Review of Environmental Factors Addendum

North West Treatment Hub Upgrades (Growth Package) – Biosolids Processing and Construction Compound

(June, 2024)

Sydney WATER

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Determination

This Review of Environmental Factors Addendum (REFA) assesses potential environmental impacts of North West Treatment Hub (NWTH) Upgrades (Growth Package) – Biosolids Processing and Construction Compound. It 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 Sydney Water Project Manager is accountable for ensuring the proposal is carried out as described in this REFA, the approved REF (NWTH Upgrades and Sludge Transfer System Growth Package, July 2022) and approved Decision Report (NWTH Upgrades and Sludge Transfer System Growth Package, November 2022). Additional environmental impact assessment may be required if the scope of work or work methods described in this REFA change significantly following determination.

Decision Statement

The main potential construction environmental impacts of the proposed change include impacts on traffic and biodiversity. During operation, the main potential impacts are associated with air quality. The proposal will not be carried out in a declared area of outstanding biodiversity value and is not likely to significantly affect threatened species, populations or ecological communities, or their habitats. Therefore, a Species Impact Statement (SIS) or Biodiversity Development Assessment Report (BDAR) is not required.

Given the nature, scale and extent of impacts and implementation of the safeguards outlined in this REFA and the approved REF, the proposed work is unlikely to have a significant impact on the environment. Therefore, we do not require an Environmental Impact Statement (EIS) and the proposed change may proceed.

Certification

I certify that I have reviewed and endorsed this REFA and, to the best of my knowledge, it is in accordance with the EP&A Act and the Environmental Planning and Assessment Regulations (EP&A Regulation). The proposed change has been considered against matters listed in section 171 (Appendix A) and the guidelines approved under section 170 of the EP&A Regulation and the information it contains is neither false nor misleading.

Prepared by:	Reviewed by:	Endorsed by:	Approved by:	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Sarah Mitchell Senior Environmental Scientist Date: 23/05/24	Sally Spedding Lead Environmental Scientist Date: 07/06/24	Reza Kharaghani Senior Project Manager Date: 11/06/2024	Murray Johnson Environment and Heritage Manager Date: 13/06/24	Paul Plowman Executive General Manager, Water and Environmental Services Date: 13/06/24

1 Executive summary

Sydney Water's NWTH comprises the Castle Hill Water Resource Recovery Facility (WRRF), Rouse Hill WRRF and Riverstone WRRF. The NWTH provides wastewater servicing to Sydney's north west including the North West Growth Area (NWGA) and the North West Urban Renewal Corridor along the new Metro North West Line.

In 2022, Sydney Water proposed the NWTH upgrades to address rapid growth, meet future regulatory requirements and provide a solution that minimised impacts to the community and the environment. The proposed works included:

- upgrades at Rouse Hill WRRF and Riverstone WRRF
- constructing a new sludge transfer system between the three WRRFs to centralise biosolids treatment at Riverstone WRRF.

This REFA has been developed to assess changes to the proposal from that detailed in the approved REF and the approved Decision Report.

Table 1-1 below provides an explanation about why the proposed change is needed and summarises any changes to key impacts. Where additional impacts occur, they are minor and do not change the significance of impacts assessed in the approved REF.

Table 1-1 Summary of impacts of proposed change from approved REF

Proposed change	Why change is needed	Changes to key impacts
Construction of new carbonisation facility and associated infrastructure at Riverstone WRRF which will result in production of biochar, rather than biosolids. No expansion of existing anaerobic digestion and no upgrade to waste gas burners at Riverstone WRRF. Deletion of cogeneration unit from the scope at Riverstone WRRF	During detailed design, Sydney Water identified the NWTH upgrades as an opportunity to diversify our methods for biosolids processing. A review of technology available for advanced processing of biosolids to reduce contaminants of concern found that carbonisation with dewatering and drying was the preferred technology. Installing carbonisation at Riverstone WRRF is a proactive measure, in anticipation of more stringent Biosolids Guidelines being released.	• minor changes to construction noise and vibration, traffic and access, and visual impacts • no change in impacts to soils and contamination, flooding, waterway health, groundwater, biodiversity, Aboriginal and non-Aboriginal heritage • change to potential operational air quality impacts • minor changes to operational noise, odour and visual impacts.

Proposed change	Why change is needed	Changes to key impacts
New dewatering and outloading building at Rouse Hill WRRF	To cater for additional biosolids processing, as sludge will no longer be transferred to Riverstone WRRF.	• no substantial change to construction impacts within the WRRF • potential odour impacts and increase to truck movements during operation
Expansion of the construction footprint at Rouse Hill WRRF to include a temporary compound site at 7 Money Close, Rouse Hill (5/-/DP1158760), new temporary access road into the facility, as well as a 3m wide extension to the northern WRRF boundary for permanent access	There is limited space within Rouse Hill WRRF for a construction compound without impacting a large amount of native vegetation to the north. As such an external site is required during the construction period.	• impact to 0.45 ha of native vegetation at the Rouse Hill WRRF • minor changes to construction noise, traffic and access, and visual impacts
Ongoing use of the biological nutrient removal (BNR) and aerobic digester at Rouse Hill WRRF	With the removal of the sludge transfer system, the BNR and aerobic digester are to be retained.	• minor changes to operational noise, odour and visual impacts
Removal of both sludge transfer systems from the scope (Rouse Hill WRRF to Riverstone WRRF, and Castle Hill WRRF to Rouse Hill WRRF)	With carbonisation at Riverstone WRRF and additional Rouse Hill WRRF upgrades the sludge transfer system is no longer required.	• a substantial reduction in native vegetation removal • removal of all proposed impacts to Aboriginal and non-aboriginal heritage • removal of all construction impacts for the community along the pipelines

The proposed change remains aligned with Ecologically Sustainable Development (ESD) principles. The impact assessment has shown that the proposed change's residual impacts are still acceptable and can be effectively managed through implementing a range of safeguards already identified in the approved REF, as well as additional safeguards documented in this REFA. The proposed change reduces the overall impact to threatened ecological communities and Aboriginal heritage while providing an opportunity to diversify our biosolids product.

2 Introduction

This chapter provides an overview of the NWTH upgrade project as described in the approved REF. It also provides an overview of the proposed change.

2.1 Background

Sydney Water's NWTH comprises the Castle Hill WRRF, Rouse Hill WRRF and Riverstone WRRF (formerly called Water Recycling Plants and Wastewater Treatment Plant, respectively). The NWTH provides wastewater servicing to Sydney's north west including the North West Growth Area (NWGA) and the North West Urban Renewal Corridor along the new Metro North West Line.

Sydney's north west is experiencing rapid growth and needs to be supported by essential infrastructure capable of servicing demand. In response, Sydney Water is undertaking staged upgrades to the NWTH to support growth to 2056 in line with the NSW Government's long term population forecasts and Sydney Water's operating licence obligations. This requires balancing treatment capacity upgrades, improving environment and community outcomes and complying with environmental regulatory requirements as the NWGA develops. In particular, the NSW EPA's Hawkesbury Nepean Nutrient Framework imposes new nutrient load and concentration limits in our Environment Protection Licences (EPLs) effective from mid 2025.

Upgrades to the NWTH in response to new EPL load and concentration limits as well as EPL pollution reduction program (PRP) obligations are currently underway. These projects are termed the "Compliance Upgrade" which covers upgrades to Castle Hill WRRF and Rouse Hill WRRF, previously approved in a separate REF.

The approved REF assessed the potential impacts of the proposed upgrades on the surrounding environment. The proposal, as described in the approved REF, involved upgrades to the NWTH and a new sludge transfer system for consolidated biosolids handling at Riverstone WRRF.

The proposal involved:

- Upgrading the Rouse Hill WRRF capacity to 40 ML/d average dry weather flow (ADWF) (additional 14 ML/d) including liquid treatment amplification with increased recycled water capacity, improved treated water quality and decommissioning of biosolids handling.
- Upgrading the Riverstone WRRF capacity to 30 ML/d ADWF (additional 16 ML/d) including liquid treatment amplification, new anaerobic digestion, energy recovery facility and flexibility for future food waste co-digestion. The upgrade will be sized to receive increased sludge volumes from the hub area including from Castle Hill, Rouse Hill and Riverstone wastewater catchments for centralised biosolids treatment and outloading.
- Constructing a new sludge transfer system including:
  - a sludge pumping station (SP1224) and associated facilities at Castle Hill WRRF (assessed and approved in the Compliance Upgrade REF to account for cumulative impacts)

- upgrade of sludge pumping station (SP1223) and associated facilities at Rouse Hill WRRF
- about 6.3 km of pipelines (~315 mm diameter) between Rouse Hill WRRF and Riverstone WRRF dedicated for sludge transfer (RH2RIV)
- about 10.2 km pipeline (~200 mm diameter) between Castle Hill WRRF and Rouse Hill WRRF dedicated for sludge transfer (CH2RH).

