Review of Environmental Factors

Picton Treatment, Reuse and Discharge

November 2020

Sydney WATER

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Acknowledgement of country

The Picton area is the land of the Tharawal (D'harawal) people. Protecting waterways and the environment in this catchment is consistent with the environmental stewardship the traditional owners have provided for thousands of years. We acknowledge these traditional custodians and their ancestors of the land and waters. Their lore, traditions and customs nurture and continue to nurture the water, creating wellbeing for all. We also pay our respect to Elders, past, present and emerging.

Determination

This Review of Environmental Factors (REF) assesses potential environmental impacts of the Picton Treatment, Reuse and Discharge proposal and was prepared under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), with Sydney Water both the proponent and determining authority. The State Environmental Planning Policy (Infrastructure) 2007 allows the proposal to be carried out without development consent. The proposal has also been considered against the matters listed in clause 228 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) (Appendix A).

During construction, the main potential environmental impacts of the proposal are typical construction impacts such as some vegetation clearing, and potential sedimentation/ erosion, noise, and waste management. During operation, the main impacts are associated with potential water quality impacts from the discharge of recycled water. The assessment shows that if we adopt the measures identified in this REF, the proposal would not have a significant environmental impact. Accordingly, we do not require an Environmental Impact Statement (EIS). Once operational, the proposal will have a positive impact by improving recycled water quality currently produced by the Picton Water Recycling Plant and ensuring capacity in the wastewater system to service growth.

The Sydney Water Project Manager will make sure the proposal is carried out as described in this REF. If the scope of work or work methods described in this REF change significantly following determination, additional environmental impact assessment may be required.

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1 Executive summary

The Picton wastewater system currently services about 16,000 people in the townships of Picton, Thirlmere, Tahmoor and the villages of Bargo and Buxton. The system is located within the Wollondilly Shire local government area (LGA), about 70 km south west of Sydney.

The Picton Water Recycling Plant (WRP) treats wastewater to produce recycled water for irrigation at Picton farm. Excess recycled water is discharged to Stonequarry Creek under a 'precautionary discharge' regime (when creek flows are more than 8 ML/day), regulated by an Environmental Protection Licence (EPL) issued by the Environment Protection Authority (EPA).

Due to increasing population growth, the WRP treatment capacity was recently upgraded to 4 ML/day. The current WRP inflows are around 3 ML/day. However, our recycled water capacity, which is our ability to either irrigate the Picton farm or discharge to Stonequarry Creek, remains at around 2 ML/day. We have been investigating options to expand the recycled water capacity since 2015 in conjunction with the EPA, Wollondilly Shire Council and other stakeholders.

Due to the recycled water capacity constraint, we have been unable to accept new connections (new developments) into the Picton wastewater system for several years. We have also had to discharge to the creek ocassionally when flows are less than 8 ML/ day, which is non-compliant with our EPL.

The main objective is to increase the recycled water capacity to 4 ML/day. Specific objectives are:

- allow new wastewater connections into the WRP and service growth up to 2024-2028
- resolve current non-compliance with the EPL
- maximise beneficial reuse of recycled water
- maintain community waterway values.

The preferred solution includes expanding recycled water use to nearby farms located to the west of the WRP (subject to landowner agreement), treatment upgrades at the WRP and additional discharge, either at Stonequarry Creek or a new discharge point to the Nepean River.

This Review of Environmental Factors (REF) assesses the potential impacts of the proposal on the surrounding environment. Our assessment concludes that the proposal is unlikely to have a significant adverse impact on the environment and an EIS is not required. Potential water quality impacts have been identified, however, these impacts are not widespread and are unlikely to impact on the aquatic ecology or environmental values of the waterway. We will continue to pursue opportunities to expand the recycled water network to further minimise discharges to waterways.

We are seeking feedback on our preferred solution as presented in this REF. We will consider all submissions, prepare a Decision Report and submit a licence variation application to EPA. Pending approvals, we expect that we can start construction and accept additional connections from mid 2021.

2 Introduction

2.1 Context

Sydney Water provides water, wastewater, recycled water and some stormwater services to almost five million people. We operate under the *Sydney Water Act 1994* and have three equal objectives to protect public health, protect the environment and be a successful business.

We are a statutory State-owned corporation and are classified as a public authority, and a determining authority for the proposed work under Division 5.1 of the EP& A Act. This REF assesses the potential environmental impacts associated with the proposal and identifies safeguards that avoid or minimise potential impacts.

Under the *Protection of the Environment Operations (POEO) Act 1997*, our wastewater systems are licenced by the Environment Protection Authority (EPA) via an Environmental Protection Licence (EPL). The Picton wastewater system is licenced under Picton EPL 10555.

2.2 Proposal background and need

2.2.1 Proposal background

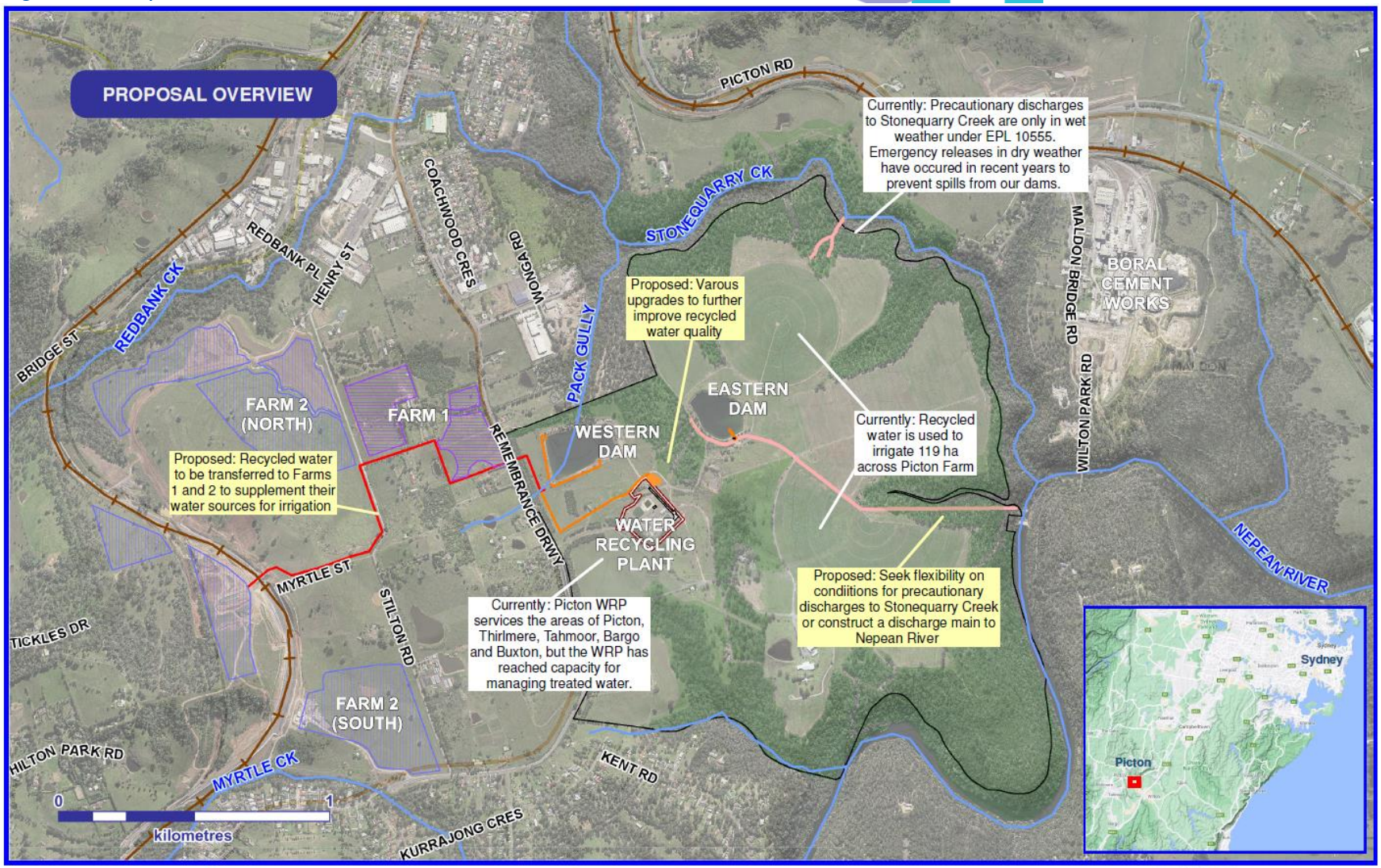
The Picton WRP was commissioned in 2000 with a capacity of 2.7 ML/day and involved a new wastewater collection system serving the urban zoned areas of Picton, Thirlmere and Tahmoor. The system was originally constructed to service 3000 lots, which were unsewered at the time and relied largely on on-site septic systems.

The system consists of pipelines to collect wastewater and transfer it, via pumping stations, to the WRP for treatment, reuse and discharge. Treated wastewater (recycled water) from the WRP is then reused for agricultural activities such as pasture production on land owned by Sydney Water adjoining the plant ('Picton farm') (refer to Figure 1). The initial land purchased, surrounding the WRP, was sufficient to enable reuse of a large proportion of the recycled water produced at the time the scheme was constructed.

Excess recycled water is stored in one of two storage dams on Picton farm and then either reused or discharged to Stonequarry Creek as per the requirements of EPL10555. Recycled water used for irrigation undergoes secondary treatment, while recycled water discharged to the creek is tertiary treated (higher quality). The current EPL requires:

- discharge is only permitted when flows in Stonequarry Creek are more than 8 ML/day
- discharge of up to 25% of the creek flow is permitted when flows in Stonequarry Creek are greater than 8 ML/day
- the total combined discharge to Picton farm and Stonequarry Creek is limited to 14 ML/day.

Figure 1 – Proposal overview



Precautionary discharges are designed to minimise changes to the natural variation in streamflow. Discharges are intermittent, are a proportion of the creek flow and are timed to occur when streamflows are high. This contrasts with a continuous discharge which can alter the flow characteristics of a waterway, particularly during peroids of low flows.

Flows in Stonequarry Creek are generally around 1 ML/day and flood events tend to be of short duration. Flows of more than 8 ML/day typically occur an average of 50 days per year and last for less than one week.

The original scheme was assessed under an Environmental Impact Statement (EIS), approved by the then Minister for Planning in 1997. In relation to potential discharges from the WRP, the EIS noted that some releases may be required when irrigation with recycled water is not possible and when the storage dams were full. The EIS noted that these releases would occur at any streamflow (ERM Mitchell McCotter, 1996). It was invisaged in the EIS that this situation would most often occur during periods of extended wet weather, when it is not possible to irrigate and the dams are full. To prevent the dams from spilling, discharges to the creek would need to occur even when Stonequarry Creek was less than 8 ML/day.

At the time of WRP approval and commissioning, Sydney Water made a commitment to work with the local community to develop additional markets over time to expand the recycled water use beyond the Sydney Water owned Picton farm.

The EPL has had several variations approved over the years since the scheme was first commissioned, however, the discharge regime has remained essentially the same. The conditions of the precautionary discharge regime have become more challenging in recent years with increasing inflows to the WRP, yet flows in Stonequarry Creek and available irrigation area remain largely the same as 20 years ago.

Due to increasing population growth in the Wollondilly Shire LGA and the connection of areas such as Bargo, Buxton and the Inghams property, the treatment capacity of the Picton WRP was upgraded to 4 ML/day in 2019 to accept additional wastewater inflows. An application to vary the EPL was not approved by the EPA. At the time of planning for the WRP upgrade, options for managing the recycled water produced were still being investigated and therefore the capacity to either use the recycled water for irrigation or discharge was not increased and remains at around 2 ML/day.

Investigations into expansion of the recycled water capacity of the original scheme have been ongoing since 2015 and a summary of the options considered is provided in Section 2.2.4.

As the Picton wastewater scheme relies on either on-site reuse at Picton farm or discharge to Stonequarry Creek when flows are over 8 ML/day, the recycled water capacity is highly variable and subject to climatic variables such as rainfall, soil moisture and creek flows.

2.2.2 Proposal need

The scheme currently services around 16,000 people. Growth in the catchment is forecast to increase to approximately 20,000 people between 2024-2028 (Table 1), which equates to a

wastewater inflow of about 4 ML/day (Sydney Water, 2019). The exact year we meet 4 ML/day wastewater inflows is dependent on the rate of development in the catchment.

Table 1 - Forecast population growth and wastewater inflows (2018-2046)

Flow projections	2015	2020	2024-2028	2036	2046
Projected population	14,000	16,000	20,275	24,945	30,251
Median WRP inflow (ML/d)	2.5	3	4.0	4.7	5.5

Current wastewater inflow to the WRP is around 3 ML/day. Our current recycled water capacity is around 2 ML/day. This leaves an excess of around 1 ML/day of recycled water we are unable to either reuse on the farm or discharge to Stonequarry Creek, under the current precautionary discharge requirement.

To address this situation Sydney Water has been operating under an 'emergency operating protocol' (EOP) since 2017, where excess flow is discharged to Stonequarry Creek (at any creek flow). This occurs when the dams are full and there is no further ability to irrigate, and is required to prevent the storage dams overtopping or spilling. EOP is highly variable and dependent on climate. In recent years EOP has occurred from about 25 to 100 days per year, and flows in Stonequarry Creek have been above the level required for compliant discharge (8 ML/day) on only about 5 to 30 days per year. We aim to resolve this non-compliant discharge with a variation to our current EPL.

Until we address how we manage current wastewater inflows to the WRP and the recycled water produced, we are unable to accept new wastewater connections. Since 2017, we have only accepted some limited developments within the amended boundary to the Picton WRP. We need to resolve this constraint on our WRP so that we can continue to service both current and future development in the Wollondilly LGA.

2.2.3 Proposal objectives

The overall objective of this project is to increase the recycled water capacity of the scheme to match the recent WRP upgrade of 4 ML/day. This will service current and future growth in the wastewater catchment up until 2024-2028.

Specific objectives are to:

- allow new wastewater connections into the WRP
- resolve current non-compliance with the Picton EPL
- maximise beneficial reuse of recycled water where feasible, minimise discharges
- maintain community waterway values.

2.2.4 Consideration of alternatives/options

Many options have been considered over the last five years to increase recycled water capacity. A summary of the key options that have been considered is provided below.

Storage

The dams at Picton farm have a capacity of around 330 ML. This option looked at what additional storage would be needed at Picton farm to prevent unscheduled discharges according to the current EPL precautionary discharge rules. Recent modelling has calculated that a dam storage capacity of around 1900 ML would be required (roughly 5-10 times the current dam storage), in combination with an additional 180 ha of off-site irrigation to achieve compliance with the current EPL discharge regime (Alluvium, 2020). Additional storage on its own would not resolve the recycled water constraint and this option on its own was discounted.

Source control

This option involves understanding how the entire wastewater collection system performs during wet weather to minimise sources of infiltration and inflow. By reducing the amount of stormwater entering the wastewater network, through illegal connections and faults in the wastewater system, we would reduce the amount of inflow coming into the WRP for treatment. Fixing nine ERS (Emergency Relief Structures) and fitting rain stoppers in low lying maintenance hole structures will be completed by mid 2021. High priority maintenance holes will be fixed on an ongoing basis. This source control work will complement other options.

Transfer

Transferring wastewater out of the catchment to the Glenfield Wastewater Treatment Plant (WWTP) was considered as the most viable sub-option in this category. The Glenfield WWTP provides initial treatment then transfers flow to the Malabar WWTP for ocean discharge. This has the benefit of keeping treated wastewater and nutrients out of the more sensitive Hawkesbury Nepean River. Under this option, the Picton WRP would be decommissioned and the Picton farm sold. However, this option involves a significant infrastructure investment of a new pumping station at the Picton WRP site, a 30 km long transfer main to Glenfield WWTP and upgrade works at the Glenfield WWTP. This option was considered too expensive and would require significant energy use to pump wastewater out of the catchment. Feedback from the Community Reference Group (refer to Section 4.2) indicated a preference to keep wastewater within the catchment and retain the Picton WRP and farm.

Reuse

A detailed investigation into additional reuse opportunities was undertaken in 2018 as part of the Pollution Reduction Program required by the EPA under Condition U3 of EPL 10555. The initial long list included 15 potential site options (Sydney Water, 2018). These options were refined using assessment criteria such as time, cost, economic benefits, longevity/adaptability, reuse potential and strategic alignment with vision and objectives. From this assessment, four options were selected for detailed analysis, being:

1. Dual reticulation to nearby new development for toilet flushing, laundry and watering
2. Irrigation of additional Sydney Water owned farmland (requiring land purchase or leasing)
3. Further automation and optimisation of Picton farm
4. Irrigation of agricultural land at nearby farms (owned and managed by others).

Dual reticulation to new developments includes additional WRP treatment upgrades to ensure the recycled water is of acceptable quality for residential use such as flushing toilets, washing machines and garden use. A benefit of this option is internal household demands for recycled water are less weather dependent than irrigation. However, the challenges were substantial including high capital cost of treatment and the dual reticulation recycled water network which could only service the relatively small areas of new development. Similarly, irrigation of public open space such as sports fields, golf courses and other parks/gardens was dismissed due to the lack of nearby open space near the WRP, high cost to pipe water to the different areas and seasonality.

The second option involves either surface or subsurface irrigation of land that Sydney Water already owns/leases or land we could purchase or lease. An advantage is the land will be managed by Sydney Water to optimise the irrigation and longevity of the scheme. Sydney Water already owns land to the north of Stonequarry Creek, however, due to topographical constraints, there is only around 19 ha available for irrigation. This makes the option of installing a recycled water pipe under Stonequarry Creek very expensive for only an additional 15% of irrigation capacity. Increased land values in the area and development pressure makes the option of buying new farms very costly and it was not taken forward as a viable option.

The third option of automation and optimisation of the existing Picton farm involves an upgrade of the existing system to allow greater control and monitoring of the scheme to increase irrigation at the farm. Automation and upgrades to the irrigation infrastructure have already occurred in 2016/17 which resulted in very good irrigation rates in subsequent dry periods. Optimisation continues with changes to crop selection, seasonal planning, monitoring and automation, resulting in ongoing small improvements and increases in the amount of reuse at Picton farm. This option will continue to be implemented, however, cannot resolve the recycled water constraint on its own.

The final option involves the supply of recycled water for agricultural purposes to other farms near the WRP. An initial survey in 2015, identified several farm operators to the west of the WRP who were interested in using recycled water. This option provides cost savings and wider economic benefits such as reducing the need for further WRP capacity upgrades, increased productivity of irrigated farmland and less discharge to waterways. There are also however potential challenges and risks such as reliance on private farmers to control and optimise irrigation activities and potential for future development of the land. On balance, this option was considered the most feasible way of expanding the recycled water use beyond the WRP and has been taken forward as the preferred reuse option. Ongoing consultation with interested farmers located to the west of the WRP has occurred over the last few years to progress this option further.

The potential option of advanced treatment and piping into the Warragamba Dam water supply as an indirect potable reuse scheme will be considered as part of an adaptive management pathway

over the long-term. Irrigating rural land to the west of the WRP in the short-term is consistent with this potential medium to long-term option as the recycled water pipeline can be extended to the Warragamba catchment over time. This option cannot be implemented in the short-term due to the relatively unknown regulatory pathway, infrastructure required, long lead time to gain government and public support and extended approvals and delivery timeframe.

Additional treatment

Enhanced treatment options at the WRP have been investigated to further reduce nutrient levels and ensure higher quality recycled water, which would support both additional recycled water use off-site and the discharge options. The following sub-options were investigated:

- denitrification filters to further reduce nitrogen levels in the recycled water
- new chlorination system and upgraded ultra-violet (UV) system
- constructed wetland treatment
- reverse osmosis.

Tertiary denitrification filters are a proven technology to reduce nitrogen loads in treated wastewater. The technology is used worldwide and involves building new denitrification filters next to the existing tertiary filter backwash area. Current total nitrogen (TN) levels from the existing treatment processes at the WRP produce recycled water of TN 4 mg/L. The recycled water quality which is likely to be achieved by installing tertiary denitrification filters at Picton is TN less than 3 mg/L. Due to their consistent and reliable performance, denitrification filters have been selected as the preferred treatment technology at Picton WRP and are described further in Section 3.

Providing additional treatment with a new chlorination system was deemed necessary to satisfy the requirements of the Australian Guidelines for Water Recycling (AGWR)(NRMMC *et al,* 2006). This will minimise the health and safety risk associated with recycled water use on farms which are not managed by Sydney Water. Similarly, the existing ultra-violet (UV) system at the Picton WRP is unreliable and not able to achieve the necessary reductions in pathogen levels required by the AGWRs for off-site reuse. Both a new chlorination system and an upgraded UV system were included in the preferred solution and are described further in Section 3. There are no other viable options other than chlorination and UV to meet these AGWR requirements.

Constructed wetlands are engineered to treat wastewater and mimic natural wetlands by using plants and naturally occurring microorganisms to reduce nutrients, pathogens and sediments from wastewater. Constructed wetlands can treat wastewater to a high level, and can have many other environmental and aesthetic benefits. However, due to the dependence on natural organic systems, wetland quality can be highly variable and influenced by changing climatic conditions. To develop this option further, we established four pilot wetland cells at Picton WRP in 2019. These pilot wetlands will take two years to establish after which time, two years of monitoring will occur. The results of the pilot wetland trial will be available in 2023 and will be used to inform any future treatment options at the Picton WRP.

Reverse osmosis (RO) is a process of treating wastewater to a very high standard, to achieve total nitrogen (TN) levels in the treated water of <1 mg/L. However, the by-product of the RO process is brine or concentrate, which is very high in salts and other substances and represents around 15% of treated flows. Disposal of this brine would require transfer out of the catchment to Glenfield WWTP approximately 30 km away which would involve a new pipeline with large construction cost, and operational energy requirements. Alternatively, the brine could be diluted with recycled water and applied to land, however, this option requires additional irrigation areas for a large-scale RO system. Although RO would produce very high-quality water for discharge to the waterways, it was discounted due to brine disposal.

Changes to discharge regime and location

The precautionary discharge regime currently licenced in our EPL restricts discharge to Stonequarry Creek and presents an operational challenge for managing volumes of recycled water, especially with inflows already exceeding the recycled water capacity.

There is an option to increase recycled water capacity by seeking approval from the EPA for additional discharge to waterways in our EPL. This could either be a relaxation of the current 'precautionary discharge' rules to Stonequarry Creek which would mean more recycled water would be discharged at the existing location or seeking approval for a new discharge location into the Nepean River. This is discussed further in Section 2.2.4.

2.2.4 Preferred option

The preferred option for the medium term (up to 4 ML/day WRP inflow) is shown in Figure 1 and has incorporated a range of the above options, including:

- **treatment** – new denitrification filters, new chlorination system and upgraded UV system will be built to produce a higher quality recycled water product
- **reuse** – expanded use of recycled water on nearby farms west of the WRP (subject to landowner agreement)
- **discharge** – additional discharge to waterways will be required when irrigation is not possible and the storage dams are full
- **source control** – source control in the catchment to reduce WRP inflows will be implemented from 2021 (subject to a separate environmental assessment)

The preferred option of increasing reuse and discharge to Stonequarry Creek has been based on initial community feedback on the proposal, and the existing infrastructure making it a slightly cheaper option.

This REF includes assessment of additional off-site reuse to the nearest two farms to the WRP (Farm 1 and 2). A land capability assessment has been prepared for both farms, which indicates a potential combined irrigation area of 60 ha (RCMG, 2019a and RCMG, 2019b). This recycled water network could also be expanded to further properties (Farms 3 and 4) over time (refer to Figure 3). The additional farms would be subject to a future environmental assessment.

Proposed treatment, reuse and discharge options assessed in this REF

Whilst we are endeavoring to expand the use of recycled water off-site to nearby farms, this relies on securing landowner agreement in the form of a Recycled Water User Agreement and contract (expected in early 2021 for Farms 1 and 2). Similarly, the final discharge regime will be determined in consultation with the EPA. We have selected and assessed three scenarios, as well as a 'baseline' or existing scenario (refer to Table 2) for comparison purposes. These are considered the most feasible options which can be implemented in 2021.

Table 2 - Treatment, reuse and discharge options assessed in this REF

Scenario	WRP inflows (ML/ d)	Recycled water quality	Reuse	Discharge location	Discharge regime	Average modelled discharge (ML/ d)
1 'baseline'	2.7*	TN 4 mg/L TP<0.1 mg/L	119 ha (Picton farm only)	Stonequarry Creek	Precautionary (with minimal EOP)	1.35
2	4	TN<3 mg/L TP<0.1 mg/L	119 ha (Picton farm) **plus** 60 ha (off-site reuse)	Stonequarry Creek	precautionary plus excess discharge	1.65
3	4	TN<3 mg/L TP<0.1 mg/L	119 ha (Picton farm) **plus** 60 ha (off-site reuse)	Nepean River	excess discharge to maintain dam levels	1.75
4	4	TN<3 mg/L TP<0.1 mg/L	119 ha (Picton farm only)	Nepean River	excess discharge to maintain dam levels	2.35

* although current (2020) flows are around 3 ML/day, for modelling purposes the baseline scenario adopted a dry weather WRP inflow of 2.7 ML/day, which aligns with the average inflow over recent years as well as the inflow during the period that water quality data was collected. This approach is more conservative as we are comparing future scenarios with a slightly lower baseline/existing scenario.

Following consideration of the submissions received on this REF (in a Decision Report), and with the more detailed assessment of the potential water quality impacts of each discharge scenario, a Licence Variation application will be submitted to the EPA for approval, also in early 2021.

Our current preference is to seek an increase to allow discharge to Stonequarry Creek when the dams are full and when irrigation with recycled water is not possible. This will avoid the need for additional construction impacts of a new discharge pipeline to the Nepean River, and associated costs. However, if we are unable to secure an amended discharge regime to Stonequarry Creek in our EPL, then we will need to construct the Nepean discharge pipeline and seek approval for a new discharge location in our EPL. The decision making process is shown in Figure 2 below.

Figure 2 - Recycled water capacity indicative decision framework

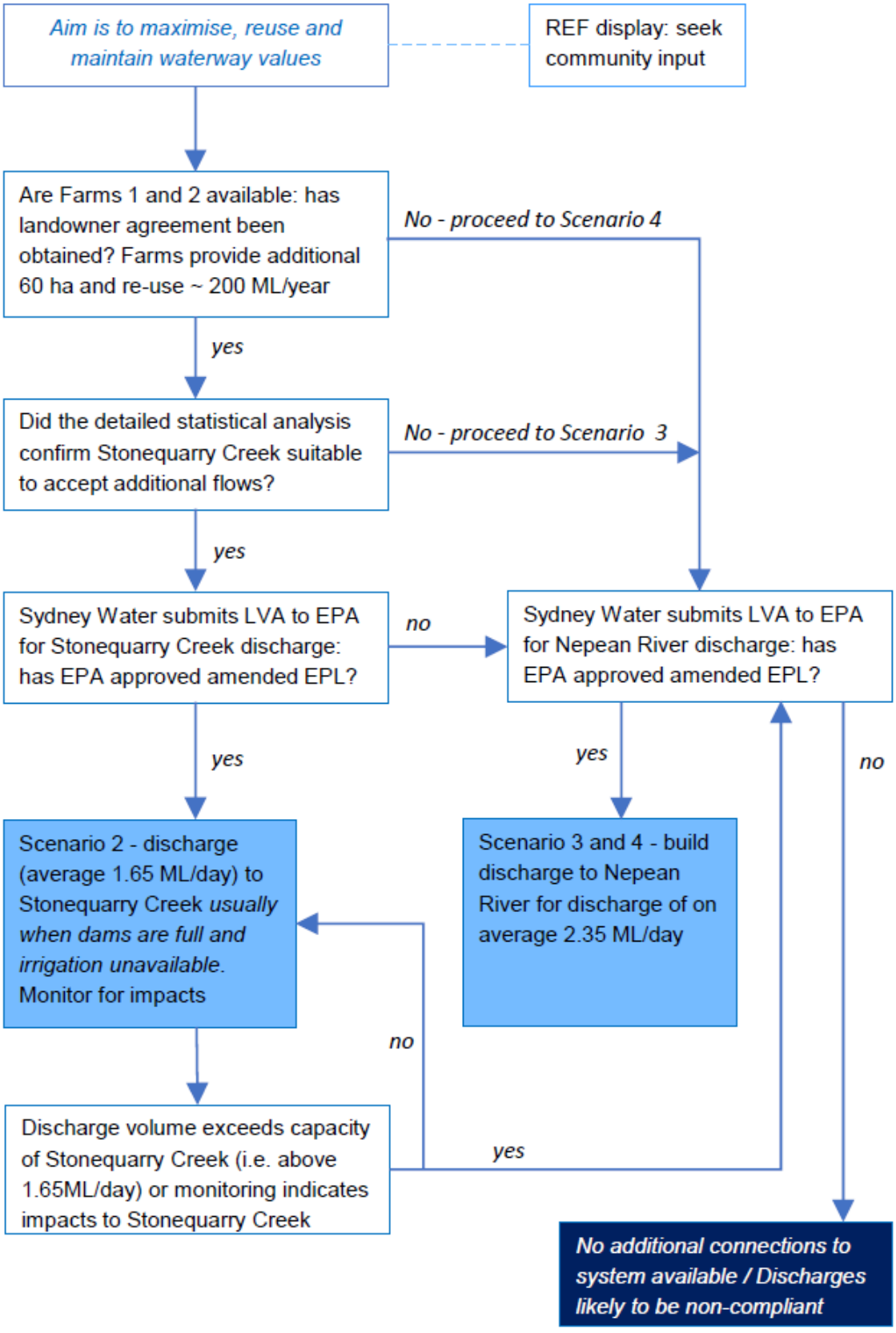
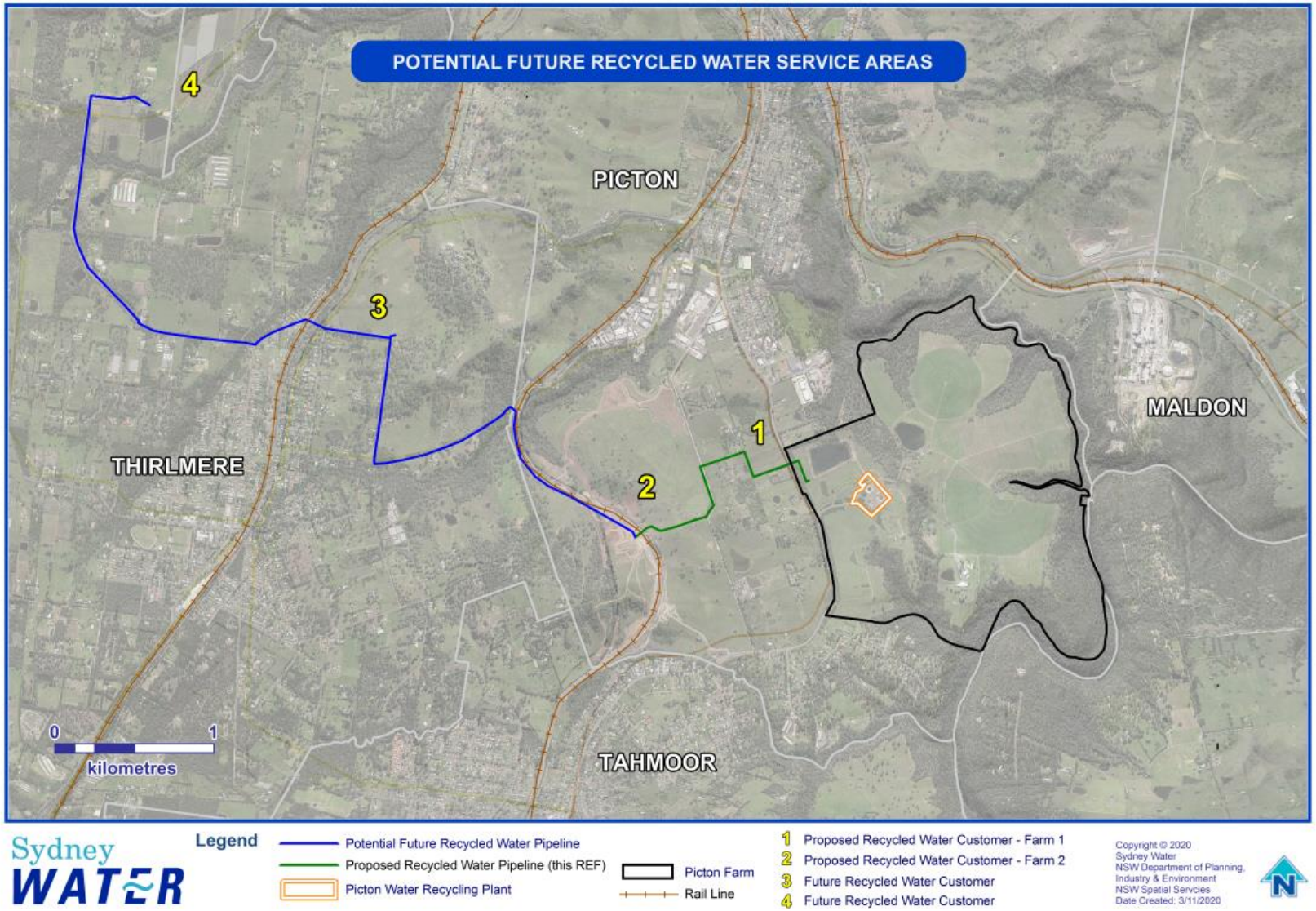


Figure 3 - Potential future recycled water service areas



2.3 Consideration of Ecologically Sustainable Development

The proposal has been considered against the principles of ecologically sustainable development (ESD) Table 3.

