the proposed works without the need to obtain development consent. However, the infrastructure scheme is required to be assessed under Part 5 of the Environmental Planning & Assessment Act, 1979 (EP&A Act). In particular, under Section 111 of the EP&A Act Council is obligated to examine all matters likely to affect the environment as a result of its construction and operation.

This REF concludes there will be relatively minor and temporary impacts associated with the construction phase. The main issues would be associated with the following:

- traffic and access disruptions (primarily along Tompsitt Drive)
- erosion and sedimentation
- social environment
- terrestrial flora
- dust emissions
- noise and vibration
- visual amenity.

However a range of measures including those identified in the accompanying servicing strategy by Calibre Consulting and Construction Management Plans will seek to mitigate such impacts.

Potential operational (long term) impacts include the visual impact of above ground water reservoirs and Sewerage Pumping Station, removal of existing trees, temporary odour and overflow issues but only in extreme and/or rare events.

The visual impact of the permanent above ground utilities are not considered significant within the wider urban setting proposed for South Tralee. Screen landscaping is also proposed to further lessen the visual prominence of other structures, such as the pumping station.

In terms of the ecological impacts, the accompanying assessment by Kevin Mills & Associates in Appendix 7 concludes that 'construction of the proposed infrastructure will not have a significant

impact upon environmental values. The land that is traversed contains very few natural features and those that are identified have been avoided and will be retained.'

To avoid any potential impacts from a failure at the sewer pump station the following are proposed:

- Emergency storage tanks to store any overflow with a capacity of 8 hours of dry weather storage, providing adequate time for QPRC to respond to the failure e.g. arranger for suckers trucks to pump out the wet well, and/or in the event of a power failure have the power failure fixed or a generator deliver to site.

According to Calibre Consulting, the above measures will ensure there are no operational impacts from a failure of the sewer pump station.

There is a potential risk of an overflow from the water reservoir tanks i.e. discharging of treated potable water into the environment. Any overflows however will be treated (dechlorinated) prior to release to the environment to mitigate any potential impacts.

It is a recommendation of this REF that a CEMP be prepared prior to construction commencing. The CEMP would incorporate the mitigation measures and requirements of this REF. QPRC would also need to review and amend, as necessary, its existing management protocols (via an Operational Environmental Management Plan) to incorporate the network extension into South Jerrabomberra.

If the scheme envelope, scope of work or construction activities described in this REF change during detailed design or construction, then further additional environmental assessment may be required.

The REF has identified and assessed the short and long term environmental impacts of the proposed scheme and identified mitigation measures to minimise potential impacts. On the basis of the supporting information and provided the mitigation measures identified in the REF are satisfactorily implemented, the proposed scheme is unlikely to have a significant environmental impact.

As also confirmed by a peer review of the REF carried out by SMEC consultants, the preparation of an EIS is not considered necessary in this particular instance.

7 APPENDICES

Appendix 1 Assessment of Clause 228 Requirements
Appendix 2 Zoning and Constraints Drawings
Appendix 3 South Jerrabomberra Sewer and Water Engineering Drawings
Appendix 4 South Jerrabomberra Water and Sewer Servicing Strategy
Appendix 5 Geotechnical Assessment
Appendix 6 Water Quality, Riparian and Flooding Assessment
Appendix 7 Ecological Assessment
Appendix 8 Air Quality and Acoustic Assessment
Appendix 9 Heritage (Aboriginal and Non-Aboriginal) Assessment
Appendix 10 Traffic Management Statement
Appendix 11 Bushfire Risk Assessment
Appendix 12 Contamination Assessment
Appendix 13 Advice from Lindsay Taylor Lawyers