2.2 Overview of the proposed change

Biosolids processing

In August 2023, the EPA published the *NSW Biosolids Regulatory Review* for stakeholder consultation. The current guidelines for the management of biosolids in NSW are the *Environmental Guidelines: Use and Disposal of Biosolids Products (*NSW EPA 1997) (Biosolids Guidelines). Since the guidelines were published, the types of contaminants entering the wastewater system have changed, as well as understanding of the risks and emerging opportunities for biosolids use. The EPA is currently considering feedback received during the consultation period which will be used to inform the drafting of updated Biosolids Guidelines. Once released these are likely to require new treatment methods for biosolids containing elevated per- and polyfluoroalkyl substances (PFAS) levels and other emerging contaminants. The biosolids at Riverstone WRRF have elevated PFAS levels which are unlikely to meet the criteria in the updated Biosolids Guidelines (depending on how the guidelines are applied).

Sydney Water awarded the delivery contract to the North West Hub Alliance (the Alliance) and detailed design commenced in late 2023. A review of technology during detailed design found that carbonisation with upstream dewatering and drying was the preferred technology for the NWTH upgrade project. Carbonisation provides an opportunity to diversify our methods for biosolids processing and reduce contaminants of concern at Riverstone WRRF.

Construction compound

Due to insufficient area within the Rouse Hill WRRF operational site, a vacant property at 7 Money Place, adjacent to the WRRF, was selected for the construction compound. A lease for this property has now been signed. This avoids the need to clear a large area of native vegetation on Sydney Water owned land to the north of the WRRF site for a construction compound.

The proposed change from the approved REF includes the following:

Riverstone WRRF

- construction and operation of a carbonisation facility and associated infrastructure including drying, heating and carbonisation systems, this will result in production of biochar rather than biosolids (further details provided in Section 2.2.1)
- no expansion of existing anaerobic digestion and no upgrade to waste gas burners
- deletion of cogeneration unit.

Rouse Hill WRRF

- construction and operation of a new dewatering and outloading building to cater for biosolids production
- expansion of the construction footprint to include a temporary compound site in 7 Money Close, Rouse Hill (5/-/DP1158760), new temporary access road into the Rouse Hill WRRF, as well as a permanent 3m wide extension to the northern boundary of the WRRF site
- ongoing use of part of the existing biological nutrient removal (BNR) treatment and existing aerobic digester.

Sludge transfer systems

- deletion of both sludge transfer pipelines (Rouse Hill WRRF to Riverstone WRRF, and Castle Hill WRRF to Rouse Hill WRRF).

The approved REF included upgrading treatment capacity at Rouse Hill WRRF to 40ML/day and Riverstone WRRF to 30ML/ day. This remains unchanged for the proposed change.

2.2.1 Carbonisation

Overview of carbonisation

Carbonisation is a process applied to wastewater biosolids, converting them into biochar, a carbon-rich material with versatile potential applications in agriculture, construction, and manufacturing. This process involves drying sludge or biosolids to a greater extent than typical dewatering methods, then subjecting them to high temperatures in a controlled environment to produce biochar. The captured heat from this process is efficiently recycled in the drying phase.

Through the carbonisation process, biosolids are exposed to high temperatures, facilitating the breakdown and removal of chemicals like organic pollutants and microplastics. The resulting gases undergo further treatment, including thermal oxidation and scrubbing, to eliminate pollutants and odours. This approach mirrors the natural process of coal formation from biomass, albeit accelerated under controlled conditions. Carbonisation has been successfully implemented globally, including in Queensland Australia. The carbonisation facility will have regulatory oversight from the NSW EPA.

Carbonisation process

The proposed biosolids management solution at Riverstone WRRF includes drying and carbonisation of combined waste activated sludge (WAS) and digested primary sludge in an integrated process that reduces biosolid volumes. Currently, the biosolids are dewatered in centrifuges to around 23% w/w solids (weight per weight solids ratio to overall sludge weight). The biosolids must be dried further to be carbonised into biochar, a more stable product that will have significant reduction in volume and lower levels of contaminants of concern. Once dried to ~80% w/w solids, they are fed to a carboniser reactor which converts the volatile organic fraction in the biosolids to syngas in a low oxygen environment. Syngas is a general term for a fuel gas mixture which contains valuable energy that is released during combustion in the thermal oxidiser. The solids that remain after carbonisation form a biochar.

Syngas from carbonisation is treated at high temperatures in a thermal oxidiser where heat is recovered from the exhaust gas. This heat is exchanged to a hot water loop, which heats the air used in the dryer. Supplementary heat for the dryer is provided by a gas water heater if required. The carboniser reactor and the thermal oxidiser collectively are referred to as a carboniser unit.

There are three sources of vent shaft emissions, namely from the dryers, the carboniser units and the water heaters. There is also an existing odour control unit (OCU) and vent shaft at the Riverstone WRRF.

The carbonisation process generally involves:

- Primary sludge is digested in the existing digesters.
- Biogas generated from the digesters will continue to be used to heat the digesters via the existing compressors and gas heaters. The excess gas will then be utilised to provide supplementary heat to the dryer and carbonisation heat loop.
- Undigested waste activated sludge (WAS) and digested primary sludge are blended in the sludge mixing tank. Achieving consistent mixing of the two sludge types is critical to the success of the drying and carbonisation processes.
- The mixed sludge is then dewatered using dewatering centrifuges.
- The dewatered sludge is dried and transferred to the carbonisers.
- Dried sludge is then carbonised. This process involves:
  - Dried sludge enters the carbonisation chamber where it is heated to between 600 – 700 ºC with limited oxygen supply.
  - The organic content in the sludge is then carbonised with syngas being transferred to a thermal oxidisation chamber. This burns the syngas, generating heat. Some of that heat is recovered to heat the carbonisation process, whilst the remainder is discharged to the atmosphere as flue gas.
  - The solid product (biochar) is created as a result.
- Before the flue gas is discharged, it is treated at each step of the process including:
  - biological scrubbing and activated carbon filters for dewatered sludge gas (through the existing site odour control system)
  - chemical scrubbing and polishing particulate matter for sludge dryer air and gas from the carbonisers.

The benefits of carbonisation are detailed below in Table 2-1.

Table 2-1 Benefits of carbonisation

Benefits	Details
Diversification of biosolids production and products	Diversification of biosolids products: • reduces dependency on a single method or technology, minimising the risk of disruptions due to equipment failure or regulatory changes • enables the production of different types of biosolids tailored for specific applications, such as soil amendment, energy production, or industrial processes, thus maximising the value of the products generated and reducing the risks associated with reliance on a single end use market (land application) • provides flexibility and adaptability to meet new requirements or take advantage of emerging opportunities.
Reduction of carbon dioxide emissions	Carbon sequestration is the process of capturing and removing carbon dioxide from the Earth's atmosphere. The carbonisation process locks the carbon dioxide away in the form of biochar, preventing the waste biomass from naturally decaying or being burned.
Contribute to Sydney Water's participation in the local circular economy	Sydney Water is committed to investing in new technologies and projects that will drive the local circular economy, along with reducing waste and increasing our ability to reuse and manage valuable resources. Carbonisation can contribute to the local circular economy in the following ways: • resource recovery – carbonisation can extract energy and valuable materials such as hydrogen, carbon monoxide, and methane from wastewater. These resources can be reused within the facility or sold for other industrial applications, contributing to the circular flow of resources. • waste minimisation - carbonisation reduces the volume of wastewater sludge by converting organic matter into syngas resulting in waste reduction and resource optimisation. • energy generation - syngas produced through carbonisation can be used to generate heat to power the dryers. Overall, carbonisation represents a circular approach by extracting value from waste streams, minimising waste generation, and promoting resource reuse.
Management of PFAS and other contaminants of concern	PFAS including PFOS, PFOA, and PFHxS, are synthetic chemicals widely used for their fire-retardant, waterproofing, and stain-resistant properties in various industrial and consumer products. They are

Benefits	Details
	present in items like food packaging, non-stick cookware, textiles, furniture, and firefighting foams. These chemicals are highly stable, bioaccumulate, and persist in the environment for extended periods, posing long-term environmental and health risks. PFAS pose a global challenge for water authorities, as they can contaminate wastewater, including byproducts like biosolids. Carbonisation is proposed as a solution to reduce PFAS and other emerging contaminants of concern, breaking them down into carbon during the process.
Continue to meet proposal needs and objectives	Through utilising carbonisation Sydney Water will continue to meet the proposals objectives. These objectives are to: • provide wastewater servicing to a growing population in Sydney's north west • improve treatment processes to meet future regulatory requirements • provide a solution that minimises impacts to the community and the environment.