Table 3 - Consideration of principles of ecologically sustainable development (ESD)

Principle	Consideration in proposal
Precautionary principle - *if there are threats of serious or irreversible environmental damage, lack of scientific uncertainty should not be a reason for postponing measures to prevent environmental degradation. Public and private decisions should be guided by careful evaluation to avoid serious or irreversible damage to the environment where practicable, and an assessment of the risk-weighted consequences of various options.*	The proposal is unlikely to result in serious or irreversible environmental damage. Additional volumes of recycled water discharged to the waterways are small (an average additional discharge of 0.3 – 1 ML/day for Stonequarry Creek and around 2.35 ML/day to the Nepean River). Both options include additional treatment so the overall nutrient loads to Stonequarry Creek and the Nepean River remain similar, or increase by only a small proportion, based on conservative modelling. We will continue our extensive monitoring program in local waterways to understand changes in waterway health. Waterway health has remained stable in recent years despite increasing discharge frequency, and we are not expecting this to change.
Inter-generational equity - *the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.*	The proposal will help meet the needs of the present and future generations by providing a reliable wastewater service that reduces risk to human health of on-site septic systems, as well as facilitating sustainable growth in the Wollondilly Shire LGA. The waterway values of both Stonequarry Creek and the Nepean River will be maintained, and the use of recycled water for irrigation provides a valuable resource from a waste product.
Conservation of biological diversity and ecological integrity - *conservation of the biological diversity and ecological integrity should be a fundamental consideration in environmental planning and decision-making processes.*	We have designed the proposed Nepean pipeline to minimise the need to clear vegetation by underboring and by using an existing access track for construction. The proposed additional discharge to the waterways is minimal (approximately 0.3 ML/day – 1 ML/day for Stonequarry Creek and around 2.35 ML/day for the Nepean River) and is unlikely to impact on the ecological integrity of either Stonequarry Creek or the Nepean River.
Improved valuation, pricing and incentive mechanisms - *environmental factors should be included in the valuation of assets and services, such as 'polluter pays', the users of goods and services should pay prices based on the full life cycle costs (including use of natural resources and ultimate disposal of waste) and environmental goals.*	The proposal will provide cost efficient use of resources and provide optimum outcomes for the community, environment and with respect to financial cost. We are seeking to expand recycled water use to private farms. This approach is supported by an economic assessment which demonstrated greater economic benefits for similar financial cost.

3 Proposal description

3.1 Proposal details

The proposal involves the construction of new treatment systems and pipeline infrastructure to enable:

- off-site reuse of recycled water to nearby farms
- increased treatment and management capacity at Picton WRP and Farm
- additional discharge.

The proposed work would be located at properties identified in Table 4.

Table 4 - Proposal location details

Site name (Ownership)	Address
Picton WRP and farm (Sydney Water)	2295-2355 Remembrance Driveway, Picton
Farm 1 (Private)	Remembrance Driveway, Picton
Farm 2 (Private)	Stilton Lane, Picton

The key components of the proposal and indicative construction footprints are shown in Figure 4, Figure 5 and Figure 6. The works are summariesd in Table 5.

Table 5. Proposal detail summary

Proposal	Detail
Off-site reuse	• a new recycled water pipeline to supply recycled water for irrigation to two private farms: Farm 1 and Farm 2, subject to landowner agreements • on-site irrigation infrastructure for Farm 1 (10 ha) and Farm 2 (50 ha) to be installed by Sydney Water and operated by third party farmers
Upgrades at Picton WRP and farm	• new tertiary denitrification plant and transfer pipeline will be built to further reduce nitrogen levels • new ultra-violet (UV) disinfection system will be installed to replace the existing system, to ,ensure the recycled water meets the *Australian guidelines for water recycling* (AGWR) (NRMMC *et al,* 2006) including for protozoa reduction • new chlorination system for the off-site recycled water to reduce virus and bacteria and meet the AGWR guidelines

	• new recycled water delivery pump station and recycled water delivery pipeline to transfer recycled water from the WRP for off-site and Picton farm reuse • modifying the existing pump at the Eastern Dam to improve drawdown and increase available irrigation water for Picton farm • relocation of the inlet pipe at Western Dam to improve performance
Additional discharge	• additional discharge to Stonequarry Creek is required, for example when the dams are full and irrigation is not possible (up to about 1 ML/day). As part of this proposal, the existing Stonequarry Creek discharge channel would be stabilised and rehabilitated to prevent further erosion • construction of a new discharge pipeline to the Nepean River and discharge of around 2.35 ML/day to the Nepean River, for example when the dams are full and irrigation is not possible

Figure 4 - Proposal detail: off-site reuse

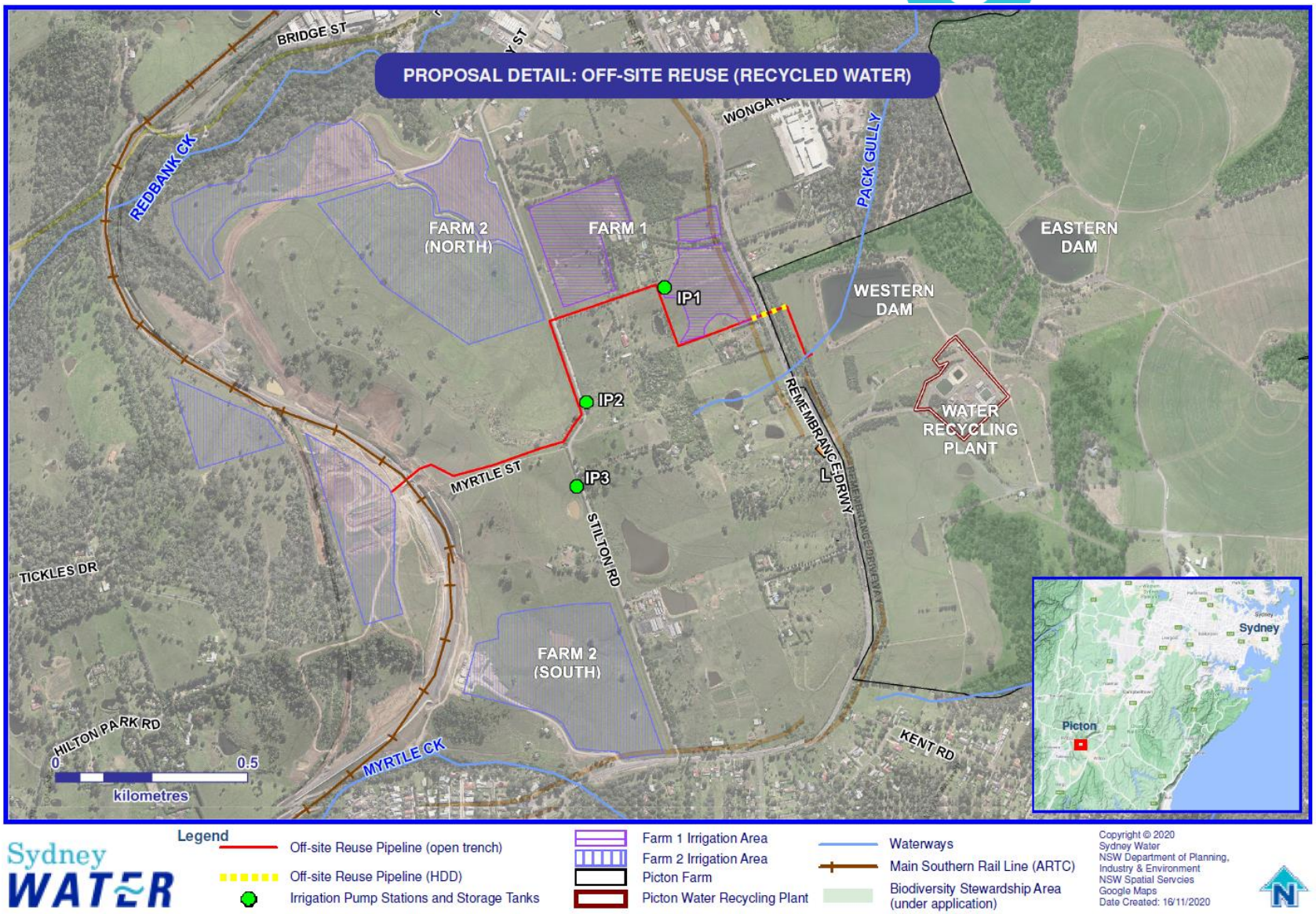


Figure 5 -Proposal detail: upgrades to Picton WRP and farm

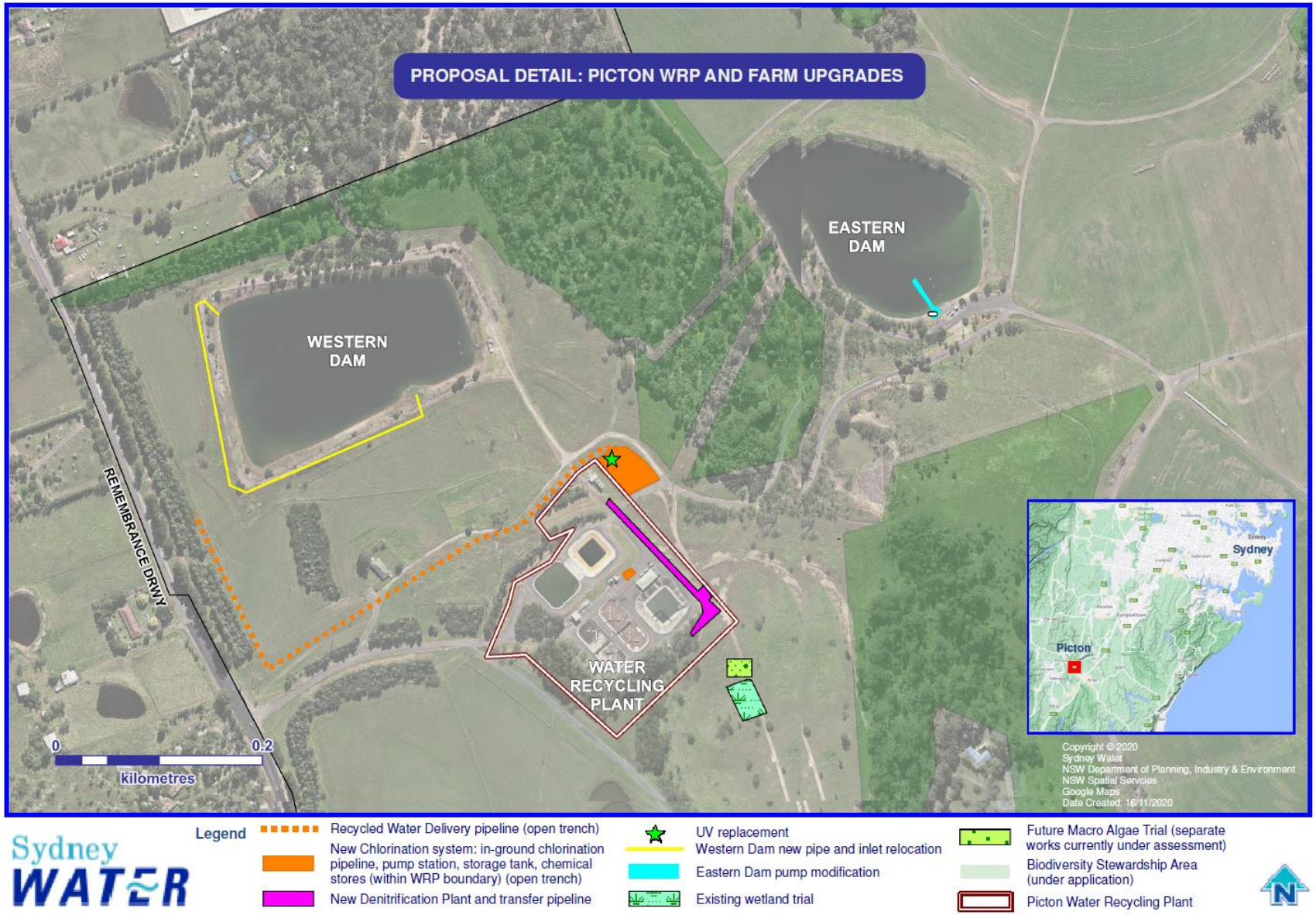


Figure 6 - Proposal detail: additional discharge regime

3.2 Construction activities

3.2.1 Pre-construction

Pre-construction activities include surveying, geotechnical investigations, soil sampling and locating existing underground services.

We will also be:

- preparing management plans and procedures including a Construction Environmental Management Plan (CEMP), a Community and Stakeholder Engagement Plan (CSEP), site inductions and safety plans
- liaising with local authorities, farmers and local residents to notify and discuss the works in accordance with Sydney Water's community relations protocols, as well as other external stakeholders (as identified in Section 4 and Table 10 of Section 5) to obtain any additional approvals needed
- establishing and marking out the designated construction areas including access routes, and areas for temporary material and machinery storage, and temporary fencing to separate construction works from WRP operations
- setting up temporary construction compounds including site sheds, amenities
- establishing traffic controls along Remembrance Driveway, Stilton Lane and Myrtle Street, if required
- preparing the site by establishing erosion and sediment controls and removing vegetation to be cleared
- delivering and storing materials and equipment.

3.2.2 Off-site reuse

The recycled water pipeline (250 mm diameter) will be constructed for about 320 metres from the WRP to Farm 1, and then from Farm 1 to Farm 2 for about 1.4 km. The main activities will be:

- installing the recycled water pipeline, associated valves and hydrants via open trench excavation (approximately 1 to 2 metres deep) and backfilling the trench with granular fill (as per Subsidence Advisory NSW requirements)
- under Remembrance Driveway, installing the recycled water pipeline using horizontal directional drilling (HDD), a trenchless construction method. This will minimise vegetation disturbance at the western edge of Picton farm. HDD construction involves set up of a launch pit at Picton farm and a receival pit at Farm 1 (typically 4 metres x 5 metres x 3 metres deep) and stringing pipes along the construction corridor. The recycled water pipeline will be constructed approximately 8 metres below Remembrance Driveway

- across the Main Southern Railway line, installing the recycled water pipeline to an overhead rail bridge following approval from ARTC

At Farms 1 and 2 the main construction activities are likely to be:

- constructing three variable speed pump stations for irrigation at Farm 1 (~3.5 kW) and Farm 2, north (~8kW) and south (~25kW) irrigation areas
- constructing three above ground storage tanks (likely 1 x 500 kL tank at Farm 1 and 2 x 1,000 kL tanks at Farm 2) with about 1.5 days' irrigation capacity in each tank
- excavating runoff diversion lines down gradient of irrigation areas and installing runoff control structures with above ground solar powered water level monitoring and alarm systems (RMCG, 2020)
- providing above ground irrigation infrastructure (K-line pod irrigation systems).

3.2.3 Picton WRP and Picton farm upgrades

- new denitrification plant and pipeline from the equalisation basin to tertiary filters:
    - installing above ground infrastructure including denitrification filters, methanol storage and dosing facility, electrical switch room, concrete storage bund, new chemical unloading bay, extension of an existing access road and modification of existing alum dosing facility
    - excavating an open trench in existing disturbed ground and installing pipework including a 200 mm diameter transfer pipeline from the equalisation basin to tertiary filters
    - decommissioning existing transfer pipeline
    - upgrading existing transfer pumps
    - installing new turbidity meters prior to tertiary filter treatment.
- replacing existing UV disinfection system
    - constructing a new UV system and installing UV lamps
    - installing associated electrical, instrumentation and control systems
    - decommissioning existing UV system.
- new chlorination system:
    - constructing a below ground, in-pipe chlorination system (250 mm diameter and ~350 metres in length) and below ground chlorination pump station (concrete wet well ~3 metres deep)
    - constructing two chemical storage tanks (1 kL and 4 kL), dosing facilities, chemical bunds, delivery tanker bunds and chemical dosing lines. All chemical storage, and dosing facilities will be located within the WRP boundary

- installing associated electrical, instrumentation and control systems.

- new recycled water delivery pump station and new recycled water delivery pipeline:
  - constructing a new recycled water delivery pump station comprising of an above ground approximately 300 kL storage tank (maximum water depth of about 3 metres)
  - constructing a new switch room
  - excavating an open trench (~1-2 metres deep) and installing a 250 mm diameter recycled water delivery pipeline (~580 metre length) for connection to the off-site recycled water pipeline and allow a tap off point for WRP use
- modifying Eastern Dam pump:
  - upgrading existing pump using a floating structure within the dam including associated pipework and electrical controls.
- relocating Western Dam inlet pipe:
  - excavating an open trench along southern and western boundary of Western Dam and installing a pipeline connecting to new inlet point.

3.2.4 Altered discharge regime

- additional discharges via existing discharge channel to Stonequarry Creek – rehabilitation of this existing discharge channel is required due to active erosion
  - temporarily bypass flows through a pipe to be laid in the secondary discharge channel to maintain precautionary discharges
  - clearing vegetation under supervision of a qualified ecologist (refer to Section 6.2.3).
  - excavating an open trench and installing about 110 metre length pipe (355 mm diameter)
  - installing rock rip-rap over the pipe, forming an overland flow channel to structurally withstand 1:100 year ARI overflow conditions
  - installing a new headwall at base of pipe
  - revegetating areas adjacent to the channel with native species.
- new discharge pipeline to Nepean River
  - installing a 375 mm diameter pipeline via open trench for 800 metres from an existing connection point at the Eastern Dam to the HDD launch pit and backfill with granular sands
  - setting up a HDD launch pit at Picton farm (approximately 10 metres x 10 metres x 3 metres deep) and HDD (for 576 metres at a grade of ~12%) to exit point (~ 20

metres above the Nepean River). All drilling fluids will be captured in a bunded area and pumped back to Picton farm via an existing access track

- constructing a dissipation structure (in ground pit) into which the pipe will exit into, reducing discharge velocity (approximately 2.5 metres x 2.5 metres x 2.5 metres deep)
- excavating an open trench (~6 metres) for an outlet pipe (375 mm diameter) from dissipation structure to edge of rock cliff
- extending and attaching pipe across rock face and open trench (if required) into rock platform for extension and submerging of pipe in the river
- backfilling open excavation with concrete.

3.2.5 Commissioning

Commissioning follows the completion of construction and involves testing and running new equipment to confirm it meets the expected performance criteria. The exact commissioning steps depend on the type of equipment, but typically include:

- providing all resources and undertaking all activities to comply with the commissioning requirements of Sydney Water's maintenance related clauses
- providing site labelling of WRP upgrade components
- preparing and testing new infrastructure which may include pressure leak tests, checking of all equipment and safety devices
- performance testing including sampling where required
- operator training and preparing maintenance manuals.

3.2.6 Post construction

Post construction activities include:

- dismantling the site, cleaning up and restoring areas
- reinstating damaged roadways and ground surfaces
- removing waste materials, machinery and excess materials
- replanting trees, and restoring grassed areas
- removing environmental controls, temporary fencing, site sheds, amenities and safety barriers
- fixing any defects during the liability period.

The work areas will be restored to the pre-existing condition following construction in consultation with the WRP operators, council or landowners as relevant.

3.2.7 Materials and equipment

The materials required for construction will include:

- concrete, structural steel, aluminium, timber and steel reinforcement
- pipework, ductwork and vessels made from stainless steel, PVC, glass fibre reinforced plastic (GRP) or steel
- K-line pod irrigation components
- polyethylene, steel and concrete
- colour bond sheeting
- electrical cabling and conduits
- mechanical and electrical equipment
- road base, rock rip-rap and engineered backfill
- asphalt for sealing roads
- fuel for equipment, machinery and vehicles
- ancillary construction materials.

Equipment required for construction will include:

- excavators and backhoes
- compactors, concrete vibrators and rollers
- light and heavy vehicles including haulage trucks
- concrete trucks and pumps
- mobile cranes
- compressors for pneumatic equipment
- generators
- welding equipment
- painting and coating equipment
- asphalt paver and profiler
- horizontal directional drilling (HDD) equipment
- water cart and pump
- hydraulic pipe jackers
- jackhammers
- temporary fencing, skip bins, environmental controls and portable amenities
- hand tools.

3.2.8 Work sites, access and vehicle movements

Construction compounds may include sheds, stockpiles, parking and material storage. Compound sites and access points will be in previously cleared and disturbed land away from drainage lines. Locations will be confirmed during detailed construction planning with the contractor, landowners and Picton WRP and farm operators. The compounds and access points will be located away from any known environmental constraints to the greatest extent possible.

Approximately 30 light vehicle movements per day across the sites are estimated. Heavy vehicle traffic generation will fluctuate depending on the program of work. Access to the WRP site, Picton farm and Farm 1 will be via the main entrance gates along Remembrance Driveway. It is expected that truck movements in this location will peak at approximately 20 movements per day.

Vehicle access to Farm 2 will be via Stilton Lane for work locations east of the Main Southern Railway Line and via Tickle Drive for work locations west of the Main Southern Railway Line. It is expected that truck movements in this location will peak at approximately 5-10 movements per day.

All sites will be accessed via existing public roads and access paths except for work sites within Farm 1 and Farm 2. Further details on traffic and access are provided in Section 6.2.8.

3.2.9 Workforce

The construction workforce is estimated to peak at around 50 people a day at the WRP.

The construction workforce is likely to fluctuate each day, depending on the program of work, but will generally be around:

- 8 people at Farm 1 and 8 people at Farm 2
- 30 people at the WRP
- 20 people at Picton farm.

3.2.10 Working hours and timeframe

Construction is expected to start in mid-2021 and finish by late 2021 to mid 2022. The following construction hours are proposed for this proposal:

- Monday to Friday – 7 am to 6 pm
- Saturday – 8 am to 1 pm

No work would take place on Sundays and public holidays.

The EPA's *Interim Construction Noise Guidelines* (ICNG) (DECC, 2009) acknowledges that the following activities can be undertaken outside standard construction hours assuming all feasible and reasonable mitigation measures are implemented to minimise the impacts to the surrounding sensitive land uses:

- the delivery of oversized plant, equipment and materials that police or other authorities determine require special arrangements to transport along public roads

- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- maintenance and repair of public infrastructure where disruption to essential services or considerations of worker safety do not allow work within standard hours
- public infrastructure works that shorten the length of the proposal and are supported by the affected community
- works where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours
- works which maintain noise levels below the noise management levels outside of the recommended standard construction hours.

We expect that most construction work will occur during standard daytime hours. However, should the need for any out of hours works be identified during detailed construction planning with the contractor, approval and further consultation will occur as per the process described in Section 6.9.

3.3 Operation and performance

The existing and proposed new treatment process flows are shown in Figure 7.

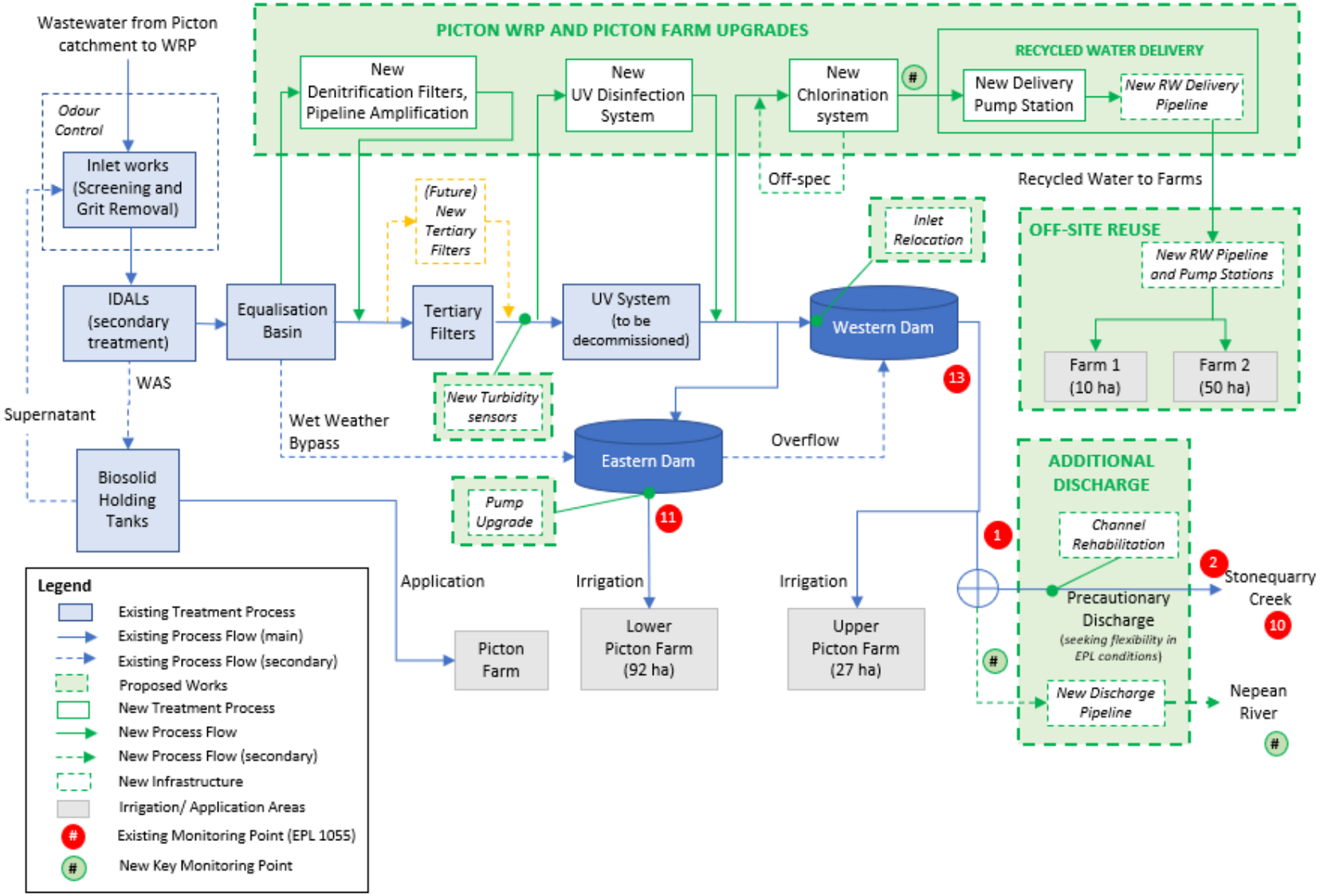
3.3.1 Off-site reuse (recycled water quality)

Recycled water at Picton farm is managed in accordance with a Recycled Water Quality Management Plan (RWQMP). This specifies operation requirements for irrigation of pasture and fodder crops consistent with the AGWR and NSW Health requirements. Under the RWQMP, 119 ha of Picton farm can be irrigated, at 4-5 ML/ha/year, which equates to an overall irrigation capacity of 475-600 ML/year. In comparison, the WRP has a treatment capacity of about 1,500 ML/year, which is the anticipated wastewater inflow in 2024-2028, allowing for expected growth.

The supply and use of recycled water at Farms 1 and 2 (combined 60 ha) will be governed by a Recycled Water User Agreement (RWUA) which would outline operational controls and responsibilities.

Sydney Water will ensure the quality of recycled water is suitable for use off-site for pasture and fodder crop irrigation as specified in the AGWR (NRMMC *et al,* 2006). On-site controls would be implemented by the land owner under a RWUA. On average, it is anticipated that 10 mm/week would be irrigated across the combined 60 ha at Farms 1 and 2. This equates to approximately 3.5 ML/ha/year or 200 ML/year.

Figure 7 - Existing and proposed treatment processes



Sydney Water would ensure recycled water quality is suitable for off-site reuse by undertaking:

- operational monitoring of the new treatment systems including a new monitoring control point at the proposed chlorination plant. If recycled water quality targets or critical control points are not achieved at the chlorination plant, monitoring control devices sound an alarm to operators and either automatically shut-down or return off-specification water to the WRP for additional treatment. Water that does not meet the quality targets is prevented from reaching the recycled water delivery pump station
- verification monitoring including sampling of recycled water will be conducted under a sampling plan prepared in accordance with the AGWR (2006). Sampling frequency will be based on a 'low-exposure scheme', given limited public exposure. Verification monitoring will also confirm the monitoring system integrity and overall performance of the recycled water system
- customer support including training and documentation (likely to be supplied by current Picton farm operators)

The use of recycled water at Farms 1 and 2 will require operational controls to ensure public health risks are minimised. These include:

- exclusion of grazing animals for five days after irrigation
- fodder will be dried and not supplied for human consumption
- no public access during irrigation
- 25-30 metre buffer distance to the nearest public access point
- spray drift control (e.g. through low-flow sprinklers, drippers, vegetation screening, etc)
- irrigation based on soil moisture deficits to minimise the chance for run-off following irrigation
- maintenance of run-off control structures and conducting water quality testing (with support from Sydney Water) if run-off is collected in run-off drains
- cease irrigation in the presence of waterlogging and during rain events
- implementation of an agreed monitoring schedule by the farmer (recycled water customer) including visual inspections of on-farm storage tanks for algae, odour, leakages and any other issues, keeping of records of irrigation events, nutrient applications and exported agricultural product quantities from irrigated areas.