2.3 Alternatives for proposed change

Table 2-2 details the short-listed options considered during detailed design for biosolids processing (since the approved REF).

Table 2-2 Details on the shortlisted options assessed for biosolids processing

Option	Summary of proposed option for biosolids processing
Option 5 (approved REF)	Centralised biosolids management at Riverstone WRRF with anaerobic digestion and dewatering, producing biosolids for beneficial reuse as a fertiliser and producing gas for generating green energy.
Option 2 (preferred)	Biosolids treatment separately at Riverstone WRRF and Rouse Hill WRRF with proactive, staged and adaptive implementation of carbonisation process technology to produce biochar. Drying and carbonisation processes installed at 12 dry tonnes/ day initial capacity to produce biochar at Riverstone WRRF.
Option 5b	Centralised biosolids management at Riverstone WRRF. Digested and dewatered biosolids product and biogas produced at Riverstone WRRF. Drying and carbonisation processes to produce biochar added in the future only after the Biosolids Guidelines have been released by EPA.

The proposed change (Option 2) was selected as the preferred option for the following reasons:

- implementing carbonisation now utilises the existing digestion capacity at Riverstone WRRF, there are capital and operational cost savings considering the updated EPA Biosolids Guidelines which are expected to be released
- avoids regrettable investments (e.g. building a sludge pipeline which may not be used)
- delivery and investment can be staged
- allows proactive progress on compliance with new regulations
- will provide delivery and operational insights that may be applicable for any future application of the technology across Sydney Water
- provides a basis for engagement with EPA on the development of regulations related to carbonisation.

The approved REF (Option 5) is not a viable option for future biosolids management at Riverstone WRRF. The quality of the biosolids currently produced at Riverstone WRRF would not meet the expected future EPA Biosolids Guidelines (assuming these align to the National Environmental Management Plan 3.0 approach). Carbonisation provides an opportunity to produce biochar with lower levels of PFAS and other contaminants of concern and maximise resource recovery.

Option 5b was discounted as it would require significant additional costs, some of which would be redundant once the updated Biosolids Guidelines are released.

A staged and adaptive approach has been developed for implementation of Option 2. The staging of the recommended biosolids management approach is summarised in Table 2-3 below. The initial stage is assessed in this REFA, further assessments will be undertaken for the ultimate stage.

Table 2-3 Option 2 biosolids processing staged approach

WRRF	Initial Stage	Ultimate Stage
Riverstone	Carbonisation to meet 2032 growth	Carbonisation to meet 2056 growth
Rouse Hill	No carbonisation, dewatering upgrades	Biosolids upgrade (potential carbonisation) to meet 2056 growth

2.4 Proposal needs and objectives

Consideration of the proposed change against the proposal objectives from the approved REF is detailed in Table 2-4 below.

Table 2-4 Consistency assessment against the proposal objectives detailed in the approved REF

Objectives	Approved REF	Proposed change
Respond to growth	Service growth in Sydney's north west to 2036 in line with NSW Government's long-term population forecasts and Sydney Water's operating licence obligations.	The proposed change is consistent with the approved REF and will enable Sydney Water to meet future growth. Carbonisation will be implemented in stages, with the first phase at Riverstone WRRF catering for growth to 2032.
Optimise value for money	Provide a 'least cost, value for money' wastewater treatment service for Sydney Water's customers to minimises bill impact.	The proposed change will lead to increased capital costs; however, its value lies in addressing the updated Biosolids Guidelines.
Develop an adaptable solution	Allow for adaptation to changing future demand scenarios with flexibility to adopt technical innovation.	The proposed change is consistent and will enable the use of technological innovation and diversify Sydney Water's wastewater treatment processes.
Implement a sustainable solution	To provide sustainable wastewater treatment services for a growing north west Sydney, that • protects the health of the Hawkesbury Nepean and local waterways • is energy efficient and maximise resource recovery • continues reliable supply of recycled water to existing customers and allow expansion of recycled water supply to potential new schemes.	The proposed change will continue to provide sustainable wastewater treatment services for growing north west Sydney. It will continue to protect the health of the waterways, maximise resource recovery and enable ongoing provision of recycled water to existing customers.
Minimise service disruption	Plan, construct, maintain and operate the infrastructure required to deliver the service with minimum disruption to stakeholders.	Construction and operation of the proposed change will not result in an increase in service disruption.

2.5 Consideration of Ecologically Sustainable Development

The proposed change has been considered against the principles of ecologically sustainable development (ESD) (refer to Table 2-5).

Table 2-5 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 proposed change includes carbonisation, a proven technology not previously used by Sydney Water. This technology has been successfully implemented in Queensland, Australia as well as other areas around the world. We have sourced operational data from suppliers and other carbonisation facilities when assessing potential impacts of this technology. The air quality impact assessment has assessed a worst case scenario (operation at peak design load) and the impacts are still predicted to be within required air quality limits (refer to Section 6.5). The proposed change will use the best available carbonisation technology and this REFA incorporates careful consideration of safeguards to ensure no threat of serious or irreversible damage. Installing carbonisation at Riverstone WRRF is a proactive measure, in anticipation of more stringent Biosolids Guidelines being released.
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 proposed change will continue to meet the needs of the present and future generations by providing a reliable wastewater service. Adopting diverse technologies across the Sydney Water system allows for adaptability to respond to alternative futures and opportunities. Reducing levels of PFAS and other contaminants of concern in biochar will ensure productivity of the environment is maintained for the benefit of future generations.
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.*	The proposed change significantly reduces the amount of native vegetation proposed for removal. The approved REF included the removal of 9.56 ha of native vegetation for the proposal. With the removal of the sludge transfer mains, this has been reduced to 1.3 ha, largely contained to Sydney Water land. The proposed change has resulted in the conservation of more biological diversity.

Principle	Consideration in proposal
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*	Overall, carbonisation in WRRFs represents a circular approach by extracting value from waste streams, minimising waste generation, and promoting resource reuse.

3 Description of proposed change

3.1 Introduction

Table 3-1 details if the proposed change is consistent with the approved REF. Where changes have occurred, further details are provided in Sections 3.2 to Section 3.8 below.

Table 3-1 Changes to the proposal description

Proposal description	Change at Riverstone WRRF	Change at Rouse Hill WRRF	Reference
Pre-construction	-	-	Refer to Section 3.2.1 of the approved REF
Construction – Rouse Hill WRRF	NA	✓	Refer to Section 3.2 below
Construction – Riverstone WRRF	✓	NA	Refer to Section 3.3 below
Construction – Sludge Transfer main	NA	NA	Removed from scope
Commissioning	✓	-	Refer to Section 3.2.5 of the approved REF
Post construction	✓	-	Refer to Section 3.2.6 of the approved REF
Operation	✓	✓	Refer to Section 3.2.7 of the approved REF and Section 3.6 below
Materials and equipment	-	-	Refer to Section 3.3 of the approved REF
Work sites, vehicle movements and access	✓	✓	Refer to Section 3.5 of the approved REF and Section 3.7 below
Working hours and timeframes	✓	✓	Refer to Section 3.8 below
Assessment area and changes to the scope of work	-	-	Refer to Section 3.7 of the approved REF