These controls will be documented in the RWUA and a RWQMP to be put in place by the farmer when using the recycled water supplied by Sydney Water.

3.3.2 Upgrades at Picton farm and WRP and improved wet weather performance

Operational documents will be updated and staff trained for the new treatment processes and new chemical storage and handling requirements. New signs will be installed including for delivery truck vehicle movements.

During wet weather, all flows currently receive screenings removal, grit removal and pass through aeration lagoons (known as IDALs). The proposed denitrification filters at the Picton WRP will enhance the water quality in our Western Dam. In wet weather, the water discharged to the creek from the western dam will be of a higher quality as a result of the new denitrification process and upgraded UV system (refer to Figure 6). The denitrification filters have been designed for a 5.5ML/ day capacity, above the WRP 4ML/ day current capacity. We expect better performance for a range of other analytes from the upgrade works proposed as part of this REF as well as from recent upgrades in 2019 which amplified the biological treatment capacity.

3.3.3 Amended discharge regime

A licence variation application (LVA) to EPL 10555 will be sought from the EPA, following display of this REF and the Decision Report. The LVA will seek greater flexibility in licence conditions including removal of the current condition where discharges can only occur when flows in Stonequarry creek exceed 8 ML/day.

An alternative to increased discharges to Stonequarry Creek, is the proposal to allow discharges to the Nepean River. Once irrigation demand is met and dam storage is nearing capacity, discharge of recycled water from the Western Dam to the Nepean River would commence. The recycled water would flow (up to 2.77 m /s) to the dissipation pit located in the access track (approximately 40 m north of the Maldon Weir and 18 m above the proposed Nepean River discharge point). The dissipation pit incorporates an internal weir that reduces the flow velocity out of the dissipation pit to approximately 0.32 m /s. The recycled water would then proceed through the pipe that would be extended and submerged into the Nepean River with flows entering the river at approximately 2 m/s. This discharge point would be located approximately 45 m north of the base of the Maldon Weir (refer Section 6.11). Discharges into the Nepean River would not exceed 4-5 ML/day except during wet weather when flows would be up to 15 ML/day. On average, discharges would be 2.35 ML/day. In comparison, average daily flows as recorded near the proposed discharge point experienced flows of 41 ML/day, 50% of the time in the last six years (Section 6.3.1)

New monitoring points will be established to monitor for operational compliance at the Picton WRP and Farm, and in Stonequarry Creek and the Nepean River (Figure 6).

Load limits will be licensed under the EPA's new framework for the Hawkesbury Nepean River system that considers the cumulative load within a subzone. The Picton WRP is located within the Yarramundi Subzone 1. Table 6 specifies the load limit allocation for plants within the subzone and a comparison to the expected nutrient loads modelled for each discharge scenario at Picton WRP (Alluvium, 2020). It is expected that the load limit allocations issued by the EPA will be decreased in the future.

Table 6 - Proposed initial (2020-2024) load limits and proposed Picton WRP discharge scenarios

	TN load limit (kg/year)	TP load limit (kg/year)	Scenario 1 (baseline)	Scenario 2 (SQ + 60ha)	Scenario 3 (Nepean + 60 ha)	Scenario 4 (Nepean + 0ha)
West Camden	23,600	430	TN 1970 kg/yr TP 49 kg/yr	TN 1820 kg/yr TP 61 kg/yr	TN 1900 kg/yr TP 64 kg/yr	TN 2560 kg/yr TP 86* kg/yr
Picton	**4,400**	**80**				
Wilton	3,900	70				
Menangle	7,800	140				
Bingara Gorge	1,000	20				
Yarramundi Subzone 1 Total	40,700	740				

* although conservative modelling results from Scenario 4 suggests an average annual TP load of 86kg/ yr (which marginally exceeds the TP load limit of 80kg/ yr), the actual load is expected to be about 40% lower, indicating the rolling 5 year average for comparison with HN load limits will be below the allocation indicated for Picton WRP within the Yarramundi zone.

3.4 Changes to the scope of work

The proposal assessed in this REF includes construction, commissioning and operation activities as described above and is based on the concept designs prepared to date. Detailed design and construction may result in changes to these components.

If the scope of work or construction methods described in this document change significantly following the awarding of the contract and exhibition of the REF, supplementary environmental impact assessment must be prepared for the amended components. These proposal changes will be documented in a Decision Report or REF addendum and displayed on Sydney Water's website.

4 Consultation

4.1 General

Our approach to community and stakeholder consultation is guided by the Community and Stakeholder Engagement Policy (Sydney Water, 2019a).

Stakeholder and community engagement is a planned process of initiating and maintaining relationships with external parties who have an interest in our activities. Community and stakeholder engagement:

- enables us to explain strategy, policy, proposals, projects or programs
- gives the community and stakeholders the opportunity to share their knowledge, issues and concerns
- enables us to understand community and stakeholder views in our decision-making processes alongside safety, environment, economic, technical and operational factors.

If our work will impact the community in some way, we will consult with affected groups through a variety of ways and through different stages of a project. This includes engaging the broader community and stakeholders during planning or strategy development or before making key decisions.

We will also provide Wollondilly Shire Council with reasonable notice before we commence works, regardless of the need for development consent. Council will be consulted about matters identified in environmental planning instruments (refer Section 4.3 below), including public safety issues, the placement of any temporary site sheds or laydown areas on council land, or full or partial road closures of council managed roadways.

A Community and Stakeholder Engagement Plan (CSEP) will be prepared for the proposal. The plan helps us to provide the community and key stakeholders with clear, accurate and timely information.

Consultation with key stakeholders will continue throughout detailed design, construction and commissioning of the proposal. We will consult with community members where the proposal directly impacts them.

During construction, the contractors responsible for delivering the proposal will do the consultation and, as representatives of Sydney Water, will adhere to our community relations policies and procedures. We will continually monitor the contractor's performance during proposal delivery.

The CSEP will identify stakeholders with an interest in the proposal, and ensure they are informed during proposal delivery. The CSEP will also:

- identify the directly and indirectly affected landowners and other stakeholders, including government agencies and interest groups

- identify issues likely to be of high community/stakeholder concern and determine the level of risk to the development of the proposal
- incorporate stakeholder views into the proposal planning and delivery.

4.2 Community Reference Group

Following a public expression of interest process in 2016, a Community Reference Group (CRG) representing a range of community and stakeholder interests was established to assist the development of the options for recycled water capacity at the Picton WRP. The CRG members included representatives from local business, environmental groups, community residents and councils in affected LGAs, who all had an interest in the outcome of the strategy. Member organisations were National Parks Association (NPA) Macarthur Branch, Bushcare, resident representatives, Chamber of Commerce members, Inghams, Wollondilly Shire Council, Camden Council and Campbelltown City Council. The CRG was engaged progressively during the development of initial recycled water capacity options through four workshops and a site visit in 2015/16.

Through this process, the CRG provided feedback on the list of options and recorded its preferences for the assessed recycled water management strategy. In general, the CRG feedback included:

- retaining the WRP and farm
- trial wetlands to improve water quality
- acceptance of increased discharge to Stonequarry Creek up to 4 ML/d
- for larger volumes (eg. up to 7 ML/d), preference for Nepean River discharges.

After the fourth meeting, Sydney Water further refined the list of options during 2017-2020 and completed the Pollution Reduction Program (PRP) Studies required by our EPL (refer to Section 4.4). The trial wetlands, which were strongly supported by the CRG, were also constructed at the Picton WRP in 2018/19.

A final CRG meeting was held in October 2020 to update the group on progress towards the preferred solution and inform the group that further opportunity to provide input would be available during the REF display process.

4.3 Council consultation

We have been actively consulting with different departments of Wollondilly Shire Council throughout the options development phase. An outline of key council groups and topics covered is detailed below in Table 7.

Table 7 - Council consultation undertaken

Council team consulted	Topic
Development services	Communication on restricting new connections to the wastewater network until new EPL is secured for the Picton WRP, general updates.
Environmental team	Collaboration with Council and their consultants developing an Integrated Water Management Strategy aiming to mitigate impacts on waterways from future development, including ways to manage stormwater runoff, treated wastewater and water sensitive urban design.
Planning team	Collaboration with input to their Rural Lands Study and presentation to their Rural Industry Advisory Committee in 2019. Pre-REF display meeting in early November.
Health and regulatory services	Attendance at 2019 risk workshop for off-site agricultural reuse. Discussion regarding runoff controls for irrigation on private property farms to ensure potential impacts on mapped drainage lines and waterways are minimised.

4.4 Consultation with EPA

We have been working with the EPA since 2015 to develop an acceptable solution to the recycled water capacity constraint at the Picton WRP. This has involved the preparation and submission of two LVAs to the EPA, one in 2015 and one in 2017. Neither LVA was approved, however, the EPA issued a series of PRP Studies to assist Sydney Water gain further information on:

- short-term water quality sampling program during three discharge regimes – condition U1
- source control investigations to reduce stormwater and industrial wastewater flows to the Picton Sewerage Treatment System – condition U2
- investigations for additional wastewater recycling and reuse options for Picton STS – condition U3
- trial pilot-scale construction wetlands project – condition U4.

The work on the PRP studies in 2018-2019 were used to inform the preferred solution which was finalised in 2020 and now subject of this REF. The most recent EPA consultation occurred in 2020 as outlined in Table 8 below.

Table 8 - Summary of EPA consultation in 2020

Date	Topic covered
May 2020	**Meeting** – update to Picton Treatment and Reuse strategy, outline timing of REF and LVA#3, identify phases of work in 2020 Provision of Waterway Analysis report for Stonequarry and Nepean River (February 2020)
August 2020	**Meeting** – discussion on EPA's comments on Waterway Analysis report, confirm approach for REF waterway assessment approach **Meeting** – provide overview of source modelling, flow gauging with Sydney Water's consultants 'Alluvium' Provision of planning approval pathway advice for Picton as requested by EPA, as well as response to EPA's comments on Waterway Analysis report
October 2020	Provision of observed water quality and algal monitoring data, as requested by EPA.
November 2020	**Meeting** – pre-REF display briefing, outlining key findings from specialist studies and preferred option.

4.5 Consultation with other government agencies

Department of Planning Infrastructure and Environment (DPIE)

As the original Picton wastewater scheme was approved by the (then) Minister for Planning in 1997, we consulted DPIE in September 2020 regarding our approach to assess this proposal under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. Division 5.1 allows Sydney Water to assess and determine the works, provided impacts to the environment will not be significant. DPIE was supportive of our approach for this proposal. Detail about the original assessment and conditions is provided in Section 5.2.

We have also worked with representatives of DPIE – Planning to understand strategic land releases and their work with Council to deliver the LEP review in an accelerated timeframe.

NSW Health and DPIE – Animal Health

As this project involves extending recycled water use to private farms, we have consulted with NSW Health and DPIE – Animal Health to understand any additional public health and animal health risks and controls that may be required. This has involved NSW Health's attendance at a 2019 risk workshop and a discussion with DPIE – Animal Health as the off-site recycled water options were progressed. Further input from NSW Health will be sought when a RWQMP is prepared for Farms 1 and 2 in 2021, prior to any supply of recycled water off-site. DPIE – Animal Health will be consulted as needed to clarify any outstanding animal health risks.

Australian Rail Track Corporation (ARTC)

ARTC is the authority responsible for the rail networks in NSW. Access to or works within the rail corridor require their approval. The proposed recycled water main to Farm 2 crosses the ARTC Main Southern Rail Line. Consultation on the concept design has occurred and further consultation will occur during detailed design and prior to construction. We will need ARTC approval for the detailed design of the rail crossing.

Department of Primary Industries – Fisheries (DPI – Fisheries)

Stonequarry Creek and the Nepean River are mapped as key fish habitat. We will consult DPI – Fisheries about works in the key fish habitat, and the proposed discharge pipeline to the Nepean River. Initial consultation indicated they will provide feedback through the REF display process. We will continue to consult DPI – Fisheries as needed during detailed design of the Nepean River discharge pipeline and before construction. The proposal will not create an obstruction across a waterway or impact on fish passage. If works in Stonequarry Creek are proposed, further consultation will be undertaken.

Subsidence Advisory NSW

Subsidence Advisory NSW regulates development within mine subsidence districts to help protect homes and buildings from potential subsidence damage. The proposal lies within the mine subsidence area for Picton. The concept design of the proposed works will be submitted to Subsidence Advisory NSW for their approval.

4.6 Consultation with the Tharawal Local Aboriginal Land Council (LALC)

The proposal falls within the land of the traditional owners, the Tharawal (D'harawal) people. Protecting pathways and the environment in this catchment is consistent with the environmental stewardship the traditional owners have provided for thousands of years. As part of our consultation, in September 2020, we held a project briefing with the Chief Executive Officer of the Tharawal LALC. Sydney Water wanted to understand if places of Gumadagul Ngurang (place of personal significance) existed in or near the study area. The CEO asked for additional project information to share with the Board. The CEO and the Board were invited to make a submission on the REF.

4.7 Consultation with the wider community

An initial project newsletter was distributed in October to around 10,000 households in Picton, Tahmoor, Thirlmere, Bargo and Buxton. An extra 1500 copies of the newsletter were distributed to council to place at council facilities such as the library, mobile library and administration centre. A follow up newsletter was distributed in November, inviting community members to provide feedback on the REF.

We have also consulted widely with the broader community to inform them of the options for recycled water capacity at the Picton WRP, and to invite them to make submissions on the REF.

We have held meetings with several individuals and groups, including:

- neighbours living next to the Picton WRP
- local water users including Bass Club, water activity consultants, Entomologist studying the dragon fly habitat in the local area, ecology tourism group
- Council's Water Advisory Committee
- wider community members who have requested more information on the Picton WRP.

4.8 Consultation on this REF

We will invite the community and stakeholders to comment on this REF. We will provide information about the proposal and the REF process, and we will invite comment through:

- a community newsletter
- Sydney Water's website (www.sydneywatertalk.com.au)
- static displays
- online webinars.

This REF will be available to download from sydneywatertalk.com.au during the display period up to 13 December 2020. Submissions must be made in writing and received by 13 December 2020 by emailing WestRegionDelivery@sydneywater.com.au.

We will collect information in written representations to help us assess the proposal. The information may be disclosed to appropriate agencies such as the EPA. If the respondent indicates at the time of submission that the information should remain confidential, Sydney Water will attempt to ensure this, but there may be legislative or legal justification for its release, for example under the *Government Information (Public Access) Act 2009.* The supply of information is voluntary.

Each respondent can request to access the information they have supplied, but not information supplied by others. Respondents may correct or update information they have submitted if it is received by 13 December 2020.

At the end of the public display period we will consider all submissions and prepare a Decision Report.

4.9 Consultation before and during construction

We will continue to inform the community and stakeholders about:

- the proposed start date

- where we will be working and when
- what to expect during each stage of the proposal's progress.

During construction, we will ensure the construction contractor is mindful of the community, that they inform the community about any work that may impact nearby residents, and that they leave a positive legacy when their work is done.

Engaging with the community enables Sydney Water and its contractors to listen and understand community values. Feedback will be used to improve our performance and all complaints during the construction of the proposal and following its commissioning will be managed according to Sydney Water's Customer Complaint Policy and Procedure.

5 Strategic context and legislative requirements

5.1 Strategic context

We have considered the following strategies from Wollondilly Shire Council and the NSW Government in the development of our proposal.

Greater Sydney Region Plan: A Metropolis of Three Cities (Greater Sydney Commission, 2018)

Picton is in the Western Parkland City as defined by the Greater Sydney Commission's vision for Sydney. The Western Parkland City is projected to grow from 740,000 in 2016 to 1.1 million by 2036, and to well over 1.5 million by 2056. There are four main growth areas identified for the Western Parkland City being:

- Greater Macarthur Growth area
- Greater Penrith to Eastern Creek investigation areas
- Western Sydney Aerotropolis
- Wilton Growth area.

Picton is not within these identified key growth areas, however it is expected to have substantial development over the coming years.

Draft Cumberland Plain Conservation Plan (DPIE, August 2020)

DPIE has prepared this plan to protect Western Sydney's biodiversity and support its growth to 2056 and beyond. This Plan will contribute to the Western Parkland City by supporting the delivery of housing, jobs and infrastructure while protecting important biodiversity including threatened plants and animals (DPIE, 2020). Specifically, the plan will protect important biodiversity in the areas nominated for development in the Western Parkland City.

There are several commitments found in this Plan which will contribute to enhancing biodiversity in the Western Parkland City, including protecting koalas, plants and animals and establishing new lands for conservation.

The potential impacts on biodiversity from this proposal have been assessed in Section 6.4. The project has been designed to avoid areas of high biodiversity values and therefore impacts on biodiversity are minor. The areas surrounding Picton farm consist of good quality Cumberland shale-sandstone ironbark forest, a threatened ecological community. Sydney Water has entered into a voluntary Biodiversity Stewardship agreement with the Biodiversity Conservation Trust to permanently protect and manage this area and further improve its biodiversity values. This proposal will not directly impact the Biodiversity Stewardship area (Section 6.4). Proposed new

infrastructure such as the Nepean discharge pipeline will be underbored to avoid biodiversity impacts, with construction access via an existing, partially cleared track outside the BSS area.

Wollondilly 2040: Local Strategic Planning Statement (WSC, 2020)

This document outlines the vision for Wollondilly LGA for land use planning over the next 20 years. The vision can be summarised as 'an enviable lifestyle of historic villages, modern living, rural lands and bush' and was adopted in March 2020, after public consultation in late 2019.

Planning priority #3 of this document includes establishing a framework for sustainable managed growth. This includes a commitment for Council to work with Sydney Water to find long-term servicing solutions for wastewater disposal and potable water, as well as develop interim measures to address the lack of capacity at the Picton WRP. The proposal as described in this REF will provide a solution to address the lack of capacity at the Picton WRP for the next four to eight years.

Planning priority #12 includes 'valuing the ecological health of Wollondilly's waterways'. This proposal seeks to maximise the use or recycled water for irrigation of agricultural properties whilst minimising the amount of recycled water to be discharged to either Stonequarry Creek or Nepean River. This will contribute to protecting the ecological health of Wollondilly's waterways.

Draft Wollondilly Rural Lands Study (WSC, 2020a)

The draft Rural Lands Strategy provides a framework for managing growth, change and development for rural land in Wollondilly LGA over the next 20 years. It was on public exhibition until 2 October 2020 and once finalised, will guide future Wollondilly LEP 2011 amendments and potential re-zonings.

Under Action 5.3.3 of this draft strategy, there is a commitment for Council to work with Sydney Water to provide secure, sustainable and long-term water supply solutions including the expansion of its WRP to support food production. Council is advocating for a reliable supply of water for agricultural uses.

Our proposal is consistent with this draft study as it includes using recycled water for rural properties (Farm 1 and 2) beyond Picton farm. The proposed new recycled water pipeline can also be extended further west in the future which will facilitate additional use of recycled water from more farms located in the rural area to the west.

Draft Integrated Water Management Strategy (IWMS) (WSC, 2020b)

This strategy outlines Councils strategic direction for managing water into the future so that it can continue to play a prominent role in supporting and improving the quality of life, and the preservation of rural living in Wollondilly. Wollondilly's vision for water is to maintain pristine creeks and rivers to be swimmable, ecologically rich and diverse. Council believes this can be achieved by new development having zero net impact on the waterways, with no extra stormwater runoff entering the waterway, and wastewater being treated and reused. Through engagement with the community, stakeholders and background research, Council identified ten community values for the waterways in Wollondilly Shire LGA being:

- water quality and endangered species
- recreation (passive, active and swimming)
- protecting the last wild rivers of Greater Sydney (this one relates mostly to Bargo River)
- cultural values
- protecting Sydney's drinking water supply
- agriculture
- mining and industry
- biodiversity and koalas
- downstream Hawkesbury-Nepean river values
- environmental flows
- sustainability, liveability and resilience.

This strategy examines possible wastewater options which could be implemented to achieve a zero-net impact as aspired to by Council and concludes that wastewater should be reused locally, reused through a regional reuse scheme to replenish/ augment other supplies, or exported from the catchment altogether. Our proposal is consistent with Councils' IWMS as it seeks to expand reuse locally beyond Picton farm, subject to obtaining landowners agreement. An assessment of the potential impacts on waterway health from the proposal is provided in Section 6.3.

5.2 Regulatory requirements

Environmental Planning and Assessment (EP&A) Act 1979

Sydney Water is both the proponent and determining authority of this proposal under the EP&A Act. The proposal does not require development consent (under the provisions of Clause 106 of the State Environmental Planning Policy Infrastructure – see Table 9), and is not classified as State Significant Infrastructure. We have assessed this proposal under Division 5.1 of the EP&A Act by preparing this REF. The REF has found that the proposal is unlikely to have a significant impact on the environment and an Environmental Impact Statement (EIS) is not required.

The original scheme was assessed under an EIS as a project of State and Regional significance by the then Department of Planning (and Minister for Urban Affairs and Planning). The project was approved on the 15 January 1997, and subject to Minister's Conditions of Approval (MCoA). The scheme was commissioned in 2000. Since commissioning, five modifications to the original project approval have been sought and granted. Modification 4 included that future works would be assessed under Part 5 (now Division 5.1) of the EP&A Act provided the works do not result in a significant impact. This modification was approved by the Minister on 9 June 2015.

Of relevance to this proposal is MCoA 8, which permits discharges to Stonequarry Creek when creek flows are above 8 ML/day or as otherwise approved by the EPA. This condition was

developed in 1996 and was used as a precautionary approach for discharges. Monitoring over the last 20 years has shown that while there are changes to water quality from the discharge, this is likely to be a localised effect with potential for water quality to improve downstream of the discharge site. We are currently undertaking further statistical analysis and assessment to evaluate the scale of impacts observed in our monitoring over the last six years, when periodically we have discharged under an Emergency Operating Protocol. We will be seeking approval from the EPA via an amendment to the EPL discharge criteria and therefore we are consistent with this CoA.

We met with DPIE in September 2020 to confirm the approach for this REF (refer to Section 4.5). DPIE requested we notify them when the EPA approves our licence variation application.

Clause 228 of the *Environmental Planning and Assessment Regulation 2000* outlines the requirements that must be considered when determining an impact of any activity on the environment. These factors have been considered in Appendix A.

Protection of the Environment Operations (POEO) Act 1997

The Picton WRP and farm is a scheduled activity 'sewage treatment' under the POEO Act. The WRP, farm and the wastewater scheme are operated in accordance with EPL 10555. The EPL governs the use of recycled water on Picton farm and the release of recycled water to Stonequarry Creek. A licence variation application will be submitted to the EPA for their approval in early 2021, seeking an additional licenced discharge point for the off-site farms reuse schemes, as well as increased to Stonequarry Creek or Nepean River.

Even with additional off-site reuse, there will be times when irrigation is not possible due to climatic factors such as soil moisture and rainfall and when the storage dams are full. At these times, Stonequarry Creek flows may be less than 8 ML/day (the requirement for discharge in the current EPL) but we have needed to discharge to prevent the dams from spilling. At these times, and since about 2017, we have been discharging under an Emergency Operating Protocol. We are seeking to resolve this non-compliant discharge as a key objective of this proposal.

We have applied for two licences variations since 2015, for additional discharge to Stonequarry Creek, however, these have not been approved. The EPA sought additional information by issuing Pollution Reduction Programs in the EPL (see Section 4.4). These PRP studies are now complete and have informed the current solution outlined in this REF.

Section 45 of the POEO Act outlines matters the EPA are to consider when reviewing a licence variation application. We have included these in Appendix B - Consideration of s45 of the .

5.2.1 Environmental planning instruments and other key legislation

The environmental planning instruments in Table 9 are relevant to the proposal. Table 10 provides a summary of key environmental legislation considerations relevant to the proposal.

Table 9 - Consideration of environmental planning instruments relevant to the proposal

Environmental Planning Instrument	Relevance to proposal
Wollondilly Local Environmental Plan 2011 (Wollondilly LEP)	The proposal is located on land zoned RU2 rural landscapes. Remembrance Driveway is zoned as special infrastructure (SP2). We do not require approval from Wollondilly Shire Council as the proposal is permissible without development consent under the ISEPP.
State Environmental Planning Policy (Infrastructure) 2007 (ISEPP)	Clause 106 permits development by or on behalf of a public authority for a 'sewerage reticulation system' without consent on any land and a 'sewerage treatment plant' on land in a prescribed zone. According to the *Standard Instrument – Principal Local Environmental Plan*, a 'sewerage treatment plant' is defined as a building or place used for the treatment and disposal of sewage, whether or not the facility supplies recycled water for use as an alternative water supply. A 'sewerage reticulation system' is defined as a building or place used for the collection and transfer of sewage to a sewage treatment plant or water recycling facility for treatment, or transfer of the treated waste for use or disposal. The proposal involves development of a sewerage reticulation system and work on a sewerage treatment plant in a prescribed zone (RU2 rural landscape). As Sydney Water is a public authority, the proposal is permissible without consent.
State Environmental Planning Policy (Koala) 2019	Koala searches were conducted by ecologists throughout the study area in 2019, however, none were recorded, and the vegetation within the study site contains limited habitat for koalas (EcoLogical, 2020). The proposal does not require consent under this SEPP.
Sydney Regional Environmental Plan No. 20 – Hawkesbury Nepean River (No. 2 - 1997 (SREP 20)	The proposal is located on land to which the SREP 20 applies. The proposal does not require consent under the SREP 20. However, as a public authority, Sydney Water is required to consider the matters listed under Clauses 5 and 6 that apply to a proposal – these are addressed in Appendix C.

Table 10 - Consideration of key environmental legislation

Legislation	Relevance to proposal	Permit /approval Timing and responsibility
Environmental Planning and Assessment (EP&A) Act 1979	Sydney Water is the proponent and determining authority under this Act. The proposal does not require development consent, and is not classified as State Significant Infrastructure. We have assessed this proposal under Division 5.1 of the EP&A Act. This REF has concluded that the proposal is unlikely to have a significant impact on the environment.	REF Pre-construction, Sydney Water
Protection of the Environment Operations (POEO) Act 1997	The Picton WRP operates under EPL 10555. The current EPL specifies conditions including effluent quality limits, licenced discharge points, recycled water utilisation area and precautionary discharge regime (refer to Section 2.2.1). This proposal includes expansion of the recycled water network to offsite agricultural properties. As these properties are privately owned, they will not be included in Sydney Water's EPL. We will design and install the system to ensure no off-site impacts from the use of recycled water on these properties. The farmer will need to operate the system to comply with section 120 of the POEO Act, which prohibits the pollution of waters. This can be achieved by operating the system in accordance with a RWQMP (refer to Section 6.2.3). We will be submitting a licence variation application to the EPL in early 2021, seeking additional discharge to waterways.	EPL variation Prior to operation, Sydney Water
Biodiversity Conservation (BC) Act 2016	Schedules 1 and 2 of the BC Act list terrestrial species, populations and ecological communities threatened in NSW. We are required to assess impacts to the listed items and complete a 'test of significance'. Minor vegetation clearing to two threatened ecological communities (TEC) at Picton farm is needed and a test of significance has been completed for each TEC (refer to Section 6.4). The assessment found the proposal is unlikely to have a significant impact on the TEC and a Species Impact Statement is not required.	none N/A
National Parks and Wildlife (NPW) Act 1974	The proposal will not directly or indirectly impact any known Aboriginal archaeological sites, objects or places. An Aboriginal due diligence assessment was prepared for the works which concluded that impacts are unlikely, an Aboriginal Heritage Impact Permit (AHIP) is not required and the works can proceed with caution (see Section 6.8).	none N/A

Legislation	Relevance to proposal	Permit /approval Timing and responsibility
Heritage Act 1977	The proposal will not directly or indirectly impact the heritage significance of any non-Aboriginal heritage listed items. The recycled water pipeline will go through a locally listed heritage item 'Koorana Farm, outbuilding and tree' and the Nepean discharge pipeline will be constructed near locally listed 'Maldon Weir'. The proposal will not negatively impact on the heritage significance of these items (Section 6.7).	none N/A
Fisheries Management (FM) Act 1994	Stonequarry Creek and the Nepean River are mapped as Key Fish Habitat under the FM Act. The proposal does not block or impede fish passage, however, a permit may be required under Part 7 of the FM Act to construct the Nepean River discharge pipeline.	Notification to DPI- Fisheries/ permit Pre-construction, Sydney Water
Water Act 1912/ Water Management Act 2000	Geotechnical investigation during concept design indicates that it is unlikely the works will intercept groundwater. As such, a Water Access Licence (WAL) under this Act is not required. This will be confirmed during detailed design.	none N/A
Roads Act 1993	The proposal involves crossing of one road, Remembrance Driveway, which is owned by Council. The crossing is likely to be via underbore to minimise impacts. A Road Occupancy Licence (ROL) will need to be obtained from council for any lane closures or impact to this road.	ROL (if required) Pre-construction, Contractor
Mine Subsidence Act 1928	As the proposal is located within the Picton mine subsidence area, the design will need to be approved by Subsidence Advisory (NSW).	SA approval Concept design, Sydney Water
Environment Protection and Biodiversity Conservation (EPBC) Act 1999	The EPBC Act protects nationally significant animals, plants, habitats and places. There are 9 'matters of national environmental significance' (MNES) to be considered under the EPBC Act. Two threatened ecological communities located on Picton farm are listed under the EPBC Act. A significance test was prepared to assess potential impacts (see Section 6.4) and these concluded impacts are likely to be minor. Referral to the Commonwealth Department of Agriculture, Water and the Environment is not required.	none N/A

6 Environmental assessment

The potential environmental aspects and impacts associated with construction and operation of the proposal are identified in this section as well as safeguards to minimise these. The construction safeguards will be incorporated into contract documents and a Construction Environmental Management Plan (CEMP) (or similar) to be developed by the Contractor prior to commencement of work. Operational safeguards mainly relate to waterway health monitoring, and will be incorporated into Sydney Water's extensive monitoring program already in place for Stonequarry Creek and the Nepean River. Any operational safeguards relating to application of recycled water to land will be incorporated into a Recycled Water Quality Management Plan (RWQMP).

6.1 Topography, geology and soils

Existing environment

Off-site reuse – Farms 1 and 2

Both Farms 1 and 2 occur on the Blacktown and Picton soil landscapes and an area of Luddenham soil landscape is located to the west at Farm 2. Residual soils are derived from Ashfield Shale. Topography varies across Farms 1 and 2 with some areas of high and steep slopes. Both farms are also located in the Bargo mine subsidence zone.

Land capability assessments were completed for both Farm 1 (RMCG, 2019a) and Farm 2 (RMCG, 2019b) and included a review of soil chemistry tests. Results indicated that at both farms:

- soils are moderately well drained and permeable and a lack of mottles indicated no periodic waterlogging
- infiltration rate is predicted to be slow, with run-on and run-off being high
- soils are acidic (however the farms are not located in areas with potential acid sulphate soil risk)
- soil salinity and sodicity are both very low, which is ideal for recycled water irrigation sites
- very low to moderate phosphorous concentrations and low ammonium-nitrogen levels mean that both farms would benefit from the addition of phosphorous fertiliser and possibly nitrogen fertilisers to maximise pasture growth.