3.2 Rouse Hill WRRF upgrade

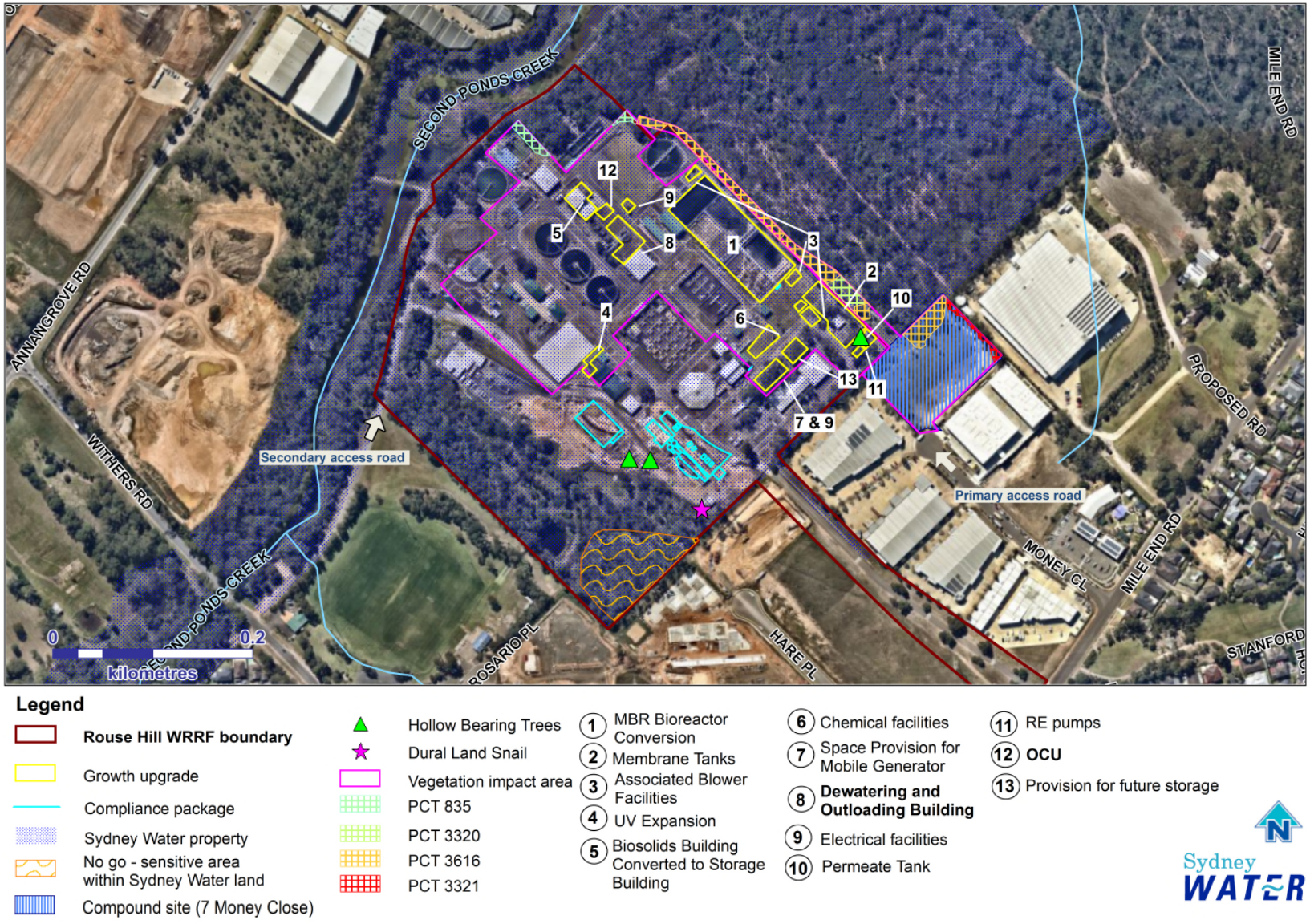
Table 3-2 Change to approved scope and additional scope at Rouse Hill WRRF

Scope		Proposed change	Justification for change
Approved scope			
primary treatment	construct primary treatment facilities mechanical primaries screens (MPS) to treat 3x ADWF or equivalent	removed	primary treatment not required due to retaining existing BNR
secondary treatment	convert all existing intermittently decanted aerated lagoons (IDALs) and all ancillaries to 4-stage-Bardenpho based membrane bioreactors (MBRs), an intensified treatment process which meets the required effluent quality at the given treatment capacity. This includes the construction of permeate tank and MRAS flow splitter. The existing covers on the IDAL feed channel will be removed for the repurposed Bioreactor feed channel.	retained	NA
	construct membrane tanks sized for 42.5 MLD (to be fitted out in stages to meet forecast growth)	retained	NA
	upgrade process aeration blowers with additional blowers and MBR air scour blowers	retained and relocated	BNR blowers in 2 new buildings either side of the Bioreactors instead of being housed in existing IDAL blower building
tertiary treatment	construct ultrafiltration (UF) membrane systems	removed	no augmentation of existing tertiary system
	modify existing Equalisation Basin for reuse as UF feed balance tank	removed	equalisation basin to be taken offline as not required

Scope		Proposed change	Justification for change
disinfection	demolish shallow bed filters and construction of new distribution chamber for the bypass chlorine contact tanks (CCTs)	removed	existing Stage 1 process stream retained
	convert CCTs to create four (4) parallel bypass CCTs	removed	CCTs to remain in existing configuration as Stage 1 process stream is retained
recycled water facility	construct ultraviolet (UV) treatment system and upgrade existing UV system	retained	NA
other	construct odour covers and odour extraction ducts for the new assets containing raw sewage and connect to the (Compliance Upgrade) odour control facility (OCF)	retained	NA
	upgrade ancillaries including existing potable water and reclaimed effluent (RE) systems	retained	NA
	construct and renew power supply connections including high voltage (HV) and low voltage (LV) network reticulation, switchboards, transformer kiosks, provision of emergency generator connection points for mobile emergency generators, upgrades to instrumentation and controls	retained	NA
	construct sludge screening (for the sludge transfer pipeline system)	removed	sludge pipeline removed
	upgrade chemical storage and dosing facilities to incorporate new chemicals and new chemical demands, including a carbon	retained and relocated	relocated adjacent to existing Stage 2 inlet works

Scope		Proposed change	Justification for change
	dosing facility and potential methanol dosing		
decommission and/or demolish existing assets	flow splitter structure and existing Stage 1 and Stage 2 inlet works (also demolish)	Stage 1 inlet works structure retained, Stage 2 and flow splitter still to be demolished	Stage 1 process retained (no primary treatment)
	Stage 1 Biological Nutrient Removal (BNR) facility	removed	Stage 1 process retained
	Stage 1 and Stage 2 tertiary clarifier	Stage 1 tertiary clarifier retained as part of the Stage 1 process. Stage 2 clarifier still to be decommissioned	Stage 1 process retained (no primary treatment)
	biosolids building for repurposing into a storage building	retained	NA
	Stage 1 secondary clarifiers (also demolish)	removed	Stage 1 process retained
	rotary drum thickener (RDT) area (also demolish)	removed	solids process retained as no sludge pipeline to Riverstone
	old primary treatment switchroom plus other ancillary structures (also demolish).	removed	solids process retained as no sludge pipeline to Riverstone
Additional scope			
new dewatering and outloading building and additional OCU		NA	no sludge pipeline to Riverstone WRRF means upgrade to the dewatering and outloading is required at Rouse Hill WRRF

Scope		Proposed change	Justification for change
compound and access track	expansion of the construction footprint at Rouse Hill WRRF to include a compound site in 7 Money Close, Rouse Hill (5/-/DP1158760), new temporary access road into the facility, as well as a 3m wide extension to the northern WRRF boundary for permanent access	NA	not enough space within Rouse Hill WRRF to accommodate a site compound internally leasing a vacant commercial site adjacent reduces the need to clear large amounts of native vegetation to the north of the WRRF site



Legend

- **Rouse Hill WRRF boundary**
- Growth upgrade
- Compliance package
- Sydney Water property
- No go - sensitive area within Sydney Water land
- Compound site (7 Money Close)
- Hollow Bearing Trees
- Dural Land Snail
- Vegetation impact area
- PCT 835
- PCT 3320
- PCT 3616
- PCT 3321
- (1) MBR Bioreactor Conversion
- (2) Membrane Tanks
- (3) Associated Blower Facilities
- (4) UV Expansion
- (5) Biosolids Building Converted to Storage Building
- (6) Chemical facilities
- (7) Space Provision for Mobile Generator
- (8) **Dewatering and Outloading Building**
- (9) Electrical facilities
- (10) Permeate Tank
- (11) RE pumps
- (12) **OCU**
- (13) Provision for future storage

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Figure 3-1 Rouse Hill WRRF Upgrades (Growth Package) - proposed change (**in bold**) and key environmental constraints

3.3 Riverstone WRRF upgrade

Table 3-3 Change to approved scope and additional scope at Riverstone WRRF

Scope		Proposed change	Justification for change
Solids stream upgrades			
construct sludge receival tank and pump station for pumping to digestors from other treatment facilities		removed	no longer required due to removal of sludge pipeline from Rouse Hill
upgrade WAS thickening facility with additional centrifuge		retained and amended	no additional centrifuge required in the near term. Additional centrifuge may still be required in future and has been accounted for as a standby in the noise assessment
construct sludge thickening building		retained and amended	extend existing sludge thickening building
install three new mesophilic digesters		removed	digestion removed to incorporate carbonisation
convert PST to feed sludge blend tank / standby primary sludge thickener		retained and amended	existing primary gravity thickener (old PST) will become a standby WAS gravity thickener
renewable energy	construct one cogeneration unit system	removed	without the new digesters there is not enough biogas to run cogen. Biogas will be used to supplement dryer heating requirements

Scope		Proposed change	Justification for change
	construct biogas pre-treatment handling and additional biogas flare(s)	retained and amended	this was for Cogen specifically. The new and much smaller pre-treatment handling will supply biogas to the water heaters
odour	upgrade existing odour control facility (OCF)	retained and amended	only changes to existing OCF are to tie in new odour sources and remove others. A new gas treatment facility will be required for dryer air
dewatering and outloading	construct biosolids outloading/ dewatering building for offsite tankering of dewatered solids required for growth package	removed	no change to the current outloading. Due to carbonisation the biosolids will be further stabilised after existing dewatering by drying and carbonisation to produce biochar
	construct dewatering equipment building extension and additional dewatering centrifuges	retained and amended	no extension to building is required, as the additional centrifuge can be installed in the existing building
	construct dewatered biosolids hoppers	retained and amended	no new hopper required. A change to the outlet of existing hopper
Liquid stream upgrades			
inlet works	construct new inlet screening channels	retained	NA
	construct additional vortex grit chamber with	retained	NA

Scope		Proposed change	Justification for change
	surrounding retaining wall		
primary treatment	construct mechanical primary screens (MPS) install new mechanical primaries plus wet weather bypass pipe to CCT	retained	NA
	construct wet weather PST (sized for 1,200L/s and expandable to future 2,200 L/s)	retained	NA
secondary treatment	construct membrane bioreactor (MBR) and associated blower facilities	retained	NA
tertiary treatment	construct additional UF capacity	retained	NA
other	upgrade ancillaries including existing potable water and first flush systems	retained	NA
	construct workshop/ maintenance building to be located within disturbed footprint area of the WRRF	retained	constructed in the next stage
	construct and upgrade power supply connections including high voltage (HV) and low voltage (LV) network reticulation,	retained	NA

Scope		Proposed change	Justification for change
	switchboards, transformer kiosks, upgrades to instruments and controls		
	upgrade chemical storage and dosing facilities to incorporate new chemicals and new chemical demands	retained	NA
treated water discharge	construct additional trenched discharge main from the CCTs to Eastern Creek adjacent to the existing discharge main and new outlet structure at Eastern Creek (if needed).	retained	constructed in a future stage
Sludge line			
construct one barometric loop (~25 m high)		removed	NA
construct pigging receival		removed	NA
construct approximately 150m of pipeline extending from the WRRF boundary to the new sludge receival tank		removed	NA
Additional scope - carbonisation facility			
gas scrubbing for drying of foul air treatment		added	carbonisation is a proactive measure, in anticipation of more stringent Biosolids Guidelines being released.
dryer and gasification roofed structure		added	
dewatered sludge to drying transfer system		added	

Scope	Proposed change	Justification for change
sludge dryers	added	
carbonisation unit and instrumentation	added	
hot water system	added	
chemical bund and outloading bay	added	
liquid nitrogen and supplementary LPG storage	added	
treated gas vent shafts	added	

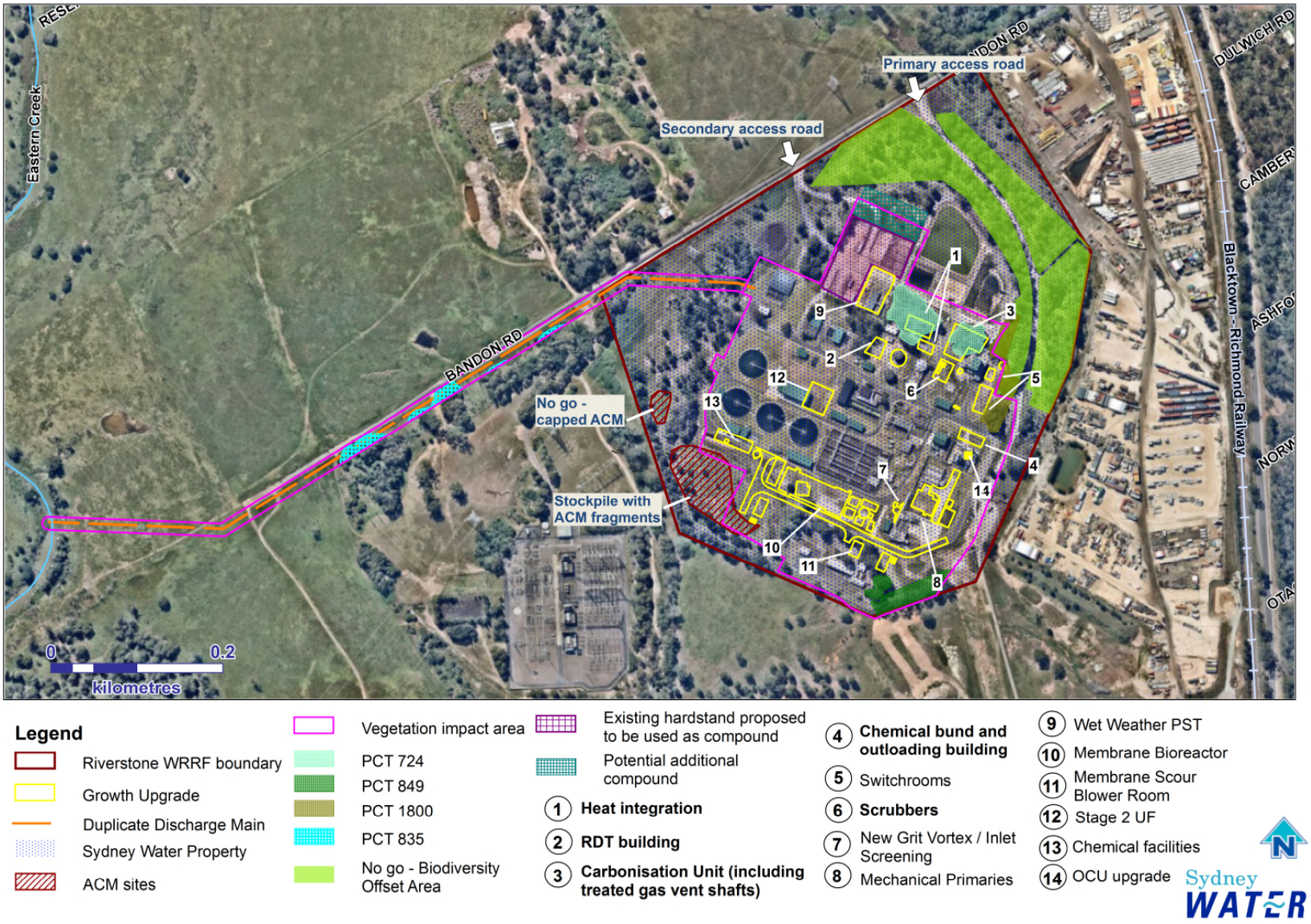

Figure 3-2 Riverstone WRRF Upgrade (Growth Package) - proposed change (**in bold**) and key environmental constraints

3.4 Commissioning

Commissioning of the carbonisation facility will involve testing and running the new equipment to ensure it is working correctly and integrated with existing facility operations. The exact commissioning steps depend on the type of equipment and process, but typically include:

- providing site labelling of WRRF upgrade components
- factory and site acceptance tests
- preparing and testing new infrastructure which may include hydrostatic or pressure leak tests and flow testing with water to check the performance of all equipment and safety devices
- performance testing including sampling where required
- process proving and system commissioning tests
- operator training and preparing maintenance manuals.