Land capability assessments concluded that both Farms 1 and 2 are suitable to use recycled water for irrigation in a sustainable manner. The main limitation at both farms is topography, however controls such as the use of sprinkler irrigation and buffer distances would minimise the potential for run-off impacts. Risks from run-off are not uncommon for recycled water irrigation schemes, and can be managed through standard safeguards.

There are no known contaminated sites through which the proposed recycled water main would intersect.

Picton WRP and farm

The Picton WRP and farm are located on residual Blacktown soil landscapes with localised alluvial deposits associated with the adjacent waterways to the north, east and south, and drainage channels located at Picton farm. Residual Blacktown soils are derived from Ashfield Shales, and Hawkesbury Sandstone is the dominant geological bedrock adjacent to waterways.

The WRP and farm are located on undulating terrain, however the areas used for irrigation are located on relatively flat terrain (~160 m AHD). To the north east and east, the farm features steep slopes towards the gullies through which Stonequarry Creek (elevations in the order of ~90-100 m AHD) and the Nepean River flow (elevations in the order of ~80-90 m AHD). The WRP and farm are in the Bargo mine subsidence zone. Fill material is likely to be encountered at the WRP and known to occur around the Eastern and Western dams. There is the potential that contaminated fill may be encountered at the WRP, including asbestos pipes. However, soil tests conducted by Aurecon Arup (2020a) did not indicate contaminated soils along the alignment of the proposed discharge pipeline to the Nepean River.

The area is not mapped in an area with the potential for acid sulphate soils. There are low to moderate salinity risks mapped along pipeline alignments and the Eastern and Western dams.

Discharge locations

The existing discharge channel to Stonequarry Creek is a steep channel 120 m long with an approximate grade of 12% that is actively eroding. The bed and banks are a mixture of alluvial sediments consistent with a dispersive clay, sandstone boulders and bedrock outcrops.

The proposed new discharge main to the Nepean River is located on relatively shallow grade from the Eastern Dam at Picton farm. The steep slope from Picton farm (HDD entry location at ~ 160m AHD) to the Nepean River downstream of the Maldon Weir (82m AHD) requires a drilling grade of about 12% through sandstone bedrock.

Both locations are not mapped areas with the potential for acid sulphate soil risk or salinity. Both locations are located within the Bargo mine subsidence zone.

Potential impacts – construction

All proposed works are in mine subsidence zones. Approval from Subsidence Advisory NSW would be obtained for the proposal. Consultation is ongoing and designs have addressed initial considerations and guidelines for work within mine subsidence areas.

Except for the HDD portion of the discharge main to the Nepean River, most of the proposed works require shallow excavations and grading in previously disturbed areas. There is a potential to encounter contaminated materials within areas of fill, particularly at the WRP. Shallow excavations may require temporary open pits and minor stockpiling which, if inappropriately handled may result in erosion and sedimentation to surrounding land and drainage lines. Excavations will be backfilled with excavated material, where suitable, or imported clean fill.

Horizontal directional drilling (HDD) has the potential for frac-outs, which is the temporary loss of drilling fluids into the environment (soils or nearby waterways). HDD to install the new discharge

pipeline near the Nepean River will be appropriately managed by experienced drilling contractors to ensure no impacts to the waterway occurs.

Potential impacts – operation

The works are not proposing to permanently change the surface topography of the area. Following construction, the overland drainage patterns would be similar to existing patterns.

Steep slopes at Farms 1 and 2 have the potential for run-off following irrigation. Run-off would be managed by operational controls in the RWQMP including using spray irrigation and having drainage lines leading to run-off control structures with online monitoring. A soil-moisture deficit irrigation method would be used so irrigation only occurs when soil moisture levels enable infiltration, minimising the likelihood of overland run-off.

The proposal includes rehabilitation of the existing discharge channel at Stonequarry Creek, to prevent future erosion and reduce sedimentation to Stonequarry Creek.

The proposed pipeline to the Nepean River would be fixed or installed into a trench in the rock surface with the outlet submerged in the river. The area would be restored to match pre-construction conditions as much as possible. There is not expected to be any permanent change to the surrounding soils, geology or topography as a result of the operation of the new discharge pipeline.

Safeguards

We will implement the following safeguards during construction and operation to minimise any impacts to soils, topography and geology.

- prevent sediment moving off-site in accordance with *Managing Urban Stormwater, Soils and Construction, Volume 1 and 2A* (Landcom 2004 and DECC 2008), including:
    - developing a Soil and Water Management Plan (SWMP) as part of the CEMP
    - diverting surface runoff away from disturbed soil and stockpiles
    - installing sediment and erosion controls before construction starts
    - reusing topsoil where possible and stockpile separately
    - inspecting controls daily and immediately after rainfall
    - rectifying damaged controls immediately
    - removing controls once surfaces have been stabilised, including removing trapped sediment in drainage lines
- minimise ground disturbance and stabilise disturbed areas progressively
- ensure imported material is certified for intended use and is free from contamination including asbestos

- stop work in the immediate vicinity of suspected contamination. Indicators of contamination include discoloured soil, anthropogenic fill material, asbestos, strong chemical or petrol odours and leachate
- prepare a Waste Management Plan as part of the CEMP to guide waste classification and management activities, to segregate waste of different classification, and identify opportunities to manage materials under the resource recovery frameworks. The plan would identify the type and location of known/potential contamination, management and disposal measures
- stop work during heavy rainfall or in waterlogged conditions when there is a risk of sediment loss off site
- sweep up any sediment/soil transferred off site at least daily, or before rainfall
- eliminate ponding and erosion by restoring worksites to the pre-works condition
- rehabilitate the existing discharge channel at Stonequarry Creek and the new pipeline/ outlet at Nepean River; use appropriate rock armouring as needed
- outline measures as part of the CEMP to avoid impacts from HDD drilling fluids including:
    - contain and monitor drilling fluids at entry/ exit points
    - identify and manage potential frac-outs
    - use of suitable biodegradable drilling fluids
- help prepare a RWQMP and provide training support to Farms 1 and 2 operators
- install operational controls for the off-site reuse to minimise the risk of overland run-off, including:
    - spray irrigation
    - run off control structures with online monitors
    - use of soil-moisture deficit irrigation method.

6.2 Human health

Potential impacts

Potential hazards in wastewater include bacteria, viruses, protozoa and helminths[1] which may cause illness to humans if exposed. Bacteria and helminths may also pose risks to animals consuming irrigated fodder. Recycled water produced by Picton WRP is required to meet target recycled water quality criteria as set out in the AGWR prior to delivery off-site for agricultural reuse,

[1] *Helminths are parasitic wormsm however helminth infections are not common in most parts of Australia. Monitoring for protozoa can be used as a reference for helminths as helminths, if present would be lower in numbers than protozoa. They are readily removed by physical filtration and detention time (AGWR, 2006).*

and more stringent criteria for discharge to waterways which may be used by people, for example for swimming.

Recycled water for irrigation

At Picton WRP, recycled water used for irrigation undergoes secondary treatment. This proposal includes an upgrade to the existing UV system and a new chlorination system. These upgrades will ensure we meet AGWR requirements for recycled water use for off-site irrigation. Should monitoring at the WRP indicate the required water quality criteria have not been met, the recycled water will be treated further.

Sydney Water has successfully operated recycled water schemes for many years with no public health impacts identified. Sydney Water's Picton farm scheme has operated for over twenty years. Examples of other recycled water irrigation schemes in operation nearby include the Elizabeth MacArthur Agricultural Institute and many Council parks and golf courses.

When assessing human health risks, the dose response and exposure scenarios should be considered. The dose response refers to the probability that people will be infected by pathogens from exposure to a quantity of recycled water. It can be influenced by many host factors including immune status, pre-existing health conditions and nutrition. No vulnerable groups are anticipated to be engaged in the application of recycled water for irrigation water, so the standard risk levels applied in the AGWR based on the exposure of healthy adults apply. Exposure to recycled water may occur via the planned uses of the water, or by accidental ingestion or inhalation via droplets from sprays, or dermal exposure, and accidental mis-use. Receptors would primarily be farm operators. It is considered unlikely/rare for public pedestrians to be walking around the farm boundaries of Farms 1 and 2, and there should be no members of the public on the properties. Human health risks from the irrigation of crops that are not for human consumption can be largely reduced or removed by implementing preventative measures that focus on minimising human exposure to the water (AGWR, 2006).

A topical risk during the current COVID-19 pandemic is the causative virus, SARS-CoV-2. Sydney Water has had access to expert advice nationally and internationally since the beginning of the pandemic. The COVID-19 coronavirus survives poorly in wastewater and is highly susceptible to chlorine and UV disinfection as well as inactivation by sunlight. The risk from COVID-19 in the Picton Scheme is lower than for other viruses and with all the controls in place is considered very low.

As part of its management of recycled water schemes, Sydney Water consults with NSW Health as the public health regulator. An expert-facilitated risk review workshop for the expansion of the Picton scheme was held in 2019 with NSW Health present, and further consultation with NSW Health will occur as planning and implementation progresses. Discussions were also held in 2019 with DPIE – Agriculture to scope the management of animal health risks and align current understanding of these risks in the local context as part of the planning process.

Recycled water for discharge to waterways

Existing environment

The Hawkesbury-Nepean River system is an important recreational resource, offering the community many opportunities to walk, swim, fish and observe nature (Wave Consulting and WSC, 2020).

Faecal coliforms found in waterways are an indicator that there are upstream inputs of animal and/or human waste. Both stormwater runoff from urban areas and wastewater contain faecal coliforms. An increase in faecal coliforms can impact the swimmability of a waterway.

The section of Stonequarry Creek downstream of the WRP discharge point before it meets the Nepean River is approximately 1.3 km long. This stretch of Stonequarry Creek is largely inaccessible to the public due to the steep terrain and storm debris from previous flood events.

Downstream of the confluence with Stonequarry Creek (near site N91 refer to Figure 10), there is easy public access to the Nepean River via a marked track down the escarpment to the waterway. The site consists of a wide slow flowing deep pool with sandy substrate, making it a popular for recreational activities and a highly valued swimming spot for the local community (Figure 8).

Figure 8 - Nepean River at Maldon Bridge

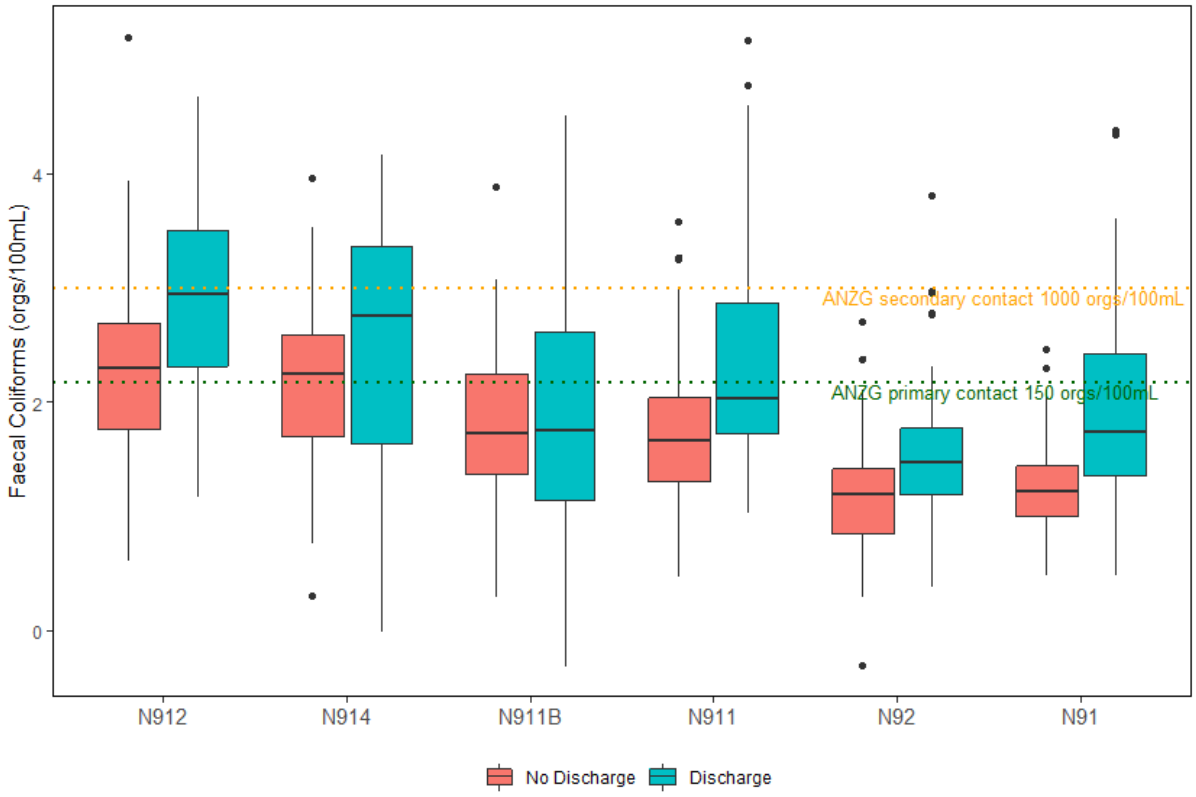
The existing conditions in Stonequarry Creek and the Nepean River have been monitored over the last five years as part of Sydney Water's water quality monitoring program (July 2014 - May 2019). Results of the faecal coliform monitoring are shown in Figure 9 and show that:

- faecal coliform levels were similar at upstream (N911B) and downstream sites (N911) of the discharge point in Stonequarry Creek for both discharge and non-discharge conditions
- faecal coliform levels were more elevated at further upstream sites in Stonequarry Creek near the Picton township (N912) and in Redbank Creek (N914), suggesting inputs from other catchment sources such as stormwater runoff
- faecal coliform levels were higher at the Nepean River site downstream of the confluence of Stonequarry Creek (N91) in comparison to upstream site (N92) in discharge conditions,

however, the overall impact might be related to other localised sources or catchment runoff during wet weather

- median values of faecal coliform where all within the primary contact guideline of 150 orgs/ 100mL (ANZG, 2018).

Figure 9 – Existing conditions - faecal coliform densities across monitoring sites



Potential impacts

A new discharge point is proposed at the Nepean River. The recycled water to be discharged is tertiary treated and an upgraded UV system will be installed as part of this proposal, which will further improve the quality. The proposed discharge of recycled water to the Nepean River would be small (around 2.35 ML/day) compared with the total Nepean River flow.

The small additional volume to be discharged into either Stonequarry Creek or directly into the Nepean River as a result of this proposal, is unlikely to have an impact on human health or impact the recreational values of the Nepean River. The risk of impacting human health from existing or increased discharges to Stonequarry Creek is considered negligible.

Safeguards

We will implement the following safeguards during operation to minimise impacts to human health for recycled water use on off-site farms:

- achieve performance for removal of pathogens at the WRP before delivery of recycled water for off-site reuse
- work with the farm operators to prepare a RWQMP in consultation with NSW Health for their off-site reuse scheme
- establish operational controls in the RWQMP to further reduce exposure risks, such as
    - using spray drift control
    - avoiding public access during irrigation and potentially limiting contact thereafter
    - establishing buffer zones of 25-30 m
- include occupational controls in the RWQMP based on Sydney Water's extensive experience managing risks at Picton farm to further reduce the potential for exposures
- we will continue to manage animal health risk under the AGWR with updated advice from DPIE-A.

For discharge of recycled water to waterways used for recreation, the following safeguards will be implemented to minimise impacts to human health:

- continue water quality monitoring program to assess any changes in nutrients, including faecal coliform in Stonequarry Creek and the Nepean River, associated with increased discharges
- include additional microbial water quality indicators *E. coli* and *intestinal enterococci* to the water quality monitoring parameters to further clarify risk to swimming

6.3 Waterway health

Construction impacts

The proposed Nepean pipeline will be constructed as a submerged pipe at the location shown in Figure 26. In order to construct the pipe and attach it to rock, a temporary coffer dam and dewatering of a small section of the Nepean River may be required during construction. This will not block fish passage as the majority of the width of the river in this section will remain free from obstruction. If a temporary coffer dam is required it will be designed in accordance with the '*Policy and guidelines for fish habitat conservation and management'* (DPI, 2013).

Due to difficult terrain, there will be limited access for large construction plant and equipment. Installation of the discharge pipe is likely to be by scaffold and manual labour, with small machinery if access permits. There is a risk of the Nepean River levels rising during heavy rainfall and inundating the construction work area. Safeguards will be implemented to ensure these flooding risks can be managed.

Operational impacts - introduction and methodology

Healthy waterways have important ecological values, as well as providing a range of social and economic benefits to communities. Waterways have a range of threats such as stormwater runoff, wastewater inputs, clearing of vegetation, sedimentation and altered flow regimes, all of which can lead to degradation and loss of these values.

The Picton catchment includes agricultural, industrial, rural and urban land uses and catchment runoff (stormwater) from these transports pollutants, including nutrients and bacterial contamination to the waterways.

This section describes the potential impacts of the proposal on the two receiving waterways being Stonequarry Creek and the Nepean River for key indicators of waterway health being:

- hydrology (creek flow)
- water quality
- aquatic ecology (macroinvertebrates, macrophytes and other aquatic species).

To assist in understanding potential waterway health impacts, flow and water quality modelling for Stonequarry Creek in the broader Nepean River catchment has been undertaken (Alluvium, 2020). The model was developed using the eWater Source software and was calibrated to observed data then used to model the potential future discharge scenarios. Four different scenarios have been modelled (refer to Table 2) and have been assessed to determine the varying impacts resulting from each. Simulated flow data for relevant locations up and downstream of the two considered discharge locations were generated by the model.

Water quality, fish and macroinvertebrate data has been collected at key monitoring sites by Sydney Water over the last six years and this data has been used to inform the waterway health assessment. These sites and the data collected are shown in Table 11 and Figure 10.

Existing environment generally

Stonequarry Creek is a tributary of the Nepean River, with a catchment area of approximately 84 km^2. Stonequarry Creek receives inflows from four main tributaries: Racecourse Creek from the east, Crawfords Creek from the north, and Cedar and Mathews Creek to the west of Picton. The Stonequarry Creek catchment is characterised by grassed hills and areas of moderate to dense tree cover, with urban areas within the Picton township and parts of Thirlmere to the south (Aurecon Arup, 2020b).

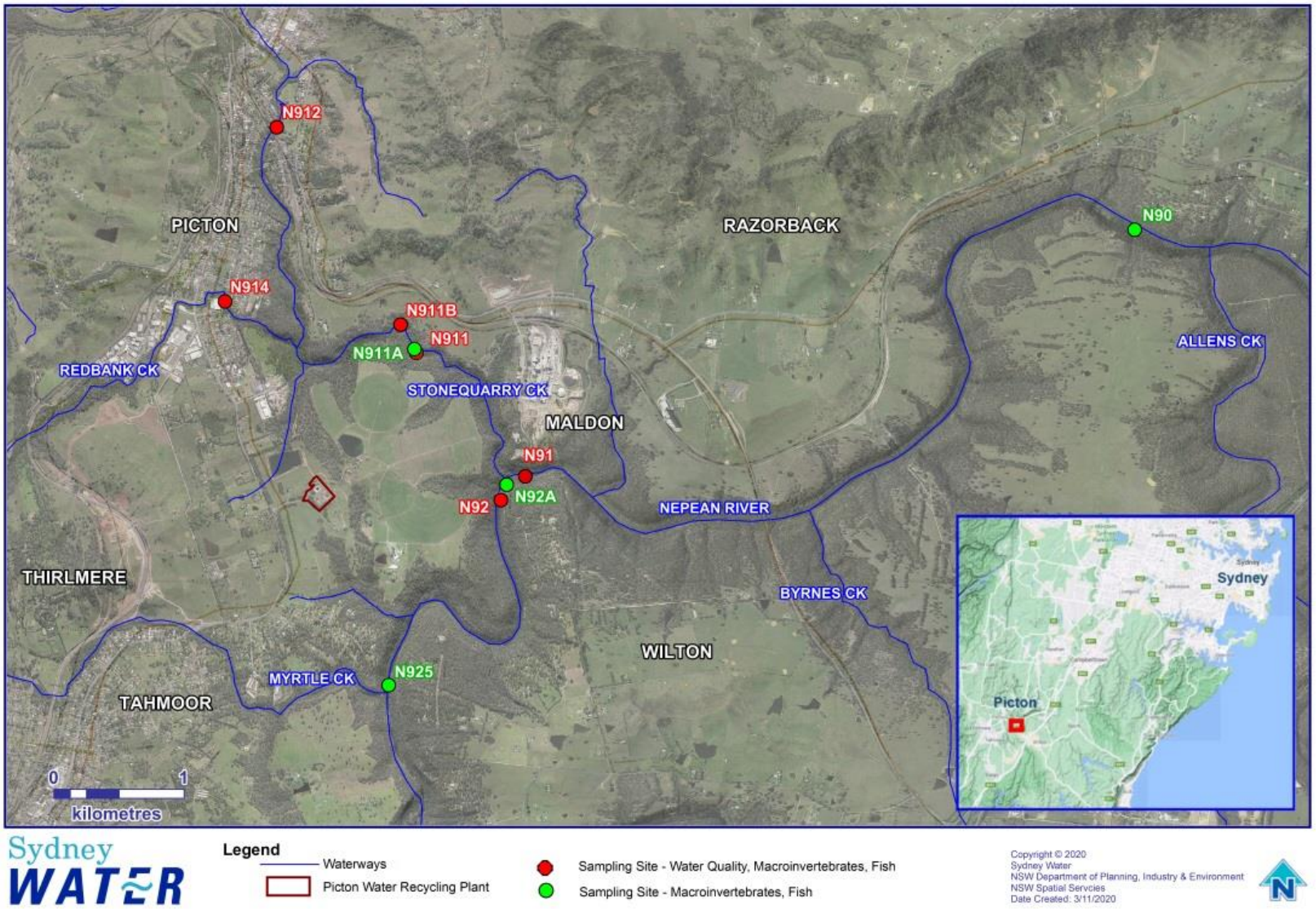
Upstream of Picton WRP, the banks of Stonequarry Creek comprise of native and exotic vegetation, and the creek itself is a series of shallow pools. Redbank Creek (a small tributary of Stonequarry Creek which discharges approximately 1.2 km upstream of the WRP discharge location) is relatively narrow and slow flowing, receiving stormwater from the surrounding area. Creek banks are eroded and covered by exotic vegetation. Downstream of Picton WRP, Stonequarry Creek banks are heavily disturbed, being a mix of bare earth, boulders and native and exotic vegetation. The Picton WRP precautionary discharge point is in a steep gully consisting of narrow deep pools with small riffle sections.

The reach of the Nepean River between Maldon Weir and the confluence with Stonequarry Creek is a series of shallow pools and a small riffle fed by the weir. Sandstone boulders dominate the banks with native and exotic vegetation. Downstream of the Stonequarry Creek and Nepean River confluence, there is a wide slow flowing deep pool used for public recreation. The eastern bank is disturbed, the western bank is less so, as it is harder to access. The banks are a mixture of sandstone outcrops with native and exotic vegetation.

Table 11 - Water quality and macroinvertebrate field sampling sites

Site	Description	Relative to discharge
Fish, macroinvertebrates and water quality		
N914	Redbank Creek, opposite the swimming complex	Upstream tributary creek to Stonequarry Creek
N912	Stonequarry Creek at the end of Webster Creek	Upstream from current discharge point
N911B	Stonequarry Creek at Picton farm, further upstream of discharge gully	Immediately upstream from current discharge point
N911	Stonequarry Creek at Picton farm, downstream of precautionary discharge point	Downstream from current discharge point
N91	Nepean River at Maldon Bridge, downstream of Stonequarry Creek confluence	Downstream of Stonequarry Creek and discharges
N92	Nepean River at Maldon Weir, upstream of Stonequarry Creek (upstream of weir)	Upstream from proposed Nepean discharge point
Macroinvertebrates only		
N90	Nepean River downstream of Maldon Bridge	Downstream of Stonequarry Creek and discharges
N911A	Stonequarry Creek at Picton farm, upstream of precautionary discharge point	Upstream from current WRP discharge point
N92A	Nepean River at Maldon Weir, upstream of Stonequarry Creek (downstream of weir)	Upstream from proposed Nepean discharge point
Fish only		
N925	Nepean River upstream of Maldon Weir, downstream of Myrtle Creek	Upstream from current discharge point.

Figure 10 - Water quality and macroinvertebrate field sampling sites



6.3.1 Hydrology

Existing environment

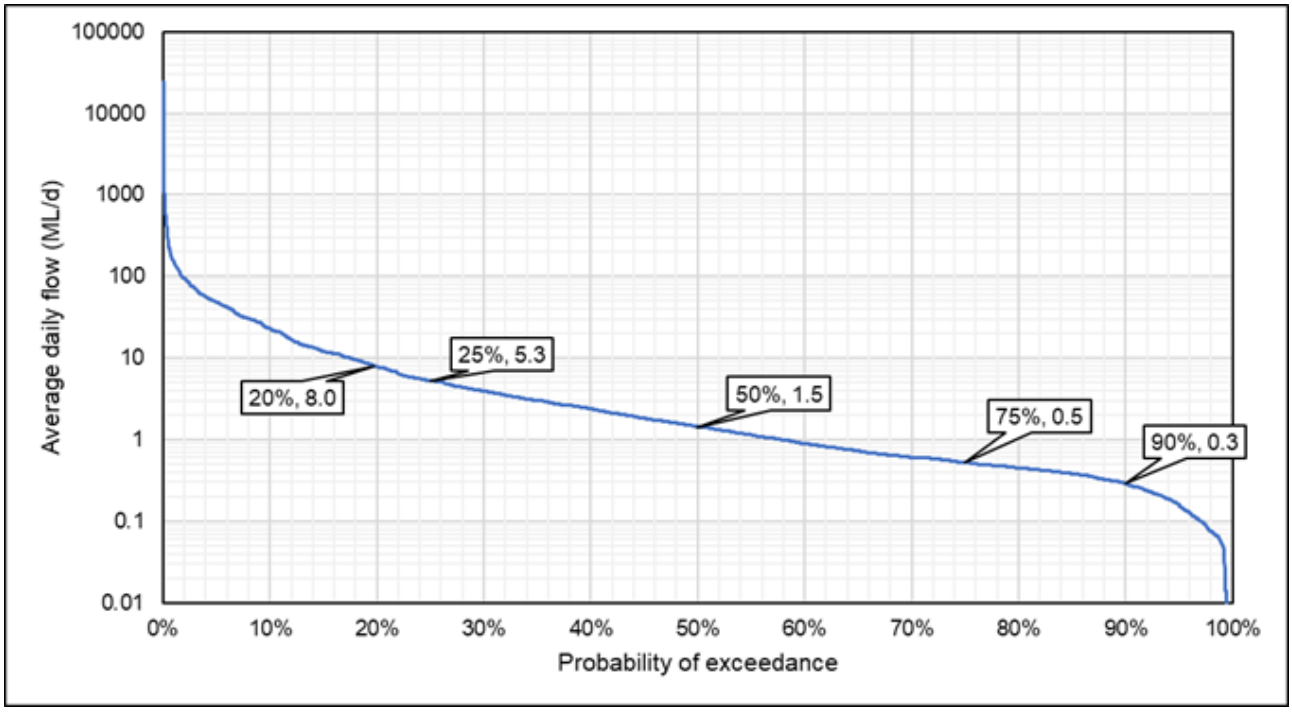
Stonequarry Creek

The hydrology (flows) of Stonequarry Creek can vary significantly. To determine the existing hydrology of Stonequarry Creek, data from two stream flow gauges was obtained:

- WaterNSW gauge - near the Picton township, approximately 3 km upstream of the WRP discharge point, data has been collected at 15 minute intervals since 1990
- Sydney Water gauge - approximately 60 metres downstream of the Picton WRP discharge point, with data collected at 15 minute intervals since 1997.

Daily average WRP discharge rates from January 2014 to July 2020 were subtracted from the average flowrates recorded at the Sydney Water flow gauge in Stonequarry Creek to determine the upstream hydrology conditions in Stonequarry Creek. These are shown in Figure 11.

Figure 11 - Stonequarry Creek - Flow duration curve (Jan 2014 – July 2020)



Source: Aurecon Arup, 2020b, Sydney Water Stonequarry Creek flow gauge

Key percentile values for Stonequarry Creek flows are noted on the graph and are listed below for the period assessed:

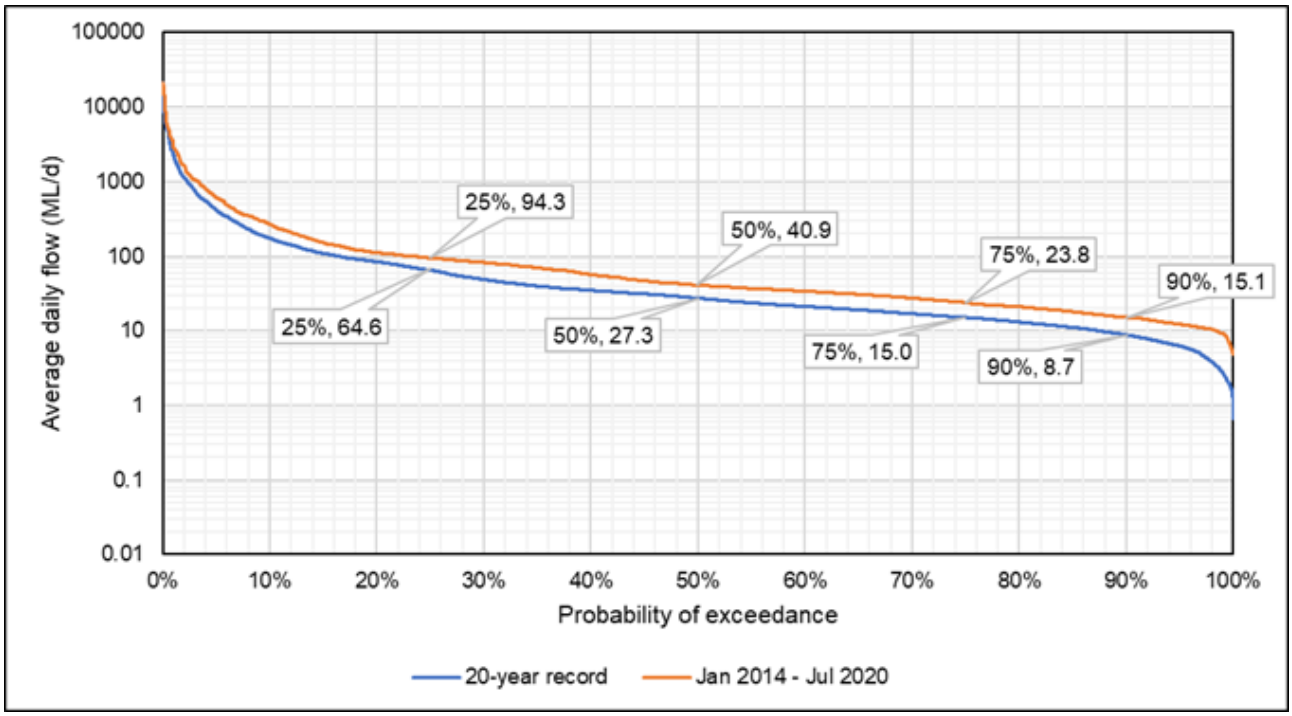
- High flows (> 5.3 ML/d) occurred 25% of the time
- Median flows (~1.5 ML/d) occurs 50% of the time
- Low flows (<0.5 ML/d) occurs 25% of the time

- Very low flows (<0.3 ML/d) occurs 10% of the time
- 8 ML/day (current requirement for precautionary discharge in EPL) occurs around 20% of the time.