3.5 Post-construction

The construction compound at 7 Money Close will be in place for up to 5 years and dismantled once work at Rouse Hill WRRF is in 2029. The site will be cleaned up and restored to pre-existing condition or better in consultation with the property owner.

3.6 Operation

The proposed change will facilitate improved environmental performance and enable operation of the WRRFs to meet regulatory requirements while servicing growth. Rouse Hill WRRF and Riverstone WRRF, must operate under the following EPLs:

- EPL 4965 – Rouse Hill sewage treatment system including the sewage treatment plant
- EPL 1796 – Riverstone sewage treatment system including the sewage treatment plant.

During construction, Rouse Hill WRRF and Riverstone WRRF will continue to be operated to meet EPL compliance. However, an interim EPL variation will be required for Rouse Hill WRRF as the secondary treatment upgrades (which requires one IDAL at a time to be taken off-line) will extend beyond mid-2025, as outlined in the approved REF.

Both EPLs will be varied to reflect the new operational conditions and scenarios of the upgrades for each treatment plant. Process flow diagrams will be updated to show the process improvements and how each facility will operate. Licence Variation Applications will be prepared by the project team and submitted to the EPA prior to commissioning, well ahead of the minimum 60 days timeframe set in the regulation.

EPL 1796 for Riverstone WRRF is likely to include air emission limits, discharge point and monitoring requirements for the new carbonisation facility.

The biochar product is likely to be regulated separately, in accordance with the Biosolids Guidelines and a new resource recovery order.

3.7 Work sites, vehicle movements and access

Construction compounds may include sheds, stockpiles, parking and material storage. A compound site at Rouse Hill WRRF will be located at 7 Money Close, Rouse Hill (5/-/DP1158760). The site is an empty commercial lot located on the east corner of Rouse Hill WRRF. It will require the construction of a new temporary access road between the compound site and the WRRF. The location of the proposed compound site and temporary access road are shown in Figure 3-1.

During construction, Rouse Hill WRRF will be accessed via the new, temporary access road connected to Money Close and the main entrance via Mile End Road will be a secondary access road for construction. The access off Mile End Road will remain the primary operational access for the WRRF.

The indicative location of the compound site and the proposed access roads at Riverstone WRRF remains unchanged from the approved REF.

Further details on traffic and access are provided in Section 6.8.

3.8 Working hours and time

Establishment of the compound would occur from August 2024, with construction at both WRRF sites commencing in late 2024. Construction is expected to be complete in mid 2027 for Riverstone WRRF and mid 2029 for Rouse Hill WRRF.

The working hours have not changed from the approved REF, with most construction work being able to occur during standard construction hours. Any out of hours works would be justified and approved according to the safeguards outlined in Section 6.4 of this REF.

4 Consultation

4.1 Community and stakeholder consultation

Our approach to community and stakeholder consultation will continue to be guided by the Community and Stakeholder Engagement Policy (Sydney Water, 2021).

A Community and Stakeholder Engagement Plan (CSEP) has been prepared for the proposed change and will be updated as the project progresses. The plan helps us to provide the community and key stakeholders with clear, accurate and timely information.

Whilst carbonisation is a proven technology elsewhere, it is yet to be operated in NSW. We have consulted with the following two key stakeholders during preparation of this REFA:

- NSW EPA – meetings occurred on 7 July 2023 and 26 March 2024 to provide a project overview and seek their requirements for the air quality impact assessment.
- NSW Health – meeting on 20 May 2024 to provide a project overview and approach to assessing potential human health risks.

Consultation with stakeholders will continue throughout detailed design, construction and commissioning of the proposed change.

During construction, the Alliance will be responsible for delivering the proposed change, they will consult and engage with the community, act as representatives of Sydney Water, and will adhere to our community relations policies and procedures. Sydney Water will continually work with the Alliance to support and guide engagement activities during delivery and commissioning of the project.

4.2 Consultation on this REFA

Sydney Water will invite the community and stakeholders to comment on this REFA. We will provide information about the proposed change and the REFA process, and we will invite comment through:

- a community newsletter
- Sydney Water's website (www.sydneywatertalk.com.au)
- digital advertising
- online and face to face community information sessions
- door knocking and letters to directly impacted property owners.

This REFA will be available to download from sydneywatertalk.com.au during the display period from the 17 June 2024. The community phone line is **1800 560 682**. Feedback must be made in writing and received by 9 July 2022 by emailing NorthWestTreatmentHub@sydneywater.com.au

We will collect information in written representations to help us assess the proposed change. The information may be disclosed to appropriate agencies such as the EPA and NSW Health. 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.*

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 the update is received by 9 July 2024.

At the end of the public display period we will consider all submissions and prepare a Decision Report for the proposed change. This will also be available on www.sydneywatertalk.com.au

4.3 Consultation required under State Environmental Planning Policies and other legislation

Sydney Water must consult with councils and other authorities for work in sensitive locations or where the work may impact other agencies' infrastructure or land. This is specified in the State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP).

No formal consultation was required under the TISEPP. Further detail is provided in Appendix B.

5 Legislative requirements

5.1 Strategic context

The strategic context has been provided in detail in the approved REF. All aspects detailed below are additional considerations for the proposed change.

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

As detailed in the approved REF, future expansion and productivity envisaged for the NWGA and Metro North West Urban Renewal Corridor will be supported by ensuring capacity of wastewater services keep pace with growth. The proposed change will continue to positively contribute to several priorities for the Central City district. These include planning for a city supported by infrastructure (Planning Priority C1), protecting and improving the health and enjoyment of the area's waterways (Planning Priority C13), reducing carbon emissions and managing energy, water and waste efficiently (Planning Priority C19) and adapting to the impacts of urban and natural hazards and climate change (Planning Priority C20).

INSW State Infrastructure Strategy (Infrastructure NSW, 2018)

The proposed change will continue to meet the priorities outlined in this policy as detailed in the approved REF.

The Greater Sydney Water Strategy

The Greater Sydney Water Strategy is a comprehensive plan aimed at delivering sustainable and resilient water services to Greater Sydney. The strategy provides a roadmap for reliable water supplies, improved water quality, and enhanced community resilience in the face of future challenges. The proposed change will continue to contribute to Sydney Water's delivery of the following priorities:

- Priority 3 Our city is green and liveable:
  - progress a circular economy approach for water services
  - maintain and improve ecosystem health
  - invest in wastewater management.
- Priority 5 Water management and services meet community needs:
  - enhance community confidence through engagement and transparency.

NSW Circular Economy Policy Statement (NSW EPA, 2019)

The proposed change will continue to meet the priorities outlined in this policy as detailed in the approved REF.

NSW EPA Strategic Plan 2021-24

The Strategic Plan 2021–24 has five areas of focus, including legacy and emerging contaminants. It identifies the need to proactively manage high-risk legacy, current and emerging contaminants resulting from chemicals used in different industry settings.

The EPA has committed to taking action to reduce the impact of waste and contaminants on the environment. It also supports industry to identify hazards, assess risks, and implement effective controls to protect the environment and the community from contaminants.

The proposed change will contribute to this strategy by proactively implementing alternative biosolids management and reducing potential risks from emerging contaminants of concern.

Waste and Sustainable Materials Strategy 2041 (WASM)

The WaSM sets out key focus areas regarding waste and sustainable materials, including commitments to:

- reduce carbon emissions through better waste and materials management
- recover 80% of all waste by 2030
- halve the amount of organic waste sent to landfill by 2030.

By implementing carbonisation at Riverstone WRRF we will actively contribute to this strategy by diversifying our biosolids product, finding new markets and aiming to reuse 100% of our biochar product.

NSW Climate Change Policy Framework (NSW OEH, 2016) and Net Zero Plan Stage 1: 2020-2030 (DPIE, 2020)

The proposed change will continue to contribute to Sydney Waters action on climate change and goal to reach net zero emissions by 2050 as detailed in these plans.

Hills Future 2036 Local Strategic Planning Statement (THSC, 2019)

The proposed change will align with the following planning priorities by:

- upgrading wastewater servicing to support growth in The Hills Shire Council and reducing the risk of housing development delays (Planning Priority 6)
- improving the quality of treated wastewater and thereby protecting areas of high environmental value and significance such as waterways (Planning Priority 17)
- continued provision of recycled water through the Rouse Hill Water Recycling Scheme and thereby facilitating efficient water use and reducing Council's reliance on potable water (Planning Priority 19)
- informing the community about planning matters that affect them due to this proposed change, such as through newsletters and available online information sessions (Planning Priority 21).

Blacktown Local Strategic Planning Statement (BCC, 2020)

The proposed change aligns to the statement by:

- continuing to work with Blacktown City Council on improving the health of waterways and water management (Planning Priority 11)
- adopting ways to manage energy and waste efficiently (Planning Priority 16).

5.2 Environmental legislation

Sydney Water is the proponent and determining authority under the EP&A Act. The proposed change does not require development consent and is not classified as state significant infrastructure. We have assessed this proposed change under Division 5.1 of the EP&A Act. This REFA has concluded that the proposed change is unlikely to have a significant impact on the environment.

The following environmental planning instruments (Table 5-1) and legislation (Section 5.3) are relevant to the proposed change. All other legislative requirements remain unchanged and are detailed in the approved REF.

Table 5-1 Environmental planning instruments relevant to the proposed change

Environmental Planning Instrument	Relevance to proposed change
The Hills Shire Local Environmental Plan 2019 Blacktown Local Environmental Plan 2015	The proposed change is in the following land use zones: • Rouse Hill WRRF and 7 Money Close - General industry (E4) • Riverstone WRRF - Infrastructure (SP2) All areas of environmental conservation (C2) within Riverstone WRRF will be avoided.
State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP)	The aim of Chapter 2 (Infrastructure) of the TISEPP is for the effective delivery of infrastructure across the State. Section 2.126 permits development by or on behalf of a public authority for sewage treatment plants, biosolids treatment facilities and water recycling facilities without consent in a prescribed zone (or equivalent under Section 2.124) in the prescribed circumstances (carried out by a public authority). The compound at 7 Money Close is required to facilitate development associated with the sewerage system. The carbonisation facility is a biosolids treatment facility associated with a sewage treatment plant. The project involves upgrading a sewage treatment plant and water recycling facilities in land zoned Infrastructure and General industry (being a prescribed land use zone or equivalent). As Sydney Water is a public authority, the proposed change is permissible without consent.

5.3 Consideration of key environmental legislation

5.3.1 National Environment Protection Council Act 1994 - Commonwealth

The National Environment Protection Council (NEPC) was established under the National Environment Protection Council Act 1994 (NEPC Act). The primary functions of the NEPC are to:

- prepare National Environment Protection Measures (NEPMs)
- assess and report on the implementation and effectiveness of the NEPMs in each state and territory.

NEPMs are a special set of national objectives designed to assist in protecting or managing aspects of the environment, e.g. air quality.

The NEPMs relevant to air quality for the project are:

- National Environmental Protection (Ambient Air Quality) Measure 2021 (Air NEPM)
- National Environmental Protection (Air Toxics) Measure 2011 (Air Toxics NEPM).

National Environment Protection (Air Quality) Measure 2021

The Air NEPM outlines standards and goals for key pollutants that are required to be achieved nationwide, with due regard to population exposure. The air quality modelling and human health and ecological risk assessment results were compared to the Air NEPM criteria (see Section 6.5).

National Environment Protection (Air Toxics) Measure 2011

The objective of the Air Toxics NEPM is to improve knowledge regarding ambient air toxic pollutants within areas containing sensitive receptors that are likely to be impacted by elevated concentrations to facilitate development of standards that will protect human health and well-being. The air quality modelling and human health and ecological risk assessment results were compared to the Air Toxics NEPM criteria (see Section 6.5).

5.3.2 Protection of the Environment Operations Act 1997 - NSW

The *Protection of the Environment Operations Act 1997* (POEO Act) provides the NSW legislative framework for the regulation of water, air and noise pollution, and the transport and disposal of waste. An environment protection licence (EPL) must be obtained for scheduled development work and scheduled activities. The proposed change would involve activities that would upgrade elements of Sydney Water's wastewater systems that are operated in accordance with EPLs that have been issued by the Environment Protection Authority (EPA) under the POEO Act. As discussed in Section 3.6, a potential licence variation is likely to be needed during construction for the Rouse Hill WRRF EPL. Prior to operation of the proposed change, both Riverstone WRRF and Rouse Hill WRRF will require a licence variation to be approved.

Air pollution

POEO (Clean Air) Regulation 2022

The NSW Protection of the Environment Operations (Clean Air) Regulation 2022 'the Clean Air Regulation' (which came into force on 16 December 2022), provides statutory emission limits and operating requirements for industrial facilities and activities.

There is currently no specific regulation for the operation of a carbonisation facility in NSW. However, section 69 of the Clean Air Regulation provides emission limits applicable to Group 6 afterburners and other thermal treatment facilities (excluding flares) which is the closest description of carbonisation technology available. The carboniser used for the project has an oxidation chamber for management of syngas that could be considered an afterburner.

These emission limits apply to gases within the vent shaft for periods in which the facility is operational, excluding facility start-up and shutdown.

Section 69, Part 5, Division 5 of the Clean Air Regulation states that the emissions of an afterburner without a catalytic control system must comply with:

(a) the time between an air impurity entering and exiting the afterburner is—

(i) if the air impurity originates from material containing a principal toxic air pollutant—more than 2 seconds, or

(ii) otherwise—more than 0.3 seconds, and

(b) the temperature for the combustion of an air impurity by the afterburner is—

(i) if the air impurity originates from material containing a principal toxic air pollutant—more than 980°C, or

(ii) otherwise—more than 760°C, and

(c) the destruction efficiency of the plant, in relation to an air impurity entering the plant, is—

(i) if the air impurity originates from material containing a principal toxic air pollutant—more than 99.9999%, or

(ii) otherwise—more than 99.99%.

The principal air toxic pollutants associated with emissions from the carbonisers are arsenic (As), cadmium (Cd), chromium (Cr), nickel (Ni), dioxins, furans, and polycyclic aromatic hydrocarbon (PAH). Appendix G provides further details of how the air quality impact assessment (AQIA) has assessed the proposed carbonisation facility in the absence of specific requirements relevant to the technology.

The AQIA documents an outcomes-based assessment using estimated air emissions, rather than focusing on specific design parameters of the technology used to achieve these outcomes, as specified in the Clean Air Regulation. Whilst the Clean Air Regulation requires specific design parameters to be met for afterburners, we are taking a risk-based approach to demonstrate that the environmental outcomes can be achieved. This provides the EPA the information and data to set licensing performance and monitoring conditions accordingly. We will use best available

technology, as well as implementing all reasonable and feasible mitigation measures to meet the air quality outcomes specified in the Clean Air Regulation, whilst proactively reducing contaminants of concern in the wastewater byproducts.

Biosolids regulation

Biosolids refer to the organic product that results from sewage treatment processes. Currently about 50% of biosolids produced in NSW are applied to land for use in agriculture (NSW Biosolids Regulatory Review | NSW Environment Protection Authority).

The POEO Act is the primary environmental legislation in NSW under which the generation, treatment, use and disposal of biosolids is regulated. It sets the framework to ensure that the environment and human health are protected from the inappropriate use of waste.

The current guidelines for the management of biosolids in NSW are the *Environmental Guidelines: Use and Disposal of Biosolids Products* (NSW EPA 1997) (Biosolids Guidelines). Since the guidelines were published, the types of contaminants entering sewerage systems have changed, as well as our understanding of the risks and emerging opportunities associated with biosolids.

In 2023 the EPA published *NSW Biosolids Regulatory Review*. The NSW EPA is in the process of updating the current guidelines for biosolids management in NSW due to changes in contaminants and understanding of risks. The process involved considering peer-reviewed research and best practices to ensure effective biosolids management for public health and the environment. The review outlined the following objectives:

- identify opportunities to improve the quality of biosolids
- maximise opportunities for the beneficial use of biosolids
- ensure that the land application of biosolids in NSW does not present an unacceptable risk to human health and the environment
- continue to keep the community safe by monitoring for unknown and emerging risks
- ensure a strong circular economy in the medium to long term.