Nepean River

The hydrology of the Nepean River in the area around Picton WRP and farm has a more continuous flow. The existing hydrology of the Nepean River near Picton can be obtained from the gauge operated by WaterNSW. The gauge is located at Maldon Weir, approximately 150 metres upstream of the confluence with Stonequarry Creek and adjacent to the proposed new discharge point into the Nepean River. The gauge has been active since July 1973, and the 20-year record (August 2000 – July 2020) has been assessed and compared to the corresponding period available for the Stonequarry gauge operated by Sydney Water for the last six years (January 2014 – July 2020).

Figure 12 – Nepean River, Maldon Weir Gauge - Flow duration curves



Source: Aurecon Arup, 2020b, WaterNSW Maldon Weir flow gauge

Key percentile values representing Nepean River flows, near Maldon Weir, are noted on the graph and are listed below for a six year period assessed:

- High flows (> 94 ML/d) occurred 25% of the time
- Median flows (41 ML/d) occurs 50% of the time
- Low flows (<24 ML/d) occurs 25% of the time
- Very low flows (<8.7 ML/d) occurs 10% of the time

The curves indicate a general increase in river flows over the most recent six year period compared to the complete 20 year dataset. This could be because of wetter climatic conditions, changes in catchment land use or the addition of environmental releases in recent years.

Potential impacts

USIA methodology

Diverse and varying flows within a river or creek support the ecology in different ways.

An assessment of potential impacts of the baseline (existing) scenario and the three possible future discharge scenarios on the hydrology of Stonequarry Creek and the Nepean River was undertaken (Aurecon Arup, 2020b). To assess the impact on the hydrology of waterways, several critical flows were considered, these being overbank flows, high flows, low flows, freshes (short-duration flow events that submerge the lower parts of the river channel) and cease to flow/ zero flow conditions. Potential impacts associated with these flow categories were then considered using the methods recommended in the *Stormwater and Outflow Planning Controls for Waterway Health: Applying the Urban Streamflow Impact Assessment (USIA)* (Streamology Pty Ltd, 2019).

To inform the waterway health assessment several of the hydrologic metrics relevant to urban settings as recommended in the USIA methodology were considered, including:

- USIA1 Mean annual flow volume (MARV)
- USIA2 Mean duration of zero flow periods (average over all zero flow events)
- USIA3 Total duration of zero flow periods (as a portion of the total flow period assessed)
- USIA5 Frequency of freshes (flows > 3 times median flow)
- USIA6 Total duration of freshes (flows > 3 times median flow)

The proposed metrics were applied by considering the proportional change due to the proposed activity (i.e. increase in recycled water discharge). The following generic impact classes were defined based on the percentage of change from the current condition and corresponding risk of degrading or losing creek value:

- Low risk: <20% change in creek value (green)
- Moderate risk: 20-50% change in creek value (orange)
- High risk: >50% change in creek value (red)

USIA results

The predicted risk levels related to potential creek degrading due to the additional discharge scenarios were assessed against the USIA metrics comparative to upstream conditions. Results in Table 12 indicate:

- Stonequarry Creek – all the USIA metrics assessed indicate a low risk of potentially degrading or losing creek value, ranging from 3-12% of relative change.

- Nepean River – all the USIA metrics assessed indicate a low risk of potentially degrading or losing creek value, ranging from 1-9%.

Table 12 – Potential hydrology impacts - USIA metrics comparison

Metric		Units	SQ upstream	SQ downstream		Nepean upstream	Nepean downstream	
				Scenario 1	Scenario 2		Scenario 3	Scenario 4
USIA1	Mean Annual Flow Volume	ML/yr ML/d	4,086 11.19	4,578 12.53	4,691 12.84	59,026 162	59,664 163	59,886 164
USIA2	Mean duration of zero flow periods (<0.001 ML/d)	days	8 (1 event in 28 yrs)	none	none	4	6	none
USIA3	Percent duration of zero flow periods	%	0.08	none	none	0.25	0.11	0.00
Baseflow*	Baseflow index (ratio of baseflow to total flow)	%	7.9	7.4	8.0	10.6	10.6	11.0
	3 x median flow (freshes threshold)	*ML/d*	*5.8*			*61.8*		
USIA5	Frequency of freshes (flows > 3 times median)	events/yr	18.8	19.4	19.8	7.8	7.6	7.6
USIA6	Total duration of freshes (Percentage of time > 3 x median)	%	28.4	29.8	31.2	23.9	24.3	24.4
Low risk of degrading or losing creek value **Moderate** risk of degrading or losing creek value **High** risk of degrading or losing creek value								

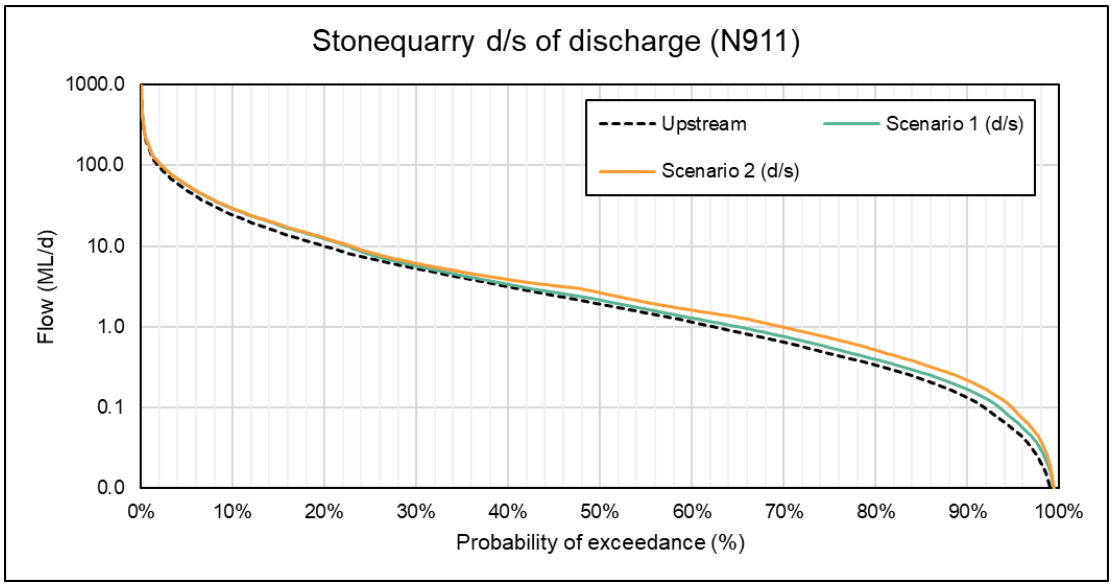
Source: Aurecon Arup, 2020b

Flow duration curves

The flow duration curves representing modelled results for the upstream (u/s) and downstream (d/s) conditions for Scenario 1 and 2 in Stonequarry Creek are shown in Figure 13 and indicate:

- minimal divergence between the upstream and Scenario 1 (baseline) flow regime
- a more apparent divergence is observable when comparing Scenario 1 and 2, specifically for flows less than 2 ML/ day.

Figure 13 – Stonequarry Creek flow duration curve - Scenario 1 and 2

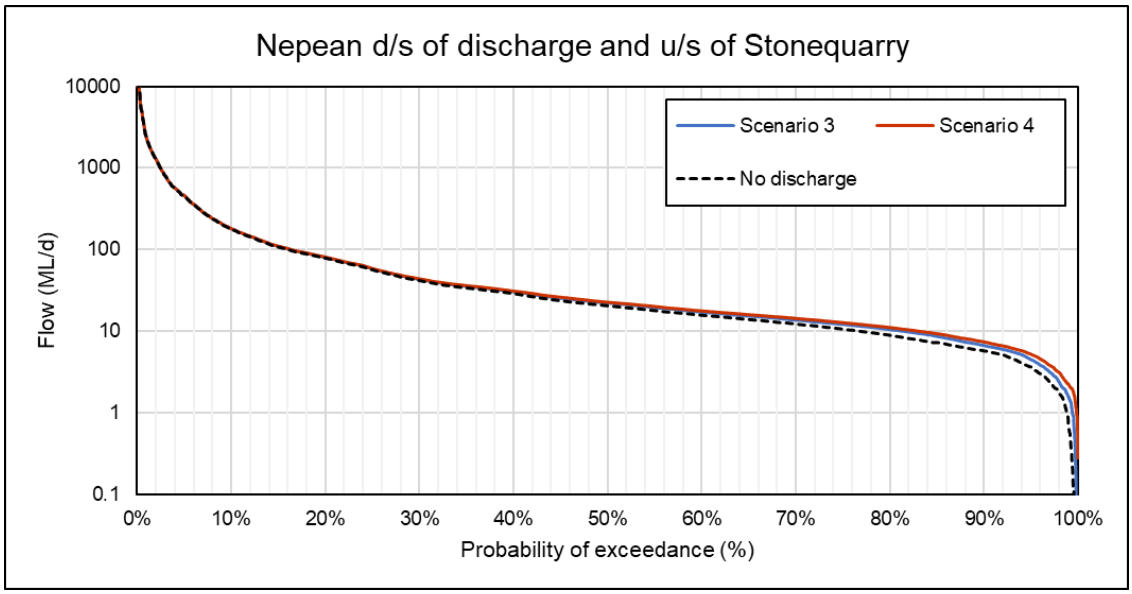


Source: Aurecon Arup, 2020b

The flow duration curves representing the modelled flows for the upstream and downstream conditions for Scenario 3 and 4 in the Nepean River are shown in Figure 14 and indicate:

- minimal divergence between the 'no discharge' and both Scenario 3 and 4 flow regimes for flows above 10ML/ day
- a small divergence between Scenario 3 and 4 is also apparent for flows below 8ML/ day.

Figure 14 - Nepean River flow duration curve - Scenario 3 and 4



Source: Aurecon Arup, 2020b

Erosion risk

Stonequarry Creek and Nepean River are confined gully channels which flow through sandstone bedrock. They are considered to have 'low' fragility, demonstrating a low propensity to change shape, location or condition when disturbed (Aurecon and Arup, 2020b). The increased discharge has the potential to slightly increase bank erosion rates, primarily due to the increased flow rates and velocities. The hydrology and geomorphology assessment undertaken previously (AAJV, 2015) demonstrated that bank erosion as a result of increased discharge is likely to be insignificant compared to erosion during flood events. It is the larger flood events (ie. less than once a year) that have the biggest influence on the overall geomorphology of the creek. The proposed discharges contribute a relatively small proportion of these higher flow ranges.

Flooding risk

The maximum discharge rate to Stonequarry Creek during wet weather would be 15ML/ day. Estimated flows within Stonequarry Creek during flood conditions were sourced from Council's 2019 Flood Study (WSC, 2019). These results indicate that the WRP discharge will proportionally add less than 1% of the flow during a 1 in 2 year storm event.

The maximum discharge rate to the Nepean River would also be 15ML/ day. Historic (pre-environmental flows) flood frequency curves for the Nepean River at Maldon Weir were sourced and compared to this maximum discharge rate. The results suggest a flow rate of almost 100,000 ML/ day during a 1 in 2 year storm event, making the proposed Nepean discharge contribution less than 0.015%, or negligible.

Overall, there is not expected to be any significant impact to hydrological and geomorphological conditions downstream as a result of any of the discharge scenarios.

6.3.2 Water quality

Methodology

The water quality guidelines used to assess potential impacts were primarily:

- the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2000) which provide default water quality criteria, as well as
- updated Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) which provide a framework for setting site specific water quality criteria.

Both Stonequarry Creek and the Nepean River are considered slightly to moderately disturbed ecosystems under the guidelines, and so the water quality guidelines shown in Table 13 were adopted. The analytes shown in Table 13 are typically associated with wastewater discharges, and can have a potential impact on waterways.

Table 13 - Water quality guidelines for Stonequarry Creek and the Nepean River (ANZG, 2018)

Analyte	Lower SQ (N911B, N911, N912, N914) (lowland)	Nepean (N91, N92) – Pheasants Nest (80%ile)
Total nitrogen (mg/L)	0.35	0.31
Total phosphorus (mg/L)	0.025	0.010
Ammonia (mg/L)	0.02 (default guideline) 0.9 (toxicity)	0.14
Oxidised nitrogen (nitrate and nitrite as NOx) (mg/L)	0.04	0.14
Soluble reactive phosphorus/ filterable reactive phosphorus (mg/L)	0.02	0.002
Chlorophyll-a (µg/L)	3	2.3
Dissolved oxygen saturation (%)	85-110	104-109*
Conductivity (µs/cm)	125-2,200	82-94.5
Total aluminum (µg/L)	55	55
Total arsenic (µg/L)	13	13
Total boron (µg/L)	370	370
Total copper (µg/L)	1.4	1.4
Total lead (µg/L)	3.4	3.4
Total magnesium (µg/L)	1,900	1,900
Total nickel (µg/L)	11	11
Total zinc (µg/L)	8.0	8.0

* denotes 20%ile to 80%ile range

A review of existing waterway health monitoring data and modelled outputs was undertaken and a Waterway Health Technical memo was prepared (Aurecon Arup 2020c) to inform this REF. A more detailed statistical analysis of potential water quality changes is currently being prepared by Sydney Water's Monitoring, Design and Reporting team, which will inform the LVA submission to EPA in early 2021.

Existing environment

From an analysis of six years of water quality monitoring data in Stonequarry Creek and the Nepean River during both discharge of recycled water and non-discharge events, the key findings in relation to existing water quality include (Aurecon Arup, 2020c):

- total nitrogen (TN) concentrations within the proposal study area are marginally above the relevant guidelines. N911 (the site immediately downstream of the WRP discharge point) generally has TN higher than other sites
- TN exceedances were higher in both upstream and downstream sites during discharge events, which usually coincides with rainfall in accordance with the EPL precautionary

discharge regime. Therefore, TN elevation at these periods (simultaneous discharge and rain events) can be partly attributed to runoff/stormwater

- ammonia concentrations within Stonequarry Creek adjacent to the discharge point are typically within both ANZG and Nepean River reference site guidelines under all flow conditions. This indicates an improvement from upstream water quality sites and adequate assimilative capacity. During discharge conditions, sites downstream of the discharge indicated dilution of median ammonia concentrations with interaction with the Nepean River
- oxidised nitrogen median concentrations within the proposal study area are marginally above the relevant guidelines during discharge conditions. The flow and discharge categories suggest that higher oxidised concentrations are associated with higher flow and discharge
- total phosphorus concentration exceedances were higher under discharge conditions, from both upstream and downstream sites. A clear demarcation between the Stonequarry Creek and Nepean River was evident with far fewer exceedances recorded in the Nepean River catchment than the Stonequarry catchment
- chlorophyll-a concentration exceedances were typically higher under low flow conditions and higher concentrations were associated with the upper Stonequarry Creek catchment under non-discharge. Higher levels were associated with the discharge point during discharge events
- dissolved oxygen saturation for all sites did not adhere to the guidelines, ANZG or Nepean River. Noting this, the lower Stonequarry and Nepean River sites typically adhered to the ANZG range for dissolved oxygen saturation
- conductivity exceedances of the reference guidelines occurred across all sites regardless of flow category or discharge condition, however no site exceeded the ANZG guidelines. Generally, the highest median conductivity was identified from higher in the Stonequarry Creek catchment, with lower conductivity levels from the Nepean River sites
- total metal exceedances were noted predominantly for Aluminium and Zinc. Other total metals were typically within ANZG objective guidelines and were not considered as a current risk within the proposal study area.

Potential impacts

Potential future water quality associated with the discharge scenarios was calculated using the SOURCE model (Alluvium, 2020). The discharge modelling was used to:

- simulate the flow and waterway concentrations in Stonequarry Creek
- simulate the inflow, treatment, storage and use of recycled water at the Picton WRP and farm, as well as potential off-site reuse
- simulate the discharge to the two waterways under various configurations and simulate the resulting changes to water quality and creek flow.

The baseline (Scenario 1) has been modelled to reflect the existing conditions (including recent use of the EOP). Scenario 2 is a future scenario with increased WRP inflows, additional treatment, additional reuse and increased discharge to Stonequarry Creek. The upstream water quality site (N911B) is simulated in the model and provides a benchmark for comparison with the water quality simulation downstream of the discharge point (N911).

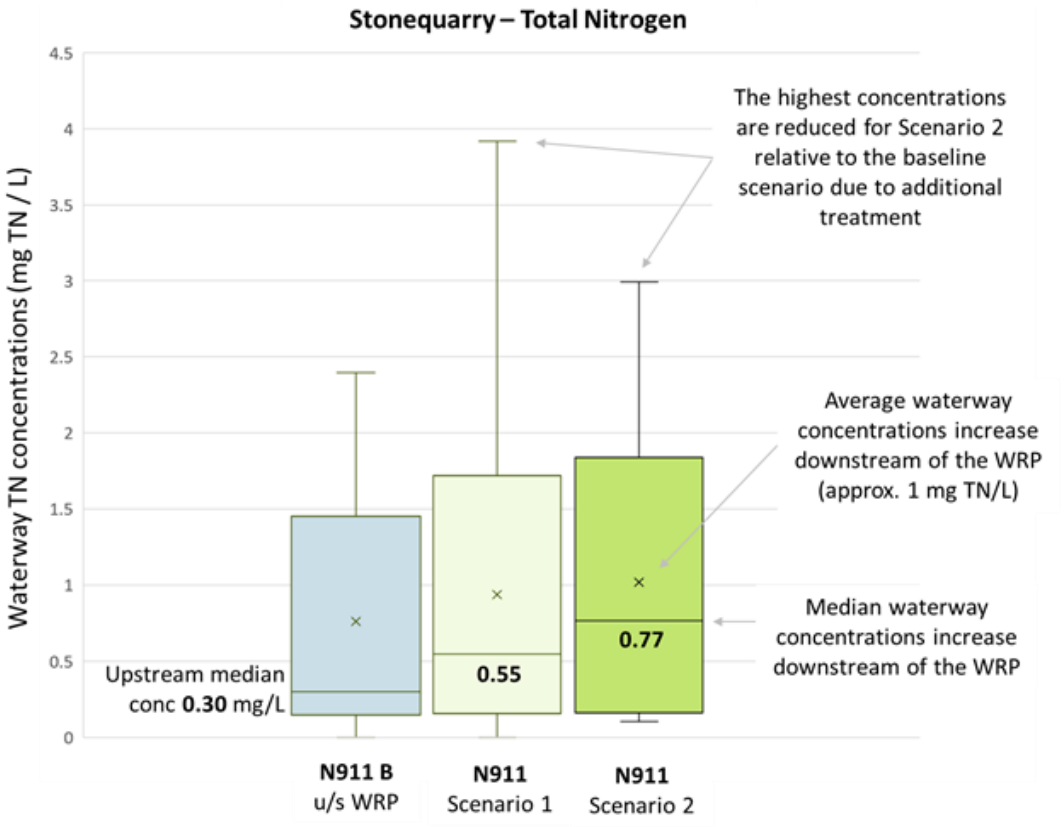
Total nitrogen (TN) and total phosphorus (TP) are key indicators of impacts on water quality and at elevated levels can degrade stream health. Although modelled output concentrations of the bioavailable forms such as oxidised nitrogen (NOx) and soluble reactive phosphorus (SRP) are not presented in this REF, the trends simulated are expected to be similar as they are ratios of TN and TP within the model.

Total nitrogen concentrations – Stonequarry Creek

Key findings from the model in relation to potential total nitrogen concentrations in Stonequarry Creek are shown in Figure 15 and include:

- the modelled site on Stonequarry Creek upstream of the WRP (N911B) has a median concentration of 0.3 mg/L, meeting both the ANZG (0.35 mg/L) and reference site objectives (Nepean River – 0.31 mg/L)
- scenario 1 (baseline) shows higher concentrations downstream of the WRP discharge point (median 0.55 mg/L) at the modelled site on Stonequarry Creek downstream of the WRP (N911)
- scenario 2 (future Stonequarry Creek additional discharge) shows further increase in concentrations as discharge volumes increase, and discharge occurs more frequently (median 0.77 mg/L) at the modelled site on Stonequarry Creek downstream of the WRP (N911).

Figure 15 - Modelled TN concentrations in Stonequarry Creek for Scenarios 1 and 2



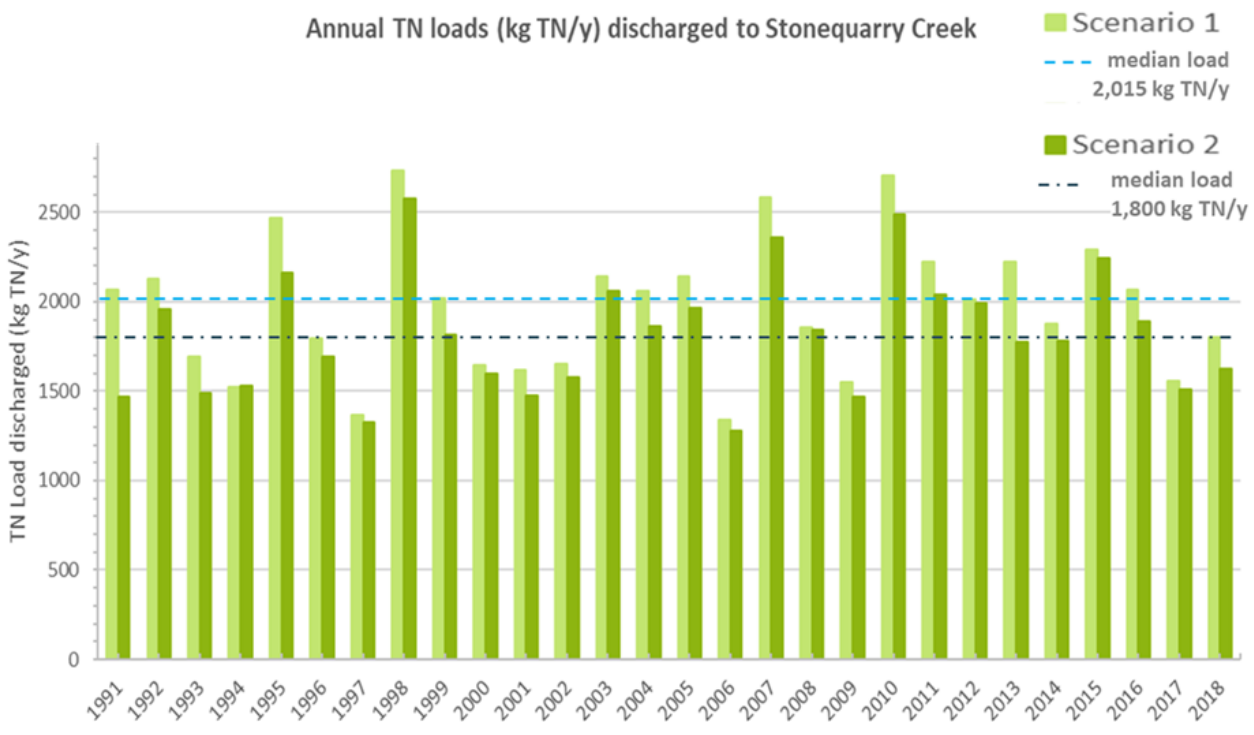
Source: Alluvium, 2020

Total nitrogen loads – Stonequarry Creek

While there is an increase in median and average concentrations downstream of the WRP with Scenario 2 due to increase frequency of discharge, the model indicates a slight reduction in overall loads. The load reductions relate to the additional treatment reducing discharge concentrations from 4 mg/L to 3 mg/L. Key findings from the model in relation to TN loads in Stonequarry are shown in Figure 16 and include:

- the average annual TN load for Scenario 1 (baseline) is approximately 2000 kg TN/year which reduces slightly to around 1800 kg TN/year for Scenario 2 (future)
- both Scenarios exceed the current EPL (1460 kg TN/year) but are well below the Hawkesbury Nepean Framework load allocation for Picton WRP (approximately 4000 kg TN/year)
- year to year the loads are highly variable due to changes in rainfall, inflows and reuse.

Figure 16 - Annual TN loads (kg TN/yr) discharge to Stonequarry Creek



Source: Alluvium, 2020

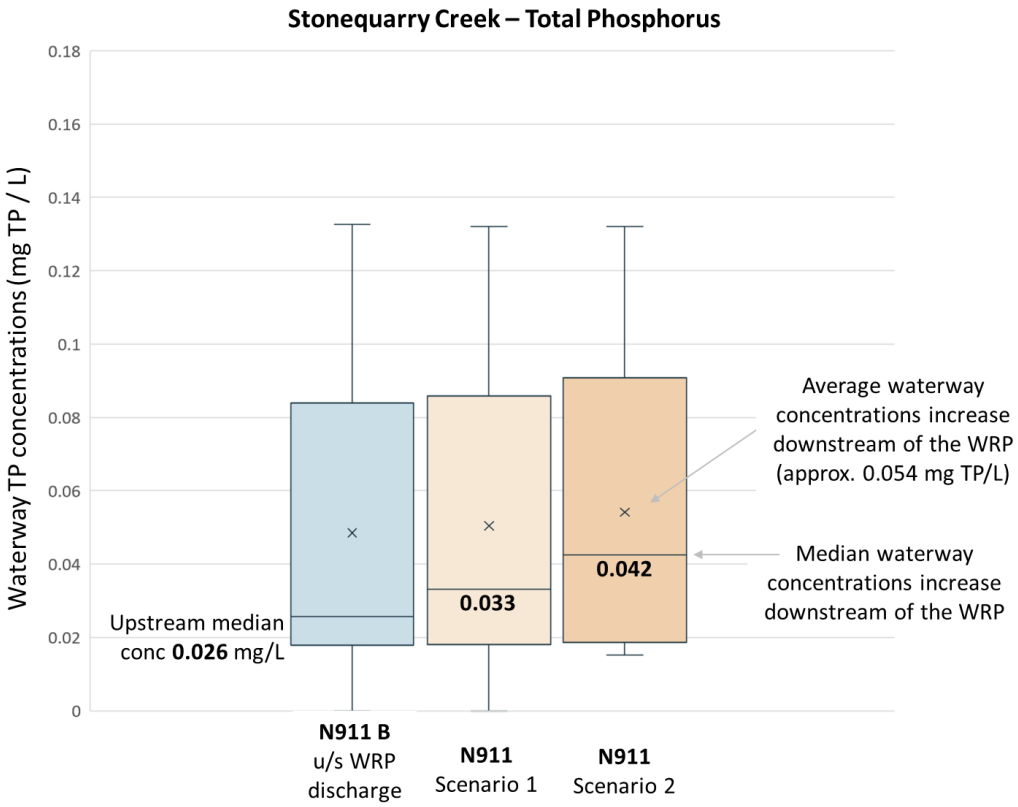
Total phosphorus concentrations – Stonequarry Creek

Key findings from the model* are shown in Figure 17 and include:

- the modelled site on Stonequarry Creek upstream of the WRP (N911B) has a median TP concentration of 0.026 mg/L, just outside the ANZG (0.025 mg/L) and exceeding the Nepean River reference site objectives (0.010 mg/L)
- scenario 1 (baseline) shows higher TP concentrations downstream of the WRP discharge point (median 0.033 mg/L) at the modelled site on Stonequarry Creek downstream of the WRP (N911)
- scenario 2 (future Stonequarry Creek additional discharge) shows further increase in TP concentrations as discharge volumes increase, and discharge occurs more frequently (medium 0.042 mg/L) at the modelled site on Stonequarry Creek downstream of the WRP (N911).

* TP concentration is conservatively modelled at 0.1 mg/L with concentrations in the recycled water discharge from Picton WRP typically much less than this in recent years (median 0.03 mg/L).

Figure 17 - Modelled total phosphorus concentrations for Stonequarry Creek



TP and TN concentrations in the Nepean River downstream of the Stonequarry Creek confluence

Each of the modelled scenarios also results in a water quality change in the Nepean River downstream of the confluence of Stonequarry Creek confluence (N91). This change is shown in Figure 18 and Figure 19. Key findings are:

- scenario 2 (future Stonequarry Creek additional discharges) demonstrates very minimal change in the Nepean River water quality, with the median TN concentration increasing slightly from 0.42 to 0.43 mg/L and conservative modelling of TP indicating median concentration remains similar at 0.015 mg/L
- scenario 3 (discharge directly to the Nepean River), concentrations increase to 0.46 mg/L for TN and 0.017 mg/L for TP
- scenario 4 (discharging directly to the Nepean River, higher average volume), concentrations increase to 0.48 mg/L for TN and 0.018 mg/L for TP.

Figure 18 - Total nitrogen concentrations in the Nepean River for all scenarios

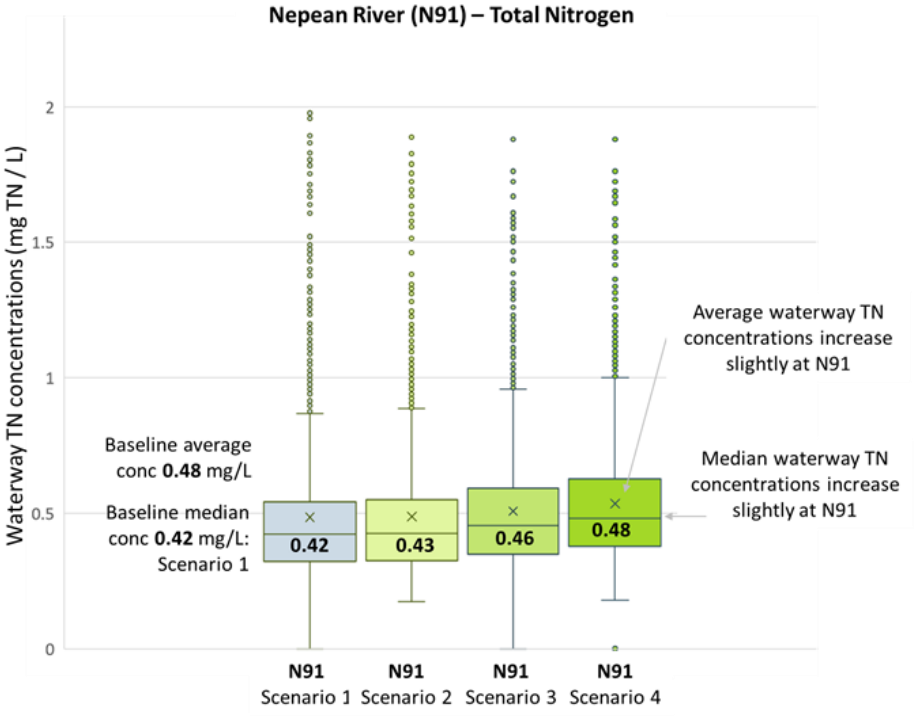
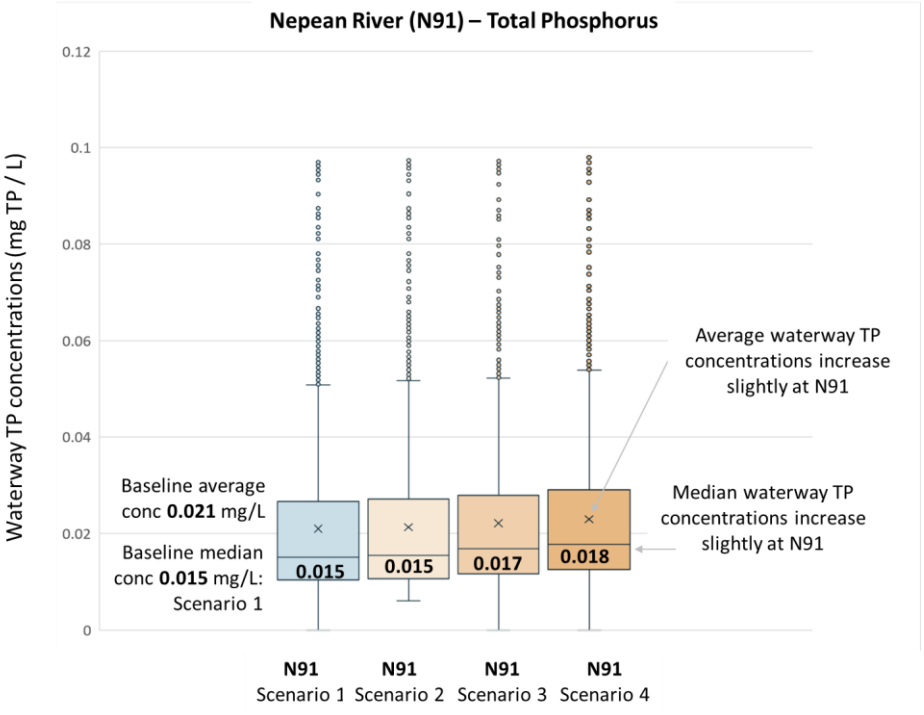


Figure 19 - Total phosphorus concentrations in the Nepean River for all scenarios



Summary

Table 14 provides a comparison of the summary statistics for each of the discharge scenarios.

Table 14 - Summary of modelling outputs for current and future scenarios

Metric	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Mean Annual Load (ML/yr)	492	605	638	860
Mean Annual TN Load (kg/yr)	1,970	1,820	1,900	2,560
Mean Annual TP Load (kg/yr)	49	61	64	86
Mean Annual Discharge Frequency (days/yr)	123	155	217	280
Discharge as proportion of Stonequarry Creek flow (%)	12%	15%	0%	0%
Discharge as proportion of Nepean River flow (%)	0%	0%	1%	1%
Proportion of days when discharge is to creek flows < 8 ML/d	11%	20%	n/a	n/a
Proportion of volume discharged when creek flow is < 8 ML/d	12%	24%	n/a	n/a

A review of the existing monitoring data over the last six years indicates that Stonequarry Creek has retained some assimilative capacity. There is an improvement in water quality concentrations from upper Stonequarry Creek, which is impacted by catchment runoff from the township of Picton, downstream towards just above the discharge point (approximately 3.2 km). Dilution effects are also noted with the current discharge upon entering the Nepean River receiving environment. While no data is available for Stonequarry Creek immediately upstream of the confluence of Nepean River, a degree of dilution and improvement in water quality (relative to the discharge point monitoring site) would be expected. Although there may be a deterioration of water quality concentrations downstream of the discharge points, particularly in Stonequarry Creek, this does not necessarily correlate into negative impacts to stream health or aquatic ecology (refer to Section 6.3.3).

Preliminary dilution modelling indicates that the required zone of near field mixing is predicted to be in the first 2 m for discharge to Stonequarry Creek during high flow conditions (>5.4 ML/ day) and within 1.5m for discharge to Nepean River for all flow categories (Aurecon and Arup, 2020c2). Relative to the adopted trigger values for a common suite of toxicants, nitrate is considered the only contaminant that may raise a risk of environmental harm to local biota, if undiluted. Should discharge to Stonequarry Creek be proposed at flows less than 5.4ML/ day, then the nitrate levels in the recycled water would need to be below the adopted trigger so as to not require dilution in the waterway. This proposal involves construction of denitrification filters, which is expected to produce TN<3 mg/L and consequently reduce nitrate levels below recently recorded concentrations, and the applicable ANZG trigger value.

For the purposes of this assessment, the magnitude of the impact is defined as being comprised of the nature and extent of the potential impact, including direct and indirect impacts. Based on environmental assessment to date, the overall magnitude of impact from the modelled increases in water quality concentrations are not considered significant because:

- the impact extends beyond the immediate discharge point to downstream, however, is not considered widespread or far reaching in the context of Stonequarry Creek or the Nepean River. Monitoring shows that elevated TP and TN concentrations are no longer observed after the confluence with the Nepean River (approximately 1.2 km downstream) at monitoring site N91
- stream health in Stonequarry Creek has not shown signs of deterioration despite the recycled water discharged over the 20 years of operation, as well as the increased discharge occurring over the last few years through the EOP
- the stretch of Stonequarry Creek downstream of the discharge is not a high use recreational area due to the steep terrain and lack of access, and there is little indication that recreational activities occur in this part of Stonequarry Creek
- although there is a high use recreational area downstream of the proposed Nepean discharge pipeline, the discharge quantities are very small compared to river flow and there is almost immediate mixing and dilution with river water
- safeguards can be used to mitigate the impact such as further extending reuse, discharging intermittently, and continuing to explore enhanced treatment technologies such as wetlands

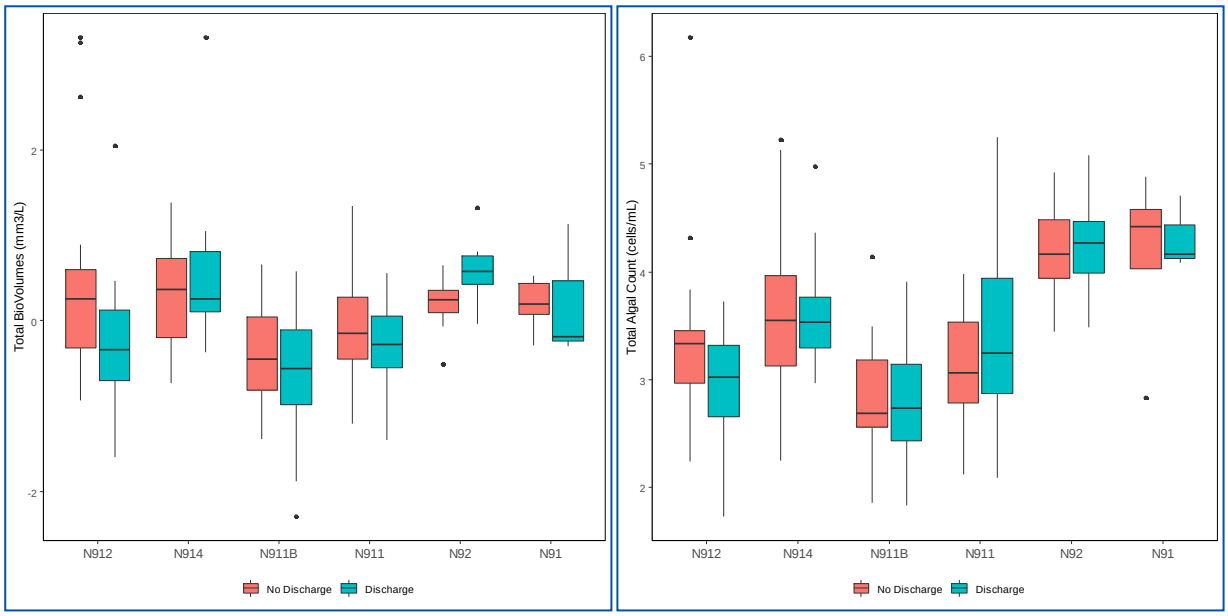
6.3.3 Aquatic ecology

Existing environment

Both the Nepean River and Stonequarry Creek are mapped as key fish habitats. The Nepean River is also identified as an aquatic groundwater dependent ecosystem (GDE). The local aquatic environment includes ecological communities that may respond rapidly to changed aquatic conditions. These communities include algae and macroinvertebrate assemblages, fish populations and threatened species, within the waterway and the riparian buffer environments.

Regular monitoring and sampling of the aquatic ecology is undertaken as shown in Table 11. The monitoring shows algae biovolumes and counts vary between periods of existing WRP discharge and non-discharge within the upper Stonequarry catchment and the Nepean River. Downstream of the discharge point higher median biovolume and counts were recorded compared with upstream of the discharge point (Figure 20).

Figure 20 - Algal biovolumes (left) and total algal count (right)



Diverse macroinvertebrate assemblages comprise a range of species including insect larvae (e.g. dragonfly larvae), crustaceans, snails and worms. As water pollution increases, sensitive macroinvertebrates can be affected and are not detected during routine monitoring. In this way, macroinvertebrate sensitivity is an indicator of a healthy waterway and can be measured using a technique referred to as the Stream Invertebrate Grade Number Average Level (SIGNAL-SG) index. Survey data indicates that the Nepean River sites (N90, N91 and N92) had SIGNAL-SG ranges indicative of 'clean water' to 'mild organic contamination'. Macroinvertebrate assemblages from Stonequarry Creek and Redbank Creek were indicative of 'moderate organic contamination'.

The Nepean River provides suitable habitat for the following threatened or protected species:

- Macquarie Perch (*Macquaria australasica*), an endangered fish under the EPBC Act and FM Act. However, fish surveys in 2015 did not record this species (Table 15).
- Sydney Hawk Dragonfly (*Austrocordulia leonardi*) and Adams Emerald Dragonfly (*Archaeophya adamsi*), both endangered under the FM Act
- platypus (*Ornithorhynchus anatinus*).

Review of the occurrence of the platypus in 2016 found a few recorded sightings in Stonequarry Creek and the Nepean River around Maldon Weir and Maldon Bridge. This study concluded discharges are unlikely to result in erosion to habitat or disruption to platypus food supplies (Ensure, 2016). Residential habitat in Stonequarry downstream of the WRP discharge for the platypus is limited due to the rocky substrate, compared to reaches further upstream in Stonequarry Creek and in the nearby Nepean River.

Potential suitable habitat for the Adams Emerald Dragonfly has also been recorded in several deep pools downstream of Stonequarry Creek discharge point. These pools are very confined, high energy environments. The Sydney Hawk Dragonfly larvae was recently recorded in the Nepean

River at Maldon Bridge in 1m deep pools on the underside of submerged logs (Grieves and Theischinger, 2020).

Table 15 - Fish assemblage (2015) survey following catch and release methods*

Site number	Site location	Date sampled	Fish species captured (n)
N90	Nepean River U/S Allen Creek	5/02/15	Cox's Gudgeon (3); Smelt (2); Flathead Gudgeon (1); Long-finned Eel (1); Striped Gudgeon (4)
N91	Nepean River at Maldon Bridge	6/02/15	Cox's Gudgeon (12); Empire Gudgeon (2); Flathead Gudgeon (7); Gambusia (4)
N92	Nepean River at Maldon Weir	6/02/15	Flathead Gudgeon (2); Smelt (1); Cox's Gudgeon (18); Empire Gudgeon (5); Gambusia (1); Long-finned Eel (7)
N925	Nepean R u/s Maldon Weir	22/01/15	Cox's Gudgeon (8); Smelt (1); Flathead Gudgeon (2); Gambusia (24); Bullrout (1); Carp (1); Empire Gudgeon (2); Long-finned Eel (1)

* as described in the Australian Government *Survey Guidelines for Australia's Threatened Fish (2011)*

Potential impacts

Each modelled scenario will result in a varying increase in water quality with potential exceedance of relevant guideline values for total nitrogen and total phosphorus (Section 6.3.2). Additional load and nutrients exceeding the assimilative capacity of the current environment may result in a variance to the aquatic ecological community. It is possible that algae biovolumes and counts would increase because of increased nutrient loads. Indirect impacts to sensitive ecological receptors may be evidenced in changed SIGNAL-SG indices indicating less clean waters. Subtle habitat changes or changes to trophic diversity associated with foraging may result.

A summary of the qualitative assessment of impact on sensitive ecological receivers under each modelled scenario is presented in Table 16. A detailed statistical analysis on the potential impacts from the discharge scenarios is currently being completed to support the LVA in early 2021.

Fifteen key threatening processes under the EPBC Act and eight key threatening processes under the FM Act were assessed for key environmental receptors (being the Macquarie Perch, Sydney Hawk Dragonfly, Adams Emerald Dragonfly and Stonequarry Creek and the Nepean River as key fish habitats (Aurecon Arup 2020c). It was considered that no key threatening processes will be impacted by the proposal.

No habitat for the Sydney Hawk Dragonfly is present in Stonequarry Creek. Impacts to populations of the endangered species in the Nepean River at N91 are not expected under any scenario due to the localised nature of the mixing zone. Initial dilution modelling indicates that the required mixing occurs within 1.5 m of the Nepean River discharge point even in low flows (Aurecon and Arup, 2020c2). The marginal increase in flows predicted by the proposed changes would maintain deep pool habitats for the dragonfly larvae.

An assessment under the FM Act (or 7-part test) was conducted for each of the threatened species potentially present, concluding that the proposal is unlikely to have a significant impact on the life cycle of these species (Arup and Aurecon, 2020c).

Table 16 - Assessment of impact significance as a result of the proposal on ecological receptors

Receptor	Sensitivity	Potential impacts for each scenario				Impact following application of proposal mitigation measures
		1	2	3	4	Magnitude and significance
Commonwealth significant ecological constraint						
Species listed under EPBC Act: **Fauna:** **Macquarie perch (*Macquaria australasica*)**	High	Consideration of potential increases in Aluminium, Boron, Nickel and Zinc from discharge		Variation in water quality resulting in trophic community variation (foraging resource) Consideration of potential increases in Aluminium, Boron, Nickel and Zinc from discharge		Low residual impact / Likely insignificant
State significant ecological constraint						
Species listed under FM Act as threatened: **Aquatic fauna:** **Sydney Hawk Dragonfly (*Austrocorduli a leonardi*)** **Adams Emerald Dragonfly (*Archaeophya adamsi*)**	High	Variation in water quality resulting in trophic community variation (foraging resource) Consideration of potential increases in Aluminium, Boron, Nickel and Zinc from discharge Potential for degradation to possible habitat for Adams Emerald Dragonfly immediately proximal to discharge due to hydrological regime variation		Variation in water quality resulting in trophic community variation (foraging resource) Consideration of potential increases in Aluminium, Boron, Nickel and Zinc from discharge Physical habitat for Sydney Hawk Dragonfly degradation immediately proximal to discharge due to hydrological regime variation		Nepean scenarios initially flagged as potential medium magnitude and potentially significant. With mitigation: low residual impact / likely insignificant across all discharge scenarios
Species protected under BC Act: **Platypus (*Ornithorhynchus anatinus*)**	High	Variation in water quality resulting in trophic community variation (foraging resource)				Low/ Likely insignificant

Receptor	Sensitivity	Potential impacts for each scenario				Impact following application of proposal mitigation measures
		1	2	3	4	Magnitude and significance
Waterways	Medium	Variation to water quality and hydrology				Scenario 2: medium magnitude before and after mitigation, however likely insignificant Scenario 4, initially medium magnitude, with mitigation likely insignificant Scenarios 1 and 3: Low /Likely insignificant
KFH listed under FM Act: **Type 1 and Type 2 fish habitat**	Medium	Variation to water quality and hydrology				Low /Likely insignificant

Safeguards

Construction and operational safeguards for waterway health are detailed below. Safeguards for erosion and sedimentation and public health are included in Section 6.1 and 6.2.

Construction

We will implement the following safeguards during construction to minimise impacts to waterway health:

- any temporary coffer dams will be designed in accordance with '*Policy and guidelines for fish habitat conservation and management*' (DPI, 2013)
- any overnight storage of construction materials near the Nepean River will only occur outside the flood zone
- extended weather forecasts will be monitored to check for flood warnings
- contingency measures in the event of a flood warning will be included in the CEMP.

Operation

As well as the WRP upgrade (to improve TN), we will implement the following safeguards during operation to minimise impacts to waterway health:

- continue to seek off-site recycled water users to minimise discharge requirements
- adjustment of the dam operating rules so discharges do not occur during zero flow periods

- ensure detailed design of the Nepean River discharge pipeline provides for efficient discharge dilution
- continue extensive water quality monitoring program to assess changes in nutrient and other waterway health indicators in Stonequarry Creek and the Nepean River as a result of the increased discharges.

6.4 Flora and fauna

Existing environment

Off-site reuse – Farms 1 and 2

Both farms are largely devoid of trees except for some sparsely located and isolated trees. Riparian vegetation is present along Redbank Creek to the north of the farms. Both farms are currently used for growing fodder for cattle grazing. Recorded fauna sightings at Farm 2 include the Glossy Black Cockatoo and Square Tailed Kite.

Picton WRP and farm

Planted vegetation is located within the WRP, while Picton farm is comprised of mainly irrigated grass fields. Areas of vegetation communities are present along the north, east and south boundaries. Extensive flora and fauna surveys (GHD, 2019) confirmed the presence of four plant community types (PCTs) ranging from very poor to good condition, including two critically endangered ecological communities (CEEC) (Table 17). The survey has been used to support a current application to conserve vegetation at Picton farm as a Biodiversity Stewardship Site.

Table 17 - Summary of PCTs located at Picton farm

PCT	Condition	Condition (area in hectares)	Conservation significance
849	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain	Moderate (7.17 ha) Poor (7.1 ha)	CEEC - BC Act and EPBC Act
1395	Narrow-leaved Ironbark – Broadleaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain	Good (93.05 ha) Moderate (6.39 ha) Poor (2.59 ha) Very Poor (2.07 ha)	CEEC - BC Act and EPBC Act
1284	Turpentine - Smooth-barked Apple moist shrubby forest of the lower Blue Mountains	Good (12.72 ha)	NA
875	Grey Myrtle – Lilly Pilly dry rainforest in dry gullies	Good (9.7 ha)	NA

Recorded threatened fauna at Picton farm are shown in Table 18. A range of other fauna species (not listed as threated species) have been recorded in the area.

Table 18 - Recorded threatened species at Picton farm (GHD, 2019)

Threatened fauna species	Location recorded (in relation to proposal)
Cumberland Plain Land Snail (*Meridolum corneovirens)* (E)	Eastern Dam
Eastern Coastal Free-tailed Bat (*Mormopterus norfolkensis*) (V)	Eastern Dam and Nepean River
Grey-headed Flying-fox (*Pteropus poliocephalus*) (V/V)	Southern boundary of Picton farm. There are no roost camps occupied by this species at the site.
Large Bent-winged Bat (*Miniopterus orianae oceanensis*) (V)	Eastern Dam and Nepean River
Large-eared Pied Bat (*Chalinolobus dwyeri*) (V/V)	Near Stonequarry Creek and Nepean River
Little Bent-winged Bat *(Miniopterus australis)* (V/V)	Eastern Dam and Nepean River. There is no breeding habitat for this cave-roosting microbat species at the site.
Southern Myotis (*Myotis macropus*) (V)	Eastern Dam, near Stonequarry Creek and Nepean River
Large-eared Pied Bat (Chalinolobus dwyeri) (V/V)	Near Stonequarry Creek and Nepean River
Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) (V)	Near Stonequarry Creek
White-bellied Sea-Eagle (*Haliaeetus leucogaster*) (V)	Nepean River - No nest trees occupied by this species were observed at the site.
Eastern False Pipistrelle (V)	Nepean River

Notes:
E – listed as an endangered species under the BC Act
V - listed as a vulnerable species under the BC Act
V/V – listed as a vulnerable species under the BC Act and EPBC Act

Discharge locations

In addition to the surveys conducted by GHD (2019), field surveys conducted by ELA (2019) along the proposed construction corridor of the discharge channel to Stonequarry Creek identified:

- PCT 1395: Narrow-leaved Ironbark – Broadleaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain (CEEC under both Acts) in disturbed (poor) to good condition
- PCT 875: Grey myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion (not listed as significant), in good condition
- no threatened flora species recorded
- one threatened fauna species, the Gang-gang Cockatoo (*Callocephalon fimbriatum*) was heard during the survey.

Field surveys conducted by ELA (2020) along the proposed construction corridor for the discharge channel to the Nepean River recorded:

- PCT 1395 Narrow-leaved Ironbark – Broadleaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain (CEEC under both Acts) in poor to good condition
- no threatened flora or fauna
- no Cumberland Plain Land Snails during targeted surveys (vegetation lacked suitable habitat resources for this species).

Koala searches by GHD in 2019 did not reveal any sightings and the vegetation contains limited habitat for koalas (ELA, 2020).

Potential impacts – construction

No vegetation would be removed or disturbed for the proposed off-site reuse pipeline and associated infrastructure. The construction corridor for the pipeline would be located within cleared and disturbed areas including existing roads, Stilton Lane and Myrtle Street.

No vegetation would be removed or disturbed for the proposed works at the Picton WRP and farm. Impacts to planted vegetated within the Picton farm boundary along Remembrance Driveway would be minimised by HDD drilling the recycled water delivery pipeline under the vegetation.

Rehabilitation works at Stonequarry Creek require some minor vegetation clearing. Vegetation will also be cleared along the existing (partially cleared) access track, to be used as the construction corridor for the new discharge channel to the Nepean River. The works would be restricted to locations not designated for future protection under the Biodiversity Stewardship Site application.

Tests of significance under the BC Act and the EPBC Act were conducted for the vegetation removal at both the Stonequarry Creek discharge alignment and the access tracks (ELA, 2020). The results indicated that no significant impacts to threatened species, populations, or ecological communities listed under the BC Act or EPBC Act are likely to occur as a result of the proposed works, and neither a Species Impact Statement (SIS) nor a Biodiversity Development Assessment Report (BDAR) are required. A summary of the impact assessment is provided in Table 19 along with habitat features identified in the surveys that could be impacted.

Table 19 - Construction impact assessment summary – terrestrial biodiversity

Proposal location	Total area of vegetation removal (worst case)	Key ecological features that could be impacted
Existing discharge channel to Stonequarry Creek (Figure 19)	Total of 0.49 ha vegetation to be cleared: • 0.43 ha of PCT 1395 (0.01 ha in good condition and 0.32 ha in disturbed condition) • 0.16 ha PCT 875 in good condition	Hollow-bearing trees, a wombat burrow and termite mound.
Proposed discharge pipeline to Nepean River (Figure 20)	Total of 0.92 ha vegetation to be cleared: • All PCT 1395 (0.43 ha in good condition and 0.48 ha in poor condition)	One hollow-bearing tree, stags, non-habitat trees, large woody debris (logs) and rocky outcrops, wombat burrow and termite mound.

Figure 21 - Terrestrial ecology – discharge channel to Stonequarry Creek

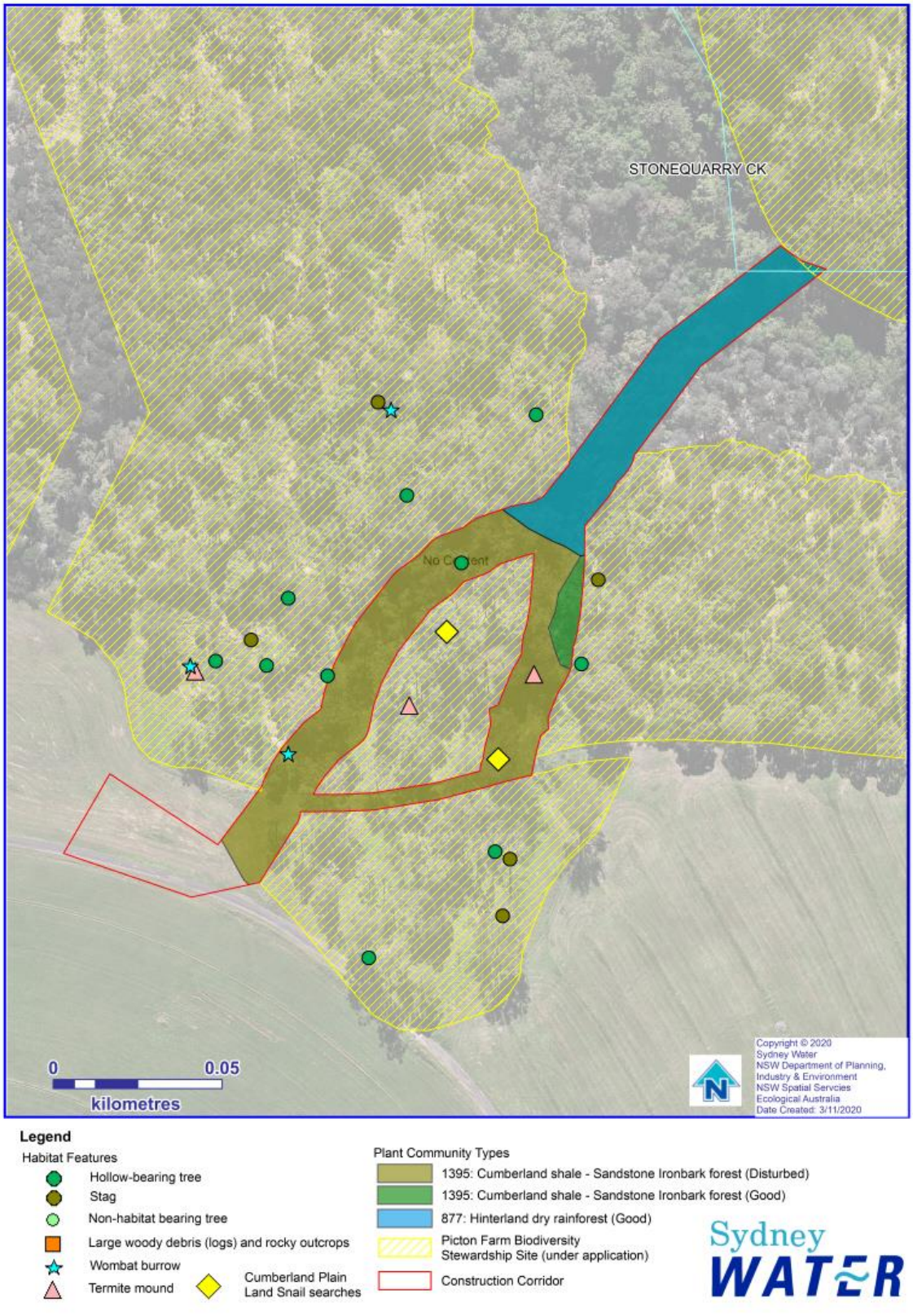
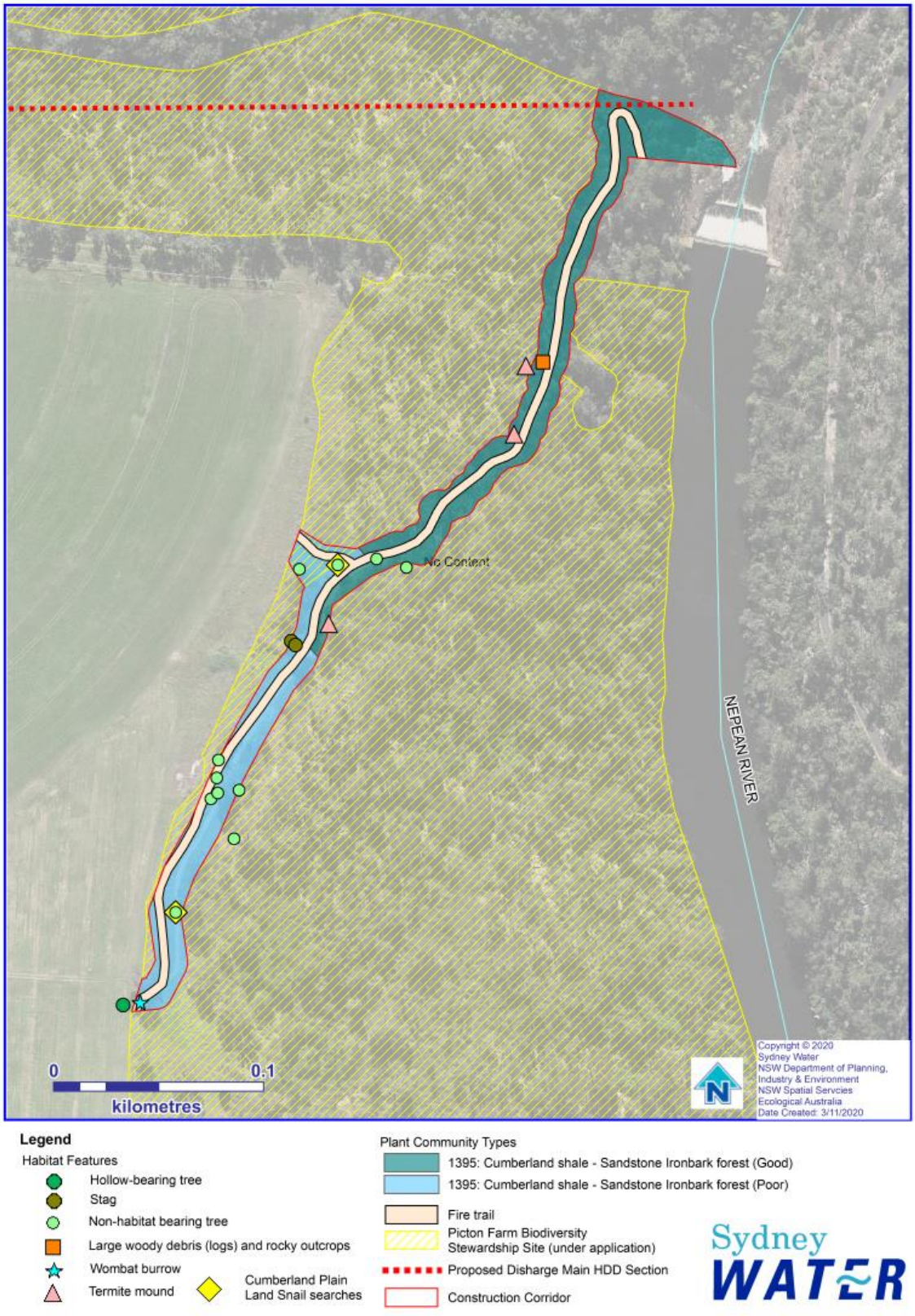


Figure 22 - Terrestrial ecology – construction corridor to Nepean River



Potential impacts - operation

No impacts to terrestrial vegetation during operation are anticipated. Cleared vegetation along access tracks would be revegetated with native species consistent with the surrounding PCT.

Safeguards

We will implement the following safeguards during construction and operation to minimise impacts to flora and fauna:

- all workers are provided with an environmental induction prior to starting construction activities on site. This would include information on the biodiversity values of the site and protection measures to be implemented to protect biodiversity during construction
- minimise vegetation clearance and disturbance. Where possible, limit clearing to trimming rather than removal of whole plants. Vegetation removal will be restricted to what has been assessed in this REF. This vegetation will be clearly delineated in the CEMP and on site prior to construction
- during detailed design and construction planning, avoid or minimise impacts to habitat features such as hollow-bearing trees, termite mounts and wombat burrows where possible
- protective fencing should comply with Australian Standards 2009 where possible. The fencing should be installed prior to commencement of clearing and should be retained in place until the completion of construction
- root zones located within or adjacent to works area or vehicular access should be protected by the application of either organic mulch, coarse gravel or geocells in consultation with an Arborist
- the root protection should be installed prior to commencement of works and should not be removed until completion of all works
- pre-clearance surveys would be undertaken by a qualified ecologist who will also be present to supervise vegetation clearing and capture and relocate fauna (if required)
- salvage and relocate habitat features (eg. leaf litter, woody debris, rocks, hollow logs and branches
- temporary storage of materials including pipe lengths to be in cleared, previously disturbed areas and not beneath tree canopies to avoid impacts on tree protection zones (TPZ)s
- provided it is essential for delivering the proposal, Sydney Water's Project Manager can approve the following vegetation removal and tree trimming, without additional environmental assessment (but only after consultation with Sydney Water's Environmental and Community Representatives and affected landowners). Sydney Water considers vegetation removal in the following circumstances has minimal environmental impact:
    - any minor vegetation trimming, removal of exotic vegetation or removal of planted native vegetation

- where the vegetation is not a threatened species (including a characteristic species of a threatened community or population), heritage listed, in declared critical habitat or in a declared area of outstanding biodiversity value
- any removal of remnant vegetation where there is no net change to environmental impact (eg a different area of vegetation is removed but the total area is the same or less than assessed in the REF).

Written explanation of the application of this clause (including justification of the need for trimming or removal and any proposed revegetation) should be provided when seeking Project Manager approval.

- if native fauna is encountered on site, stop work and allow the fauna to move away unharassed. A local wildlife rescue service or the ecologist responsible for pre-clearing surveys should be engaged to assist with fauna removal and rescue if fauna fails to move away on its own
- residual impacts to native vegetation and trees will be offset in accordance with the Sydney Water Biodiversity Offset Guideline (SWEMS0019.13). Based on the ELA (2020) assessment, the following replanting is likely to be required following construction:
  - 4.05 ha of vegetation consistent with PCT 1395 (1.35 ha total removed)
  - 0.48 ha of vegetation consistent with PCT 877 (0.16 ha total removed)

  Actual vegetation impacts would be quantified before clearing and required offsets provided for verified impacts. The location of offsets/ replanting would be determined in consultation with the Picton farm operators.

6.5 Air and energy

Existing environment

The proposal is in a mostly rural-residential land use setting, with one heavy industry located to the north east of Picton farm (Boral Maldon). The nearest potentially sensitive receivers include:

- rural residences located across Remembrance Driveway (about 330 metres distance)
- a motel located approximately 600 metres south west of the WRP
- a church located approximately 500 metres north of the Western Dam
- Picton High School located approximately 600 metres north of the Western Dam
- rural residences located approximately 250 metres south east of the Maldon Weir.

The Picton WRP is the main source of odour in the local area. Odour compliance monitoring was undertaken in May 2020 as part of the upgrade works completed in 2019 (Ensure JV, 2020). This included odour sampling of all new significant sources of odour including the IDALs, biosolid tanks and odour control stack. The monitoring showed a reduction in the emissions inventory from

3850.5 ou.m3/s from the previous 2016 odour assessment to 2711 ou.m3/s. Further, the 2 and 5 odour unit (OU) contours are contained within the Picton farm, and no exceedances of the 2 OU criterion are predicted at any nearby receptors.

There have been three recorded odour complaints in the last five years. In 2019 as part of the WRP upgrade, a biotrickling filtration odour system with activated carbon was installed. In addition, WRP operators now proactively engage with the closest residents about the timing of biosolids outloading, which can produce temporary increases to odour generation at the WRP.

Potential impacts – construction

Construction work can generate dust and vehicle exhaust emissions. Dust could result from site excavations, materials delivery, spoil stockpiles and vehicle movements, particularly during dry and windy conditions. Poorly maintained construction machinery, equipment and vehicles can release higher emissions, resulting in air quality impacts.

During construction and commissioning activities, isolated odour events can occur when odourous equipment is opened or exposed to make new connections, etc. These activities are usually short term and temporary.

Potential impacts – operation

Odour

The proposal does not introduce any new sources of odour, and additional odour impacts are not anticipated following commissioning. However, the improved quality of recycled water produced (from the new treatment processes), would minimise the potential for odour to occur during the application of recycled water for irrigation.

Energy

Water recycling plants have high energy demand to treat and recycle water, and for the transfer (pumping) of the recycled water for reuse or disposal. The pumps and new UV system will be designed in accordance with Sydney Water's *Best Practice Energy in Design Guide* to ensure new equipment meets relevant energy efficient benchmarks. Off-site reuse of recycled water aligns with Sydney Water's 2020-2030 Strategy to embrace circular economy practices and support sustainable cities as they grow. The proposal would facilitate future planned extension for recycled water delivery to additional customers, beyond Farms 1 and 2, which among other research and trial initiatives, contributes to the circular economy approach for management of recycled water by Picton WRP. Opportunities for improving the energy efficiency of the WRP, and for renewable energy generation (including solar) are being explored at Picton WRP, and as part of Sydney Water's Energy Masterplan.

Safeguards

We will implement the following safeguards during construction and operation to minimise potential for odour impacts:

- select energy efficient pumps and equipment during detailed design in accordance with Sydney Water's *Best Practice Energy in Design Guide*
- use alternatives to fossil fuels where practical and cost-effective
- track energy use as per Sydney Water's National Greenhouse and Energy Report SWEMS0015.28
- maintain equipment in good working order, comply with the Clean Air Regulations of the *Protection of the Environment Operations Act 1997*, have appropriate exhaust pollution controls, and meet Australian Standards for exhaust emissions
- switch off vehicles and machinery when not in use
- cover all transported waste
- implement measures to prevent off-site dust impacts during construction, for example:
    - water exposed areas
    - cover exposed areas with tarpaulins or geotextile fabric
    - modify or cease work in windy conditions
    - modify site layout (place stockpiles away from sensitive receivers)
    - vegetate exposed areas using appropriate seeding
- have temporary odour control available for construction and commissioning as needed

6.6 Waste and hazardous materials

Potential impacts – construction

As noted in Section 6.1, there is the potential to encounter contaminated fill (such as asbestos) during excavation at the WRP. Soil investigations completed for this proposal indicate that spoil generated from the proposal is likely to be classed as General Solid Waste in accordance with NSW EPA Waste Classification Guidelines (EPA, 2014). Natural material from excavations is likely to meet the definition of Excavated Natural Material (ENM) and could be reused on or off-site subject to further testing.

Typical sources of waste that will be generated by the proposal include:

- excavated rock and spoil that is deemed unsuitable for reuse such as for backfilling excavations
- drilling fluid from HDD works at Remembrance Driveway and the discharge pipeline to the Nepean River
- perched water that may be encountered during HDD construction of the discharge pipeline to the Nepean River. The groundwater is unlikely to be contaminated

- vegetation waste from clearing for rehabilitation works for the existing discharge channel to Stonequarry Creek and the proposed construction corridor for the discharge pipeline to the Nepean River
- demolition waste from existing structures required to be decommissioned and hardstand areas
- potential contaminated material, including asbestos
- small volumes of general construction waste.

Quantities of construction spoil have been estimated to be in the order of 20,000 m^3 of spoil.

Potential impacts – operation

No new waste streams will be generated after commissioning of the proposal. New chemical storage tanks and dosing facilities would be in bunded areas within the WRP. New signs will be installed and staff trained on any extra/new safe handling practices.

The off-site reuse of recycled water (estimate about 240 ML/year on top of existing reuse) will significantly reduce the volume of water entering the environment. The proposal also improves the quality of recycled water produced at the WRP.

Safeguards

We will implement the following safeguards during construction and operation to minimise any impacts associated with waste and hazardous materials:

- undertake further sampling if required to understand the extent and nature of contamination and establish mitigation measures for inclusion in the CEMP
- prepare a Waste Management Plan (SWEMS0025.09) as part of the CEMP
- minimise the generation of waste, sort waste streams to maximise reuse/recycling in accordance with the *Waste Avoidance and Resource Recovery Act 2001*
- identify spoil storage and disposal options during detailed design and construction planning
- securely store all wastes to prevent pollutants from escaping
- provide adequate bins for general waste, hazardous waste and recyclable materials. Remove bins when 80% full
- manage waste and excess spoil in accordance with the NSW EPA Waste Classification Guidelines 2014
- dispose wastes at an appropriately licenced facility
- manage waste in accordance with relevant legislation and maintain records to show compliance eg waste register, transport and disposal records
- dispose excess vegetation (non-weed) that cannot be used for site stabilisation at an appropriate green waste disposal facility

- if fibro or other asbestos containing material is identified, restrict access and follow Sydney Water's Asbestos Management procedure, WHSMS0064. Contact Property Environmental Services for advice
- track waste as required using EPA's WasteLocate online tracking system.

6.7 Non - Aboriginal heritage

Existing environment

A historical heritage impact assessment (Aecom, 2020) identified two locally listed heritage items under the Wollondilly LEP 2011 within the proposal area:

- Koorana Homestead, Outbuildings and Trees (located at Farm 1). The current building at Farm 1 was constructed on the remains of a former building known as 'The White House' built by Nathaniel Boon in 1860. There are also mature plantings of exotic trees around the homestead which form a distinctive silhouette on the hilltop site and an important element to the character of the listing.
- Maldon Weir (located in the Nepean River). The weir was built because of the Upper Nepean Water Supply Scheme. The natural setting enhances the appearance of the weir.

No other potential historic heritage items or structures were observed during a visual inspection undertaken in August and September 2020. Figure 23 provides the location of these sites.

Potential impacts – construction

The proposed reuse pipeline is located along the southern boundary of Farm 1 and adjacent to the fence line, and within the curtilage of the Koorana Homestead heritage item. A visual inspection of the area confirmed there was no surface evidence observed which would be indicative of archaeological potential within the proposal area. It was also inferred that any archaeological evidence would be restricted to the current building footprint and immediate surrounds and the pipeline would not result in impacts to the heritage item, or have unexpected finds.

The proposed discharge to the Nepean River will be downstream from the Maldon Weir, and outside the curtilage of the heritage item.

The assessment indicated that works within the curtilage of the Koorana Homestead and within the vicinity of Maldon Weir would result in a negligible impact to the items. It was concluded that the works can proceed without further archaeological or heritage assessment, approvals or associated constraints. Formal consultation with Wollondilly Shire Council is not required.

Potential impacts – operation

As the proposed reuse pipeline would be installed predominantly underground, there would be no direct harm to the visible or aesthetic values of the Koorana Homestead. There would be no impacts to the Maldon Weir following commissioning of the discharge pipeline to the Nepean River.

Safeguards

As a precaution, we will implement the following safeguards during construction and operation to minimise impacts to non-Aboriginal heritage.

- during ground disturbing works, an unexpected finds procedure would be followed, consisting of the following controls:
    - all work must immediately cease in, and around, the location of the unexpected find
    - the contractor supervisor must notify the environmental manager, and a qualified archaeologist will be consulted for further advice
    - should the unexpected find constitute a significant archaeological 'relic', work would cease and a s.146 Notification of the Discovery of a 'Relic' submitted to the NSW Heritage Division. Further approvals from the NSW Heritage Division would be obtained as needed.
- all impacted areas should be reinstated as near as possible to their original appearance following the completion of works.

6.8 Aboriginal heritage

Existing environment

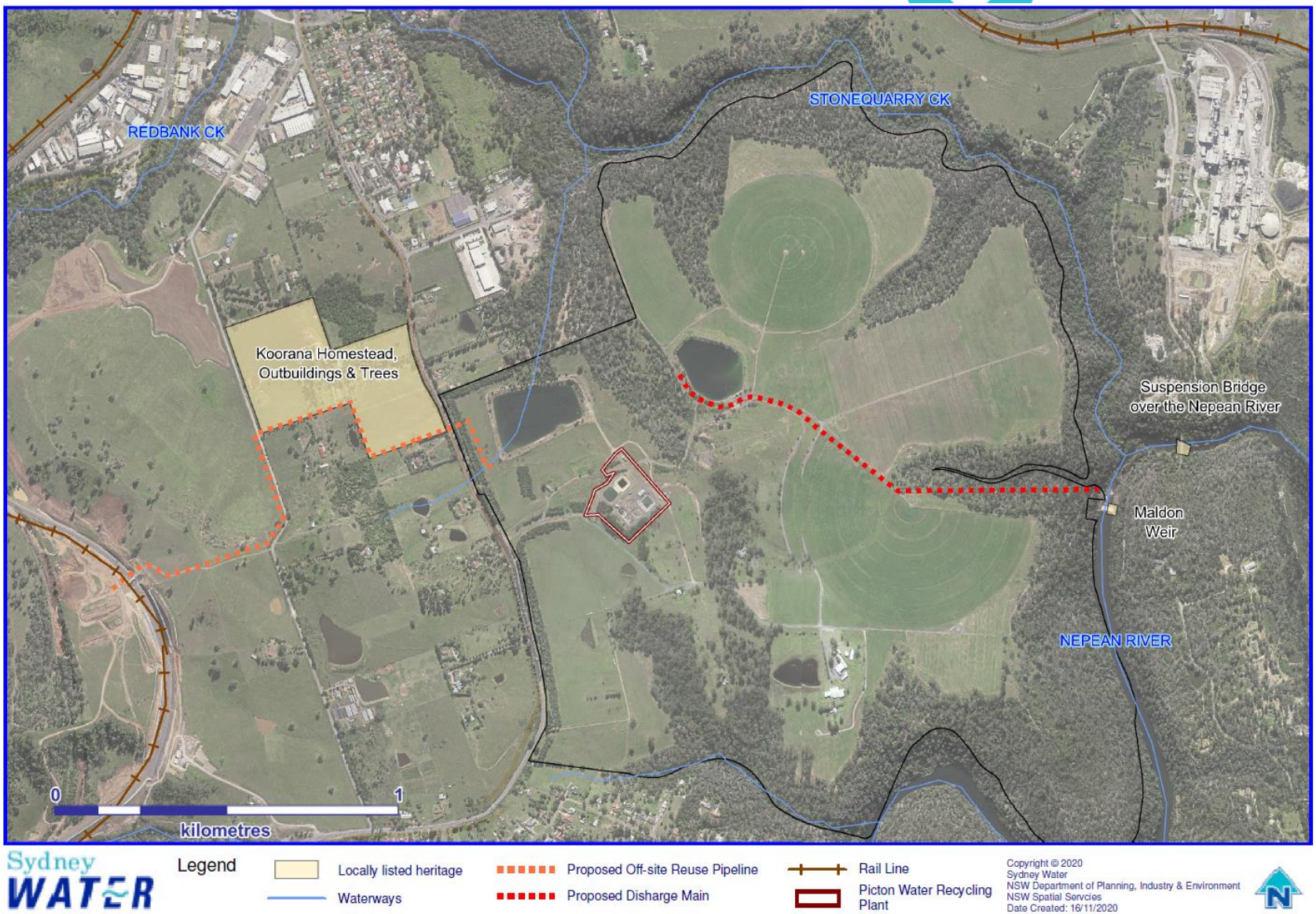
An Aboriginal Heritage Due Diligence (AHDD) assessment was completed (Aecom, 2020) with reference to the Due Diligence Code of Practice Code of Practice for the Protection of Aboriginal Objects in NSW 2010 (NSW DECCW, 2010). The assessment included a visual inspection of the proposal area for the off-site reuse pipeline and proposed discharge main to the Nepean River and surrounding land.

The assessment identified that the proposal area is characterised by steep hills formed on fine-textured Wianamatta Group shales and that Aboriginal sites are known to exist in direct association with both the Nepean River and Stonequarry Creek. However, native vegetation has been extensively modified because of agricultural and pastoral land use activities with most cleared historically for grazing and/or cropping. It was considered unlikely that mature trees with cultural scarring would be present in the proposal area.

The AHDD also identified that:

- there are no known sites including AHIMS sites within the proposal area
- there are no active native title Claims, Land Use Agreements or Determinations that includes lands held within the proposal area
- floodplain portions of the proposal area would be unlikely to contain extant Aboriginal sites in either surface of subsurface contexts based on archaeological evidence suggesting that a preference for higher order tributaries of the Nepean River
- evidence suggests that the potential for extant Aboriginal sites to be present in the subsurface contexts within the proposal area is low

Figure 23 - Historical heritage sites



- a site with characteristics of a rock shelter (NR-RS1-20) was identified during the visual inspection outside of the proposal area, approximately 100m to the south of the proposed Nepean River discharge point. The rockshelter site is associated with a potential archaeological deposit (PAD) and is a sandstone overhang.

Potential impacts – construction

The AHDD found that the proposal has low or negligible Aboriginal archaeological risks. The site NR-RS1-20, is located outside of the proposal area and the potential for vibration impacts to the site during construction have been assessed as nil (Section 6.9). The AHDD found that the works may proceed without any further archaeological or heritage assessment, approvals or associated constraint.

Potential impacts – operation

The proposal would not result in any impacts to Aboriginal heritage items during operation.

Safeguards

We will implement the following safeguards during construction and operation to minimise impacts to Aboriginal heritage:

- do not make publicly available or publish, in any form, Aboriginal heritage information on sites / potential archaeological deposits, particularly regarding location
- if any Aboriginal object or non-Aboriginal relic is found, cease all excavation or disturbance in the area and notify the Sydney Water Project Manager in accordance with SWEMS0009
- all workers will be inducted into the Aboriginal heritage sensitivities of the proposal
- in the unlikely event that possible human skeletal material (remains), are identified during the proposed works, cease all works immediately and notify the Sydney Water Project Manager in accordance with SWEMS0009
- if during detailed design the location of the Nepean discharge pipeline changes, the potential vibration impacts to site NR-RS1-20 will be re-assessed if required.

6.9 Noise and vibration

Existing environment and criteria

The primary ambient noise in the area is road traffic travelling along Remembrance Driveway as background noise is typical of a rural and semi-rural environment (insects, birds, etc).

Sensitive receivers identified closest to the WRP are residential premises about 330 metres away (R1). However, the closest residential receiver during construction of the recycled water pipeline is approximately 30m (R4) from the noise source (Figure 24). Other sensitive receivers include heritage structures, including locally listed Koorana Homestead, Outbuildings and Trees at Farm 1, the Maldon Weir and a potential Aboriginal rock shelter near the Nepean River.

A noise compliance review was undertaken following completion of the recent WRP upgrade works in 2019 (Ensure, 2020). This included both attended and unattended noise measurements at the nearest residential receiver on 1 April 2020 (L1, Figure 24). Background noise levels (RBL) were adopted from this recent compliance monitoring and are shown in Table 20.

Table 20 - Unattended noise monitoring and rating background level

Location	Rating background level (RBL) dBA		
	Day	Evening	Night
2300 Remembrance Drive	39	35	29

Source: Ensure, 2020

A noise and vibration assessment for the proposal was prepared (Aurecon and Arup, 2020d) to inform this REF. NMLs during construction were derived from the RBL + 10dB for standard daytime hours, as per the EPA's *Interim Construction Noise Guidelines* (DECC, 2009) and are shown in Table 21.

Table 21 - Construction noise management levels

Receiver	Construction NML during standard recommended hours ($L_{Aeq(15\ min)}$)	
	Noise affected (RBL + 10dB)	Highly noise affected
Residential (rural)	49	75

A review of the noise compliance monitoring results identified that no operational equipment at the WRP was audible over the existing road traffic noise and that noise level contributions from Picton WRP complied with the relevant criteria (Ensure, 2020). Based on the results and requirements from the Noise Policy for Industry (NPI)(EPA, 2017), project specific noise trigger levels were determined (Table 22). Of these, the more stringent intrusive criteria for night-time (35dB(A)) was adopted as the appropriate operational noise criteria for the WRP.

Table 22 - Operational project noise criteria

Receiver	Time	RBL, dB(A)	Intrusive criteria[1], dB(A)	Amenity criteria[2] $dBL_{Aeq(15min)}$	Project specific noise trigger level[3] ($dBL_{Aeq,\ 15min}$)
Residential (rural)	Day	39	44	58	44
	Evening	35	40	45	40
	Night	30 (29)[4]	35	40	35

1. Intrusive criteria is defined as the RBL + 5dB
2. Amenity criteria is the recommended amenity noise level minus 5dB and converted to $L_{Aeq(15minutes)}$ based on continuous noise sources

3. Project specific noise trigger level is the lower of the intrusive and amenity level
4. The minimum background noise level that many be used for the night period is 30 dB(A), as per Table 2.1 of the NPI. The measured night time RBL has been bracketed.

Potential impacts – construction

Construction of the proposal is estimated to take about 18 months with some elements completed in less time (eg. installation of the recycled water main). It is expected that all construction works would be undertaken during standard construction hours.

During construction of the recycled water pipeline along Remembrance Driveway, there is the potential for some receivers to experience noise exceedances. There would also potentially be two highly noise affected receivers, R4 and R6, due to marginal exceedances (Table 27). The predicted noise impacts for both the noise affected and highly noise affected receivers would be for limited times when noisy equipment is being used, including a vibratory roller, dozers and 10 tonne excavator breakers (if required). As construction progresses in a linear fashion, worst case impacts are not expected to last for more than one to two weeks and can be managed using the safeguards identified below.

Recommended working distances for vibration intensive plant were reviewed against the potential for impacts to heritage structures. Reference was made to the standard “DIN4150” for cosmetic damage, being the more conservative standard for cosmetic impacts due to vibration (Aurecon, Arup, 2020d). The assessment concluded that based on the anticipated construction methods, receivers (including heritage structures) are unlikely to be at risk of vibration (cosmetic) damage.

Due to the high levels of existing traffic along Remembrance Driveway, an increase to traffic noise because of construction traffic is likely to be negligible.

Potential impacts – operation

A summary of potential operational noise impacts to the nearest five receivers is shown in Table 24 and includes impacts under standard meteorological conditions (no wind) and for enhanced meteorological conditions (wind at 3 m/s from sources to receivers). Under standard meteorological conditions, there would be no operational impacts with the exception of a predicted marginal exceedance at R3 (36 dBA) compared to a criteria of 35 dBA. Under enhanced meteorological conditions, marginal exceedances would occur at all of the five nearest receivers (R1 to R5). The proposal is predicted to result in an increase of 2 dBA at R3 to R5, and up to 4 dBA above the criteria at R2 (Table 24). It is noted that a residual noise level of 2 dBA above the project noise trigger level is considered negligible.

During detailed design, further acoustic advice will be sought into the selection of plant/equipment and/or noise attenuation if required to ensure we comply with operational noise criteria.

As no significant operational vibration sources are associated with the proposal, there would be no operational impacts to sensitive receivers.

Figure 24 - Sensitive receivers and unattended noise monitoring location

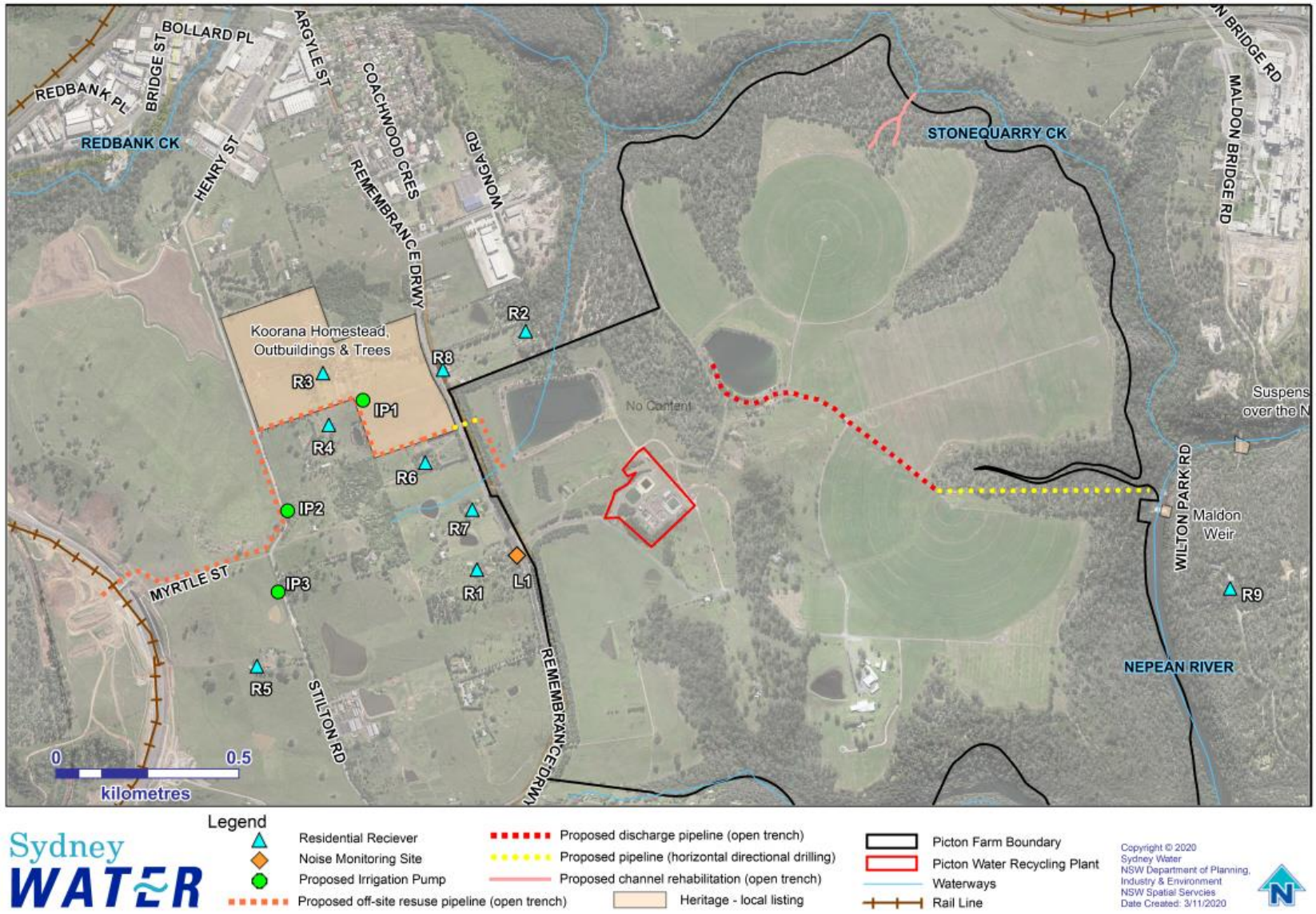


Table 23 - Affected distance for individual plant items

Distance (m)	Sound Pressure Levels													
	Pump and dewatering	Trenching maching/ [illegible] saw	Concrete pump	Truck	Crane	Roller (non vibratory)	Welding equipment	Micro-tunnelling/ directional drilling	Concrete pump truck	Virbratory roller	Dozer D9	Chainsaw	Concrete saw/ excavator breaker (10t)	Jackhammer
	96	105	106	107	108	109	110	112	113	114[1]	116	119[1]	123[1]	126[1]
30	58	67	68	69	70	71	72	74	75	76[2]	78[2]	NA[3]	NA	NA
50	54	63	64	65	66	67	68	70	71	72	74	NA	81[4]	NA
75	51	60	61	62	63	64	65	67	68	69	71	NA	78[4]	NA
100	48	57	58	59	60	61	62	64	65	66	68	NA	75	NA
150	44	53	54	55	56	57	58	60	61	62	64	NA	71	NA
200	42	51	52	53	54	55	56	58	59	60	62	NA	69	NA
300	38	47	48	49	50	51	52	54	55	56	58	61	65	68
500	34	43	44	45	46	47	48	50	51	52	54	57	61	64
700	31	40	41	42	43	44	45	47	48	49	51	54	58	61
1000	28	37	38	39	40	41	42	44	45	46	48	51	55	58
2000	22	31	32	33	34	35	36	38	39	40	42	45	49	52
3000	18	27	28	29	30	31	31	34	35	36	38	41	45	48

Notes: Red – Highly noise affected receivers (>75dBA)
Green – Noise affected receivers (>NML of 49dBA)
1. Sound power levels include a 5 dBA penalty because these plant and equipment are identified as containing special audible characteristics
2. Only one receiver is potentially affected - R4
3. The closest receiver to potential chainsaw and jackhammer activity is ~ 260 m away (R9)
4. Only one receiver is potentially affected – R6 within distance of 75 m of potential rock breaking activities for HDD pit construction.

Table 24 - Predicted operational noise impacts for the nearest five receivers

Receiver	Criteria	Assumed existing WRP contribution	Proposal contribution	Cumulative impact
Standard meteorological conditions				
R1	35	29	30	32
R2		29	31	33
R3		23	36	36
R4		23	33	33

Receiver	Criteria	Assumed existing WRP contribution	Proposal contribution	Cumulative impact
R5		21	33	33
Enhanced meteorological conditions				
R1	35	35	35	38
R2		35	36	39
R3		29	36	37
R4		29	36	37
R5		27	37	37

Safeguards

We will implement the following safeguards during construction and operation to minimise impacts:

- works must comply with the Interim Construction Noise Guideline (DECC 2009), including schedule work and deliveries during standard daytime working hours of 7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturday. No work on Sundays or public holidays.
- the Proposal will also be carried out in accordance with:
    - Sydney Water's Noise Management Procedure SWEMS0056
    - Noise Policy for Industry (EPA, 2017).
- reasonable and feasible noise mitigation measures should be implemented to mitigate noise impacts and include selection of low-noise construction equipment or methods and modifying construction program to minimise impacts
- incorporate standard daytime hours noise management safeguards into the CEMP:
    - identify and consult with the potentially affected residents prior to the commencement:
        - describe the nature of works; the expected noise impacts; approved hours of work; duration, complaints handling and contact details
        - determine need for, and appropriate timing of respite periods (eg times identified by the community that are less sensitive to noise such as mid-morning or mid-afternoon for works near residences)
        - acceptance by the community of longer construction periods in exchange for restriction to construction times
    - implement a complaint handling procedure for dealing with noise complaints
    - plant or machinery will not be permitted to warm-up near residential dwellings before the nominated working hours

- appropriate plant will be selected for each task, to minimise the noise impact (eg all stationary and mobile plant will be fitted with residential type silencers)
- engine brakes will not be used when entering or leaving the work site(s)
- regularly inspect and maintain equipment in good working order
- arrange work sites where possible to minimise noise (eg generators away from sensitive receivers, minimise use of vehicle reversing alarms)
- schedule noisy activities around times of surrounding high background noise (local road traffic or when other noise sources are active)

- if works beyond standard daytime hours, or night works are needed, the Contractor would:
  - justify the need for out of standard daytime or night work
  - consider potential noise impacts and implement the relevant standard daytime hours safeguards, Sydney Water's Noise Management Code of Behaviour (SWEMS0056.01), and other reasonable and feasible management measures
  - identify community notification requirements, and for scheduled night work notify all potentially impacted residents and sensitive noise receivers not less than one week prior to commencing night work
  - seek approval from the Sydney Water Project Manager in consultation with Sydney Water's Environment and communications representatives
- if works on Sundays or public holidays are required, the Contractor would:
  - justify why all other times are not feasible
  - consider potential noise impacts and, implement relevant standard daytime, out of hours and night-time safeguards and other reasonable and feasible measures
  - identify community notification requirements
  - seek approval from the Sydney Water Project Manager in consultation with Sydney Water's Environment and communications representatives.
- review the recommended minimum working distances (human response) for vibration intensive plant in Table 22 of Aurecon, Arup (2020d) and implement vibration monitoring for work within the minimum working distances.
- noise advice will be obtained during detailed design for selection of plant/equipment and noise attenuation if required, to ensure we can comply with operational noise criteria
- during commissioning, a single period of noise monitoring would be undertaken to assess performance against the proposal specific operational noise levels
- the potential vibration impacts on the Aboriginal site and rock shelter and Maldon Weir will be re-confirmed should the Nepean River pipeline alignment change substantially

- noise and vibration complaints would be managed in accordance with Sydney Water's Customer Complaint Procedure.

6.10 Traffic and access

Existing environment and potential impacts

Access to the Picton WRP and farm as well as Farm 1 will be via Remembrance Driveway. Access to Farm 2 will be via Stilton Lane for work locations east of the Main Southern Railway Line and via Tickle Drive for work locations west of the Main Southern Railway Line. All sites will be accessed via existing public roads and access paths except for work sites within Farm 1 and Farm 2. No road closures are required. Sydney Water will consult with council as required by the ISEPP to minimise any impacts to Remembrance Driveway during construction of the recycled water pipeline.

Access to the Main Southern Railway Line will be required to install the recycled water pipeline to Farm 2 and over the rail bridge. Approvals will be obtained from ARTC to facilitate this access.

Construction would generate light and heavy vehicle movements associated with worker movements, the transportation of construction machinery, equipment and materials to the site. During construction, expected total daily traffic movements are in the order of:

- light vehicles: 30 daily movements
- heavy vehicles: 10-25 daily movements.

Consecutive construction vehicle movements within the WRP may cause delays and safety hazards if unmanaged.

Safeguards

We will implement the following safeguards during construction and operation to minimise traffic and access impacts:

- prepare a Traffic Management Plan (TMP) for traffic movements within the Picton WRP and erect signs to inform road users of traffic changes
- minimise traffic impacts near residential properties, schools and businesses (eg. no major materials deliveries at school drop off or pick up times etc)
- ensure work vehicles do not obstruct vehicular or pedestrian traffic, private driveways, public facility or business access unless necessary and only if appropriate notification has been provided.

6.11 Social and visual

Existing environment and potential impacts

The surrounding area is characterised by a rural landscape with rolling hills, irrigated fields and steep gullies associated with waterways. Picton township lies 1 km to the north and Tahmoor township lies approximately 2.5 km to the south west. Boral Maldon, a large concrete batching plant is located to the north east of Picton farm.

The Nepean River to the east and near the Maldon Weir is a popular swimming spot used by the local community. The Maldon Suspension Bridge is located approximately 200 metres to the northeast of Maldon Weir. The timber and steel bridge, built in 1903, is closed to vehicles and previously connected Maldon Bridge Road at the north, to Wilton Park Road.

Upgrades proposed at the Picton WRP and farm would not be visible from publicly accessible roads or viewpoints (namely, Remembrance Driveway) as the WRP is located downslope of Remembrance Driveway. The proposed works at Farms 1 and 2 are also located away from readily visible locations. Further, the proposal components are largely underground pipes, and above ground infrastructure is limited to a height of 3.2 metres (recycled water delivery storage tank), largely out of public view.

The closest residential receivers to the Maldon Weir are located approximately 250 metres, away on Wilton Park Road. These residences do not have direct views of the proposal due to intervening vegetation and topography. The Nepean River is accessed by local recreational users via an unsigned public access track, accessible via foot only due to no vehicle access along Wilton Road.

The number of sensitive receivers is limited to occasional visitors, likely to be residents who are familiar with the area and how to access it through informal tracks in the bush and around steep escarpments. It is recognised that the proposal would not be prominent from residential viewpoints and is limited to recreational users at Maldon Weir.

The existing topography and existing vegetation limits the extent of viewpoints capable of viewing the proposal.

Potential impacts – construction

Construction visual impacts are temporary, and will include the movement of vehicles and machinery, installation of equipment, earth moving and changed traffic conditions. Construction impacts are common across all work sites. A bore pit will be constructed near the bottom of the access track near the Nepean River to receive the HDD bore.

Social impacts during construction include temporary disturbance (noise and visual impacts) to recreational users of the river.

A visual impact assessment report (Aurecon, Arup 2020e) assessed two viewpoints, one view looking west at the proposed discharge point in the opposite embankment (VI) and one view looking east with the proposed discharge point to the left of view (V2).

Both viewpoint 1 and 2 would be viewed by local public recreational users and was deemed to have a moderate sensitivity, with moderate to low magnitude of change and therefore moderate-low visual impact during construction.

The visual disturbance associated with the construction of the proposal would be limited to the construction phase and would be temporary. Views of existing site infrastructure from sensitive receiver locations within the study are limited.

Moderate to low level visual impacts are therefore experienced for a short duration (< 6 months).

Potential impacts – operation

The Nepean River discharge pipeline would extend down and across the rock face and would be shallow trenched into the rock and submerged into the river. The visual impact assessment concluded that the proposed discharge pipeline is likely to be noticeable only within the river environs and experienced by occasional recreation visitors to Maldon Weir. The existing topography and vegetation limits the extent of viewpoints of the proposal. Given that the pipe would be trenched into the rock and submerged in the river, both viewpoints 1 and 2 were assessed to have a negligible visual impact, given the negligible magnitude of change over time.

The visual modification that will occur is limited to a concrete filled narrow trench and a submerged pipe into the Nepean River. The base of the natural drainage line that flows into the Nepean River near this discharge point is currently dominated with weeds. This location would be rehabilitated by removing existing weeds and planting native species to revegetate the area. Any visual impacts are anticipated to be reduced to a negligible visual modification once ephemeral planting establishes around the outlet drainage area.

This visual assessment is based on concept design. Detailed design will confirm the exact configuration of the discharge outlet. Consideration of additional visual impacts and an updated photomontage will be prepared during detailed design, if required.

Safeguards

We will implement the following safeguards during construction and operation to minimise social and visual impacts:

- materials and finishes – rock rip rap should be the same material type and colour as existing on the river embankments
- proposed planting to the river embankment should be a native species and locally sourced
- undertake work in accordance with Sydney Water's Communications polices and requirements including:
    - notify impacted residents and businesses
    - erect signs to inform the public on the nature of the work
    - personnel to treat community enquiries appropriately
- worksites will be restored to the pre-existing condition or better following construction

- minimise visual impacts by retaining existing vegetation wherever possible
- maintain work areas in a clean and tidy condition
- materials selected are to reduce colour contrast and blend any new and existing structures, as far as possible into the surrounding environment.

Figure 25 - Viewpoint 1 existing (from west side of Nepean River looking south east)

Figure 26 - Viewpoint 1 post-construction

6.12 Cumulative

Cumulative impacts on waterways and ecological values

Local waterways are subject to a range of pressures and stressors as outlined in Wollondilly Shire Council's Integrated Water Management Strategy (Wave Consulting and WSC, 2020) including:

- urban development and increased imperviousness, with increased impact from wastewater management and stormwater runoff on water quality and natural creek flow characteristics, as well as direct impacts from development on riparian corridors, native vegetation and animal habitat
- climate change, with impacts on temperature, rainfall, stream flow, intensity of storms and floods, droughts and bushfires
- mining, for example fracturing of bedrock in Redbank Creek (Stonequarry Creek catchment) and in Myrtle Creek, and associated impacts on water quality and loss of surface water flows.

These and other aspects threaten the ecological health and recreational values of local waterways, however a range of initiatives aim to mitigate potential cumulative impacts. These include:

- Hawkesbury Nepean Framework and Nutrient Offsets: Licencing of discharges from wastewater treatment plants across the catchment are subject to load caps aiming to limit nutrient discharge within each zone of the river system. The EPA has developed a regulatory framework enabling the use of compliance offsets for managing nutrients from wastewater treatment plants. A variety of offset projects will be trialed before the regulatory framework is enforced from 2024. This mechanism potentially allows for cost effective mitigation of other sources of nutrients to be managed (e.g. from stormwater runoff and erosion of waterways). Sydney Water has commenced a small stormwater offset project in the Stonequarry Creek Catchment in collaboration with Wollondilly Shire Council and research partners. Nutrient loads from the Picton WRP will be well within the requirements set out in the Hawkesbury Nepean Framework for the Yarramundi Zone 1.
- NSW Government's Climate Change Policy Framework, with an objective of achieving net zero emissions by 2050 and helping NSW to become more resilient to a changing climate.
- Sydney Water's Strategy 2020-2030 and Energy Masterplan including a focus area; in embracing circular economy practices with the use of water, energy and materials to restore and regenerate the natural environment. This is reflected in a range of projects including energy efficiency and renewable energy and a commitment to keep our non-renewable (grid) electricity purchases in 2020 at or below 1998 levels. We are also piloting wastewater wetland treatment technologies (at the Picton WRP).
- The Department of Planning, Industry and Environment has developed a (draft) Cumberland Plain Conservation Plan that will include dedicated areas to protect unique native plants and animals. Vegetation surrounding Sydney Water's Picton farm will form part of a

Biodiversity Stewardship Site, with ongoing efforts to maintain the ecological values of the area.

Cumulative construction and development impacts on social amenity

Cumulative impacts on social amenity from construction noise, truck movements and other activities associated with development are also considered.

A review of DPIE's major project website and, indicates that the key projects currently in progress around the Picton area are:

- Picton High School redevelopment – construction commenced, due for completion in early 2022
- Tahmoor South coal mine – this mine has been in operation since 1979 and the current mining lease is due to cease in 2022. There is currently a proposal with DPIE to extend the mining lease for a further 10 years until 2032. This proposed extension if approved would extended the mine south towards Bargo.

Potential for cumulative impacts from the Picton High School redevelopment are unlikely as the bulk of the heavy construction works at Picton High School are anticipated to be complete by the time construction at Picton WRP commences in mid 2021.

Mining impacts on Redbank Creek, creek flows and water quality may increase potential impacts of recycled water discharge from the Picton WRP. However, mining in this area is largely complete and remediation of Redbank Creek is due for completion by late 2022.

Given that the affected catchment makes up less than 10% of the entire contributing catchment to Stonequarry Creek, and that these changes have already occurred, any future changes are expected to have minimal impact on the assessment results presented in this REF (Aurecon Arup, 2020b).

Transport for NSW has recently notified Sydney Water of their preferred route for the Picton bypass. The preferred bypass route intersects the northern portion of Picton farm and potentially reduces the existing irrigation areas. We understand this project will go on public exhibition in late November. We will continue to work with TfNSW to achieve the best outcome for both projects.

6.13 General Environmental Management

The following general environmental management safeguards will be implemented:

- prepare a Prepare a Construction Environmental Management Plan (CEMP) addressing the requirements of this environmental assessment. The CEMP should specify licence, approval and notification requirements. Prior to the start of work, all project staff and contractors will be inducted in the CEMP. The CEMP should be readily available on site and include a site plan which shows:
    - no go areas and boundaries of the work area

- location of environmental controls (including erosion and sediment controls, any fences or other measures to protect vegetation or fauna, spill kits, stockpile area)
- location and full extent of any vegetation disturbance

- the alignments shown in this REF are indicative and based on latest concept design at the time of the REF preparation. The final alignment may change based on activities such as detailed design and construction planning. No further environmental assessment is required provided the changed alignment:
  - remains within the field assessment area for the REF and has no net additional environmental impact, or
  - is outside the field assessment area for the REF but reduces the overall environmental impact of the proposal
- changes to the proposal outside the field assessment area will only occur:
  - to reduce impacts to biodiversity, heritage or human amenity, or
  - to avoid engineering (for example geological, topographical) constraints, and
  - after consultation with any potentially affected landowners and relevant agencies
- the contractor must demonstrate in writing how the changes meet those requirements, for approval by Sydney Water's Project Manager in consultation with the environmental and communication representatives
- Sydney Water's Project Manager (after consultation with Sydney Water's environment and community representatives and affected landowners) can approve temporary ancillary construction facilities (such as compounds and access tracks), without additional environmental assessment or approval if the facilities meet the following principles:
  - limit proximity to sensitive receivers
  - no disruption to property access
  - no impact to known items of non-Aboriginal and Aboriginal heritage
  - outside high-risk areas for Aboriginal heritage
  - use existing cleared areas and existing access tracks
  - no impacts to remnant native vegetation or key habitat features
  - no disturbance to waterways
  - potential environmental impacts can be managed using the safeguards in this REF
  - no disturbance of contaminated land or acid sulphate soils
  - will be rehabilitated at the end of construction
- the Delivery Contractor must demonstrate in writing how the proposed ancillary facilities meet these principles. Any facilities that do not meet these principles will require additional

environmental impact assessment. The agreed location of these facilities must be shown on the CEMP site plan and appropriate environmental controls installed

- prepare an Incident Management Plan (IMP) outlining actions and responsibilities during:
    - onset of heavy rain during works
    - spills other potential incidents relevant to the scope of works
    - unexpected heritage finds
    - all site personnel should be inducted into the IMP
- immediately notify the Sydney Water Project Manager and Community Relations Representative of any complaints
- to ensure compliance with legislative requirements for incident notification (eg. *POEO Act 1997*), Sydney Water's employees and contractors will follow SWEMS0009.

7 Conclusion

Sydney Water has prepared this REF to assess the potential environmental impacts of the Picton Treatment, Reuse and Discharge proposal. The proposal is required to increase the recycled water capacity to meet the current treatment capacity of 4 ML/day at the Picton WRP. This will enable Sydney Water to service growth in the wastewater catchment up to 2024-2028 and resolve current non-compliance with the EPL.

During construction, the main potential environmental impacts of the proposal are typical construction impacts such as some vegetation removal, potential sedimentation/ erosion, noise, and waste management. During operation, the main impacts are associated with potential water quality impacts from discharge of recycled water into a waterway. The assessment shows that if we adopt the measures identified in this REF, the proposal would not have a significant environmental impact and an environmental impact statement is not required under Division 5.1 of the EP&A Act.

Once operational, the proposal will have a positive impact by improving recycled water quality currently produced by the Picton WRP, ensuring capacity in the wastewater system to service growth and facilitating expansion of the recycled water network to off-site farms.

The proposal has been considered in accordance with the principles of ESD. The proposal will continue to provide a safe and reliable wastewater system for the Wollondilly community. The proposal is unlikely to result in the degradation of the quality of the environment and will not pose a risk to the safety of the environment. We will continue to monitor to ensure the health of the waterways are protected for current and future generations.

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WSC, 2020a. *Draft Wollondilly Rural Lands Study,* Wollondilly Shire Council, August 2020

WSC, 2020b. *Draft Integrated Water Management Strategy,* Wollondilly Shire Council, May 2020.

Wave Consulting and WSC, 2020. *Integrated Water Management Strategy Wollondilly Shire Council,* May 2020.

9 Appendices

Appendix A – Clause 228 checklist

Clause 228 checklist	REF finding
Any environmental impact on a community	There may be short-term minor construction impacts on the community from traffic, dust and noise. Potential recreational and visual impacts from the proposed Nepean discharge pipeline have been considered in this REF and conclude that impacts are likely to be minor. The proposal will result in a long-term benefit to the community by allowing new wastewater connections into the Picton system.
A transformation of a locality	The proposal will not result in a substantial transformation of a locality. The proposed new pipeline to the Nepean River has been designed to discharge through an existing rock drainage line which will minimise the visual impacts. The proposed new discharge into the Nepean River represents a small proportion of total Nepean flows and is unlikely to transform that stretch of the river, from a water quality, aquatic ecology or recreational perspective. The use of recycled water for irrigation on Farms 1 and 2 is consistent with the existing rural and agricultural nature of the area.
Any environmental impact on the ecosystem of the locality	There is potential for water quality impacts from additional discharge to the waterways, however, the impacts are not likely to be significant and are unlikely to result in an observable impact on the aquatic ecology in either Stonequarry Creek or the Nepean River. There will be some minor vegetation clearing associated with construction of the proposal, however this will not affect the ecosystems of the locality.
Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality	The proposal will not result in a reduction in the aesthetic, recreational or environmental quality or value of Stonequarry Creek or the Nepean River. The proposed new pipeline will discharge via a submerged pipe into the Nepean River, so visual impacts are minimised. The small additional discharge of recycled water to the river will not impact on the recreational values of the Nepean River. The resuse of recycled water at Farms 1 and 2 will not affect the qualities or values, including heritage of the locality. The

	proposal involves a positive outcome by reusing a valuable resource.
Any effect upon a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or any other special value for present or future generations	The proposed recycled water infrastructure will be installed within a locally listed heritage item at Farm 1, however, impacts to the heritage significance are considered minor and in keeping with the agricultural function of the property. The proposed Nepean River discharge outlet will be installed near the locally listed heritage item, Maldon Weir, and a rock shelter associated with potential Aboriginal heritage, however, no impacts are likely. Waterways are often places of special value and significance. The proposal, including discharge of highly treated recycled water to the waterways will not affect the value of these waterways, for now or for future generations.
Any impact on the habitat of any protected animals (within the meaning of the *Biodiversity Conservation Act 2016*)	The proposed work will involve clearing a small amount of a threatened ecological community listed under the BC Act 2016 located on Picton farm. However, impacts have been minimised by using an existing access track for construction access and underboring the proposed new discharge main. No impact to the Picton WRP's Biodiversity Stewardship Site are likely from the proposed works. The proposal is unlikely to have any impact on the platypus, a protected animal under the BC Act.
Any endangering of any species of animal or plant or other form of life, whether living on land, in water or in the air	An aquatic and terrestrial ecology assessment has been prepared to inform this REF and these have concluded that the proposal is unlikely to endanger any species of animal or plant or other form of life.
Any long-term effects on the environment	The proposed work is unlikely to have any long-term impacts on the environment but will have a long-term benefit by continuing to provide a reliable and modern wastewater service for the area. We will continue to monitor the waterway health surrounding the project and can adapt our preferred solution to ensure no long-term effects occur. The proposal will also provide a positive outcome by providing recycled water for reuse by irrigation to support sustainable farming practices.
Any degradation of the quality of the environment	The proposal will not cause the degradation of the quality of the environment. Whilst water quality concentrations in the waterways may go up with increased discharge, we do not anticipate this will result in aquatic health decline in the waterways.

Any risk to the safety of the environment	The proposed work will not increase risk to the safety of the environment. Potential safety risk from use of recycled water on privately owned farms has been considered in this REF. The proposal includes a UV upgrade and new chlorination plant at the WRP which will further reduce public health risks from irrigation with recycled water. Prior to being sent off-site, the recycled water will meet the Australian Guidelines for Recycled Water and operation of the irrigation scheme will be in accordance with a Recycled Water Quality Management Plan.
Any reduction in the range of beneficial uses of the environment	The proposed work will not have any reduction in the range of beneficial uses of the environment; both aquatic and terrestrial.
Any pollution of the environment	The environmental safeguards outlined in this REF will be implemented during construction to ensure no pollution of the environment. Operation of the recycled water scheme at privately owned farms will be in accordance with a Recycled Water Quality Management Plan which will ensure risk of pollution to the environment is minimised. This proposal includes additional discharge to the waterways, subject to obtaining an approval for an EPL variation.
Any environmental problems associated with the disposal of waste	The disposal of wastes will be in accordance with the environmental safeguards, and no environmental problems associated with the disposal of waste are expected.
Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply	The proposed work will not increase demand on resources, that are, or are likely to become, in short supply. The proposal involves the reuse of recycled water for irrigation, to support sustainable farming practices.
Any cumulative environmental effect with other existing or likely future activities	The proposed work is unlikely to have any cumulative environmental effect with other existing or likely future activities. This is considered further in Section 6.12 of the REF.
Any impact on coastal processes and coastal hazards, including those under projected climate change conditions	The proposed work will not have any impact on coastal processes or hazards.

Appendix B - Consideration of s45 of the *POEO Act 1997*

Matters to be taken into consideration in licensing functions	How these matters have been considered
(a) Protection of the environment policies (PEPs)	N/A - no PEPs have been made
(b) The objectives of the EPA as referred to in section 6 of the *Protection of the Environment Administration Act 1991*	The key objectives of the EPA are to: The key objectives of the EPA are to: a) protect, restore and enhance the quality of the environment in accordance with need to maintain ecologically sustainable development, and b) the reduce the risks to human health and prevent the degradation of the environment. The proposal has been designed, and safeguards have been implemented, to minimise environmental impact, in accordance with the principles of ecologically sustainable development (Section 2.3). In addition, the proposal involves upgrade to an WRP that has been built to collect and treat wastewater. This reduces the risk to human health and the environment from un-sewered properties. The proposal and ongoing operation of the WRP is to be in accordance with EPL 10555 (including any relevant variations).
(c) The pollution caused or likely to be caused by the carrying out of the activity or work concerned and the likely impact of that pollution on the environment	The potential for impacts to waterway health have been considered in Section 6 of this REF. This assessment concludes that whilst there will be changes in the water quality concentrations downstream, this is unlikely to result in significant impacts, nor impact substantially on the health or the values of the waterway.
(d) The practical measures that could be taken – (i) to prevent, control, abate or mitigate that pollution, and (ii) to protect the environment from harm as a result of that pollution,	Over the last 5 years, Sydney Water has thoroughly investigated all possible options to avoid the need for additional discharge to waterways. A summary of the options considered is provided in Section 2.2.4 of this REF. The preferred solution includes a combination of elements including source control, additional treatment, off-site reuse (subject to landowner's agreement) and increased discharge. This is the most reasonable and feasible option to enable continued servicing of the wastewater catchment for Picton.

Matters to be taken into consideration in licensing functions	How these matters have been considered
	We will continue to do extensive waterway health monitoring in Stonequarry Creek and the Nepean to inform future planning and options for further expansion. We will continue to seek further opportunities to expand recycled water use off-site which will reduce the amount of discharge required.
(e) any relevant green offset scheme, green offset works or tradeable emission scheme or other scheme involving economic measures, as referred to in Part 9.3	The EPA has developed a regulatory framework enabling the use of compliance offsets for managing nutrients from wastewater treatment plants. A variety of offset projects will be trialed before the framework is enforced from 2024. This mechanism potentially allows for cost effective mitigation of other sources of nutrients to be managed (e.g. from stormwater runoff and erosion of waterways). Sydney Water has commenced a small stormwater offset project in the Stonequarry Creek Catchment in collaboration with Wollondilly Shire Council and research partners.
(f) whether the person concerned is a fit and proper person,	Sydney Water Corporation has been operating wastewater systems in the Sydney area for over 100 years. We are a State Owned Corporation and public authority under the EP&A Act and are considered 'fit and proper'. The Picton WRP and farm operators will continue to operate the new infrastructure associated with this proposal. Private farmers will operate the recycled water infrastructure located on their farm, however, they will operate it in accordance with a Recycled Water Management Plan and with training and support from the current Picton farm operators.
(g) in relation to an activity or work that causes, is likely to cause or has caused water pollution – (i) the environmental values of water affected by the activity or work, and (ii) the practical measures that could be taken to restore or maintain those environmental values,	We understand that the environmental and community values for the waterways in Wollondilly LGA include: water quality and endangered species, recreation, cultural values, agriculture, biodiversity, sustainability and resilience (Wave and WSC, 2020). The proposed additional discharge of between 0.3 ML/ day to 1 ML/ day (depending on future scenario) is unlikely to impact on the environmental values of either Stonequarry Creek or the Nepean River. We are seeking to expand the recycled water network off-site, exploring

Matters to be taken into consideration in licensing functions	How these matters have been considered
	alternate treatment technologies (such as the pilot wetland) and funding a nutrient offset project in Picton township. These are all measures which will assist in maintaining and restoring the environmental values of the waterways.
(h) in connection with a licence application relating to the control of the carrying out of non-scheduled activities for the purpose of regulating water pollution – whether the applicant is the appropriate person to hold the licence having regard to the role of the applicant in connection with the carrying out of those activities,	The proposal relates to a sewage (wastewater) treatment plant which meets the capacity limits of a Scheduled activity under Schedule 1. Sydney Water holds EPL 10555 for the activity and will be applying for a licence variation to this EPL. It is appropriate for Sydney Water to apply for this variation as the holder of the EPL.
(i) in connection with a licence application – any documents accompanying the application,	This REF has been prepared to assess the potential construction and operational impacts of the proposal and has been prepared under Part 5.1 of the EP&A Act.
(j) in connection with a licence application - any relevant environmental impact statement, or other statement of environmental effects, prepared or obtained by the application under the *Environmental Planning and Assessment Act 1979,*	As above
(k) in connection with a licence application – any relevant species impact statement prepared or obtained by the applicant under the *Threatened Species Conservation Act 1995* or Part 7A of the *Fisheries Management Act 1994,*	A terrestrial and aquatic ecology assessment has been completed as part of this REF. No SIS is required.
(l) in connection with a licence application (i) any public submission in relation to the licence application received by the appropriate regulatory authority under this Act, and (ii) any public submission that has been made under the Environmental Planning and Assessment Act 1979, in connection with the activity to which the licence application	This REF will be publicly exhibited and submission sought from the public and government agencies. A Decision Report will be prepared responding to submission received on the REF.

Matters to be taken into consideration in licensing functions	How these matters have been considered
relates, and that has been received by the appropriate regulatory authority,	
(m) if the appropriate regulatory authority is not the EPA – any guidelines issued by the EPA to the authority relating to the exercise of functions under this chapter.	N/A

Appendix C – Consideration of SREP 20 clauses

Clause 5	Comment
The aim of the SREP is to protect the environment of the Hawkesbury-Nepean River system by ensuring that the impacts of future land uses are considered in a regional context.	This REF assesses the impacts of the proposal and considers the potential regional impacts. The proposal is not anticipated to have any significant and/ or regional level impacts. This proposal will not change the future land use but will enable the landuse identified in Wollondilly Council's Local Strategic Planning Statement (Wollondilly, 2020).
The strategies listed in the Action Plan of the H-N Environmental Planning Strategy	The proposal is not inconsistent with any of the strategies listed in the Action Plan.
Whether there are any feasible alternatives to the development or other proposal concerned.	Alternatives to the proposal have been considered and are outlined in Section 2.2.4.
The relationship between the different impacts of the development or other proposal and the environment, and how those impacts would be addressed and monitored.	Section 6 of this REF assesses the potential impacts of the proposal and identifies mitigation measures to minimise these impacts.

Clause 6	Comment
Total catchment management	Section 6.3 assess the potential impacts of the proposal on water quality and quantity at local waterways. The proposal would not result in any significant impacts on the catchment.
Environmentally sensitive areas	The Nepean River can be considered an environmentally sensitive area. The proposal has been designed to minimise the need to discharge into the Nepean River as is not expected to have more than a minor impact. The other environmental sensitive area is the biodiversity stewardship site, which is discussed further in Section 5.1 and 6.4.
Water quality and quantity, cultural heritage, flora and fauna.	As assessment of the potential impacts on water quality, cultural heritage and floral and fauna from the proposal are summarised in Sections 6.3, 6.4 and 6.8.
Riverine scenic quality	An assessment of the potential impact to riverine scenic quality from the proposed new Nepean discharge pipeline is outlined in 6.11.

Agriculture/ aquaculture and fishing	There is unlikely to be any impacts on fishing. Aquatic ecology impacts are assessed in Section 6.3.3. The proposal involves expanding recycled water to off-site farms (subject to landowner's agreements). This will enhance opportunities for productive agriculture.
Rural residential and urban development	This proposal will ensure adequate capacity at the Picton WRP to support rural residential development and urban development.
Recreation and tourism	The proposal is unlikely to impact on any recreation or tourism currently occurring in the area. Potential impact to recreation (swimming) in the Nepean River is included in Section 6.2.
Metropolitan strategy	The relevant strategic context has been described in Section 5.1.

Appendix D – Consideration of ISEPP consultation

ISEPP clause	Yes	No
Clause 13, council related infrastructure or services – consultation with council Will the work:		
Potentially have a substantial impact on stormwater management services provided by council?		√
Be likely to generate traffic that will strain the capacity of the road system in the LGA?		√
Involve connection to, and have a substantial impact on, the capacity of a Council sewerage system?		√
Involve connection to, and use of a substantial volume of water from a Council owned water supply system?		√
Involve installation of a temporary structure on, or enclosing, a public space under council's control that will cause a disruption to pedestrian or vehicular traffic that is not minor?		√
Involve excavation of the surface of, or a footpath adjacent to, a road for which the council is the roads authority that is not minor or inconsequential?	√	
Clause 14, local heritage – consultation with council		
Is the work likely to affect the heritage significance of a local heritage item, or of a heritage conservation area (not also a State heritage item) more than a minor or inconsequential amount?		√
Clause 15, flood liable land – consultation with council		
Will the work be located on flood liable land (that is land that is susceptible to flooding by the probable maximum flood event) and will they alter flood patterns other than to a minor extent?		√
Clause 15AA, flood liable land – consultation with State Emergency Services		
Will the work be located on flood liable land (ie. land that is susceptible to flooding by the probable maximum flood event) and undertaken under a relevant provision*, but not the carrying out of minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance? * (e) Div.14 (Public admin buildings), (g) Div. 16 (Research/ monitoring stations), (i) Div. 20 (Stormwater)?		√
Clause 15A, development with impacts on certain land within the coastal zone– council consultation		
Is the work on land mapped as coastal vulnerability area and inconsistent with a certified coastal management program?		√
Clause 16 – consultation with public authorities other than councils		
Will the proposal be located on land adjacent to land reserved under the *National Parks and Wildlife Act 1974* or to land acquired under Part 11 of that Act*? If so, consult with DPIE (NPWS).*		√
Will the proposal be located on land in Zone E1 Nationals Parks and Nature Reserves or in a land use zone that is equivalent to that zone? *If so, consult with DPIE (NPWS)*		√
Will the proposal be adjacent to an aquatic reserve or a marine park declared under *Marine Estate Management Act 2014? If so, consult with the Department of Industry.*		√
Will the proposal be in the foreshore area within the meaning of the *Sydney Harbour Foreshore Authority Act 1998? If so, consult with Sydney Harbour Foreshore Authority*		√
Will the proposal comprise a fixed or floating structure in or over navigable waters? consult *RMS*		√
Will the proposal be located on land in a mine subsidence district within the meaning of the *Coal Mine Subsidence Compensation Act 2017*? *If so, consult with Subsidence Advisory NSW.*	√	
Will the proposal involve clearing of native vegetation on land that is not subject land (ie non-certified land)? *If so, notify DPIE at least 21 days prior to work commencing. SEPP (Sydney Region Growth Centres)*		√