The EPA aims to improve biosolids quality, maximize beneficial use, and ensure safety for human health and the environment. A key area raised by EPA was around contaminants of concern including PFAS and galaxolide.

By undertaking the proposed change and implementing carbonisation, Sydney Water can utilise existing digestion capacity at Riverstone WRRF, diversify our biosolids product and be ready to respond when the new Biosolids Guideline is released.

The POEO (Waste) Regulation 2014 provides for orders and exemptions for the use of biosolids, including:

- *Biosolids Order 2014 (Biosolids Order)* – is a resource recovery order which set the requirements that generators and other suppliers must meet for biosolids to be supplied for land application.

- *Biosolids Exemption 2014 (Biosolids Exemption)* – provides exemptions from particular licensing and other provisions for the occupiers of premises where biosolids are applied to land.

There is currently no regulation that covers reuse of biochar. We will continue to work with EPA to ensure the necessary Resource Recovery Order (RRO) and/ or Resource Recovery Exemption (RRE) are in place prior to any off-site reuse.

6 Environmental assessment

6.1 Approach to assessment

This REFA only assesses those environmental aspects which have additional impacts from the approved REF as detailed in Table 6-1 below. All remaining environmental aspects and safeguards (as relevant) remain the same as detailed in the approved REF.

The amended environmental aspects assessed below include the original safeguards from the approved REF (as relevant), as well as any new safeguards (noted in **bold**).

Table 6-1 Environmental aspects that require additional environmental assessment

Environmental aspect	Change at Riverstone WRRF			Change at Rouse Hill WRRF			Relevant document – for assessment and safeguards
	construction impact	operational impact	specialist assessment	construction impact	operational impact	specialist assessment	
Topography, geology and soil	-	-	-	-	-	-	Refer to the approved REF
Flooding	-	-	-	-	-	-	Refer to the approved REF
Waterway health	-	-	-	-	-	-	Refer to the approved REF
Groundwater	-	-	-	-	-	-	Refer to the approved REF
Terrestrial flora and fauna	-	-	-	✓	-	✓	Refer to Section 6.2
Heritage – Aboriginal	-	-	-	✓	-	✓	Refer to Section 6.3
Heritage – Non - aboriginal	-	-	-	-	-	-	Refer to the approved REF
Noise and vibration	✓	✓	✓	✓	✓	✓	Refer to Section 6.4
Air quality	-	✓	✓	-	✓	✓	Refer to Section 6.5
Energy, Climate Change risk and Sustainability	-	✓	-	-	-	-	Refer to Section 6.6

Environmental aspect	Change at Riverstone WRRF			Change at Rouse Hill WRRF			Relevant document – for assessment and safeguards
	construction impact	operational impact	specialist assessment	construction impact	operational impact	specialist assessment	
Waste and hazardous material	-	✓	✓	-	-	-	Refer to Section 6.7
Traffic and access	✓	✓	✓	✓	✓	✓	Refer to Section 6.8
Social and visual	-	✓	-	✓	✓	-	Refer to Section 6.9
Cumulative	-	-	-	-	-	-	Refer to the approved REF.

6.2 Terrestrial Flora and fauna

An addendum flora and fauna assessment was completed by Biosis in May 2024 (Appendix C). The study area of the assessment includes the proposed construction of a construction compound at 7 Money Close, a temporary access road into the Rouse Hill WRRF, as well as a 3m wide extension of the northern WRRF boundary to allow for operational access around the assets. The assessment assumes clearing of the study area except for vegetation fringing the north-east boundary of 7 Money Close, which will be trimmed by up to 10%.

The addendum flora and fauna assessment also considered the reduction in impacts associated with the removal of the sludge pipeline between the three WRRFs.

The assessment included a desktop review of background documents relating to the study area and a habitat-based field investigation of the study area on the 16 April 2024 by two ecologists.

Existing environment

The study area is defined as being the entirety of Lot 5 DP 1158760 (the proposed compound site at 7 Money Close), as well as a strip of Lot 3 DP 251094 on Sydney Water land adjacent and parallel to the operational area of the Rouse Hill WRRF (see Figure 3-1).

The study area is situated within an industrial estate and consists of mostly cleared vegetation in the south of the proposed compound site and intact native vegetation along the northern boundary of the proposed compound site and WRRF site. The study area is connected to a large patch of

vegetation in the north which connects to the vegetated riparian corridor associated with Second Ponds Creek, a Strahler Order 3 watercourse.

The cleared portion of the study area in the south was noted as being dominated by introduced species, with some introduced species also scattered throughout the intact native vegetation.

During the field investigation, a single adult Wedge-tailed Eagle *Aquilla audax* was observed flying above the study area. Several Noisy Miners *Manorina melanocephala* were also observed in the canopy within the study area.

Table 6-2 Existing Plant Community Type (PCT) within the study area

PCT	PCT description	Associated threatened ecological community (TEC)		Condition	Legislative listing?
3616	Sydney Hinterland Grey Gum Transition Forest.	NA	0.31 ha	high (0.02 ha) and moderate (0.29 ha)	-
3320	Cumberland Shale Plains Woodland	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Critically Endangered Ecological Community [CEEC], EPBC Act*). Cumberland Plain Woodland in the Sydney Basin Bioregion (CEEC, BC Act**).	0.03 ha	low	BC Act
3321	Cumberland Shale-Sandstone Ironbark Forest	Shale Sandstone Transition Forest of the Sydney Basin Bioregion (CEEC, EPBC Act). Shale Sandstone Transition Forest in the Sydney Basin Bioregion (CEEC, BC Act).	0.03 ha	low	BC Act

* *Environmental Protection and Biodiversity Conservation Act 1999*
** *Biodiversity Conservation Act 2016*

Desktop searches identified 42 threatened flora species and 76 threatened fauna species were recorded or predicted to occur within 5 km of the study area. Of these, 3 flora species and 17 fauna species were considered most likely to occur in the study area.

Table 6-3 Potential threatened flora with most likely occurrence within the study area

Threatened Flora species	BC Act	EPBC Act
Darwinia biflora	V	V
Hairy Geebung *Persoonia hirsuta*	E	E
Pimelea curviflora var. curviflora	V	V

* V = vulnerable E = endangered

Table 6-4 Potential threatened fauna mostly likely to occurrence within the study area.

Threatened Fauna species	BC Act	EPBC Act
Dural Land Snail *Pommerhelix duralensis*	E	E
Glossy Black-Cockatoo *Calyptorhynchus lathami*	V	V
Gang-gang Cockatoo *Callocephalon fimbriatum*	E	E
Powerful Owl *Ninox strenua*	V	
Large Bent-winged Bat *Miniopterus orianae oceanensis*	V	
Large-eared Pied Bat *Chalinolobus dwyeri*	E	V
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V	
Eastern Coastal-Free-tailed Bat *Micronomus norfolkensis*	V	
Little Bent-winged Bat *Miniopterus australis*	V	
Eastern Freetail-bat *Mormopterus norfolkensis*	V	
Southern Myotis *Myotis Macropus*	V	
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	V	
Greater Broad-nosed Bat *Scoteanax rueppellii*	V	
Eastern Cave Bat *Vespadelus troughtoni*	V	
Yellow-bellied Glider *Petaurus australis*	V	
Cumberland Plain Land Snail *Meridolum corneovirens*	E	
Grey-headed Flying Fox *Pteropus poliocephalus*	V	V

During the survey no likely habitat for threatened flora species was found. Based on the size of the study area, it was considered comprehensive to assess the presence of the flora species outlined

in Table 6-3. Taking all these factors into consideration, there is a low likelihood of occurrence for the above listed species.

Based on the size of the study area, the survey effort is considered comprehensive to assess habitat presence for the species outlined in Table 6-4. During the survey the following habitat features were identified in the study area:

- feed trees suitable for a range of arboreal and flying fauna (such as Yellow-bellied Glider and Grey-headed Flying-fox) whilst in flower
- feed trees that may provide foraging resources for the Glossy Black Cockatoo and Gang-gang Cockatoo
- foraging resources
  - for the Cumberland Plain Land Snail in PCT 3320 and PCT 3321 leaf litter may provide habitat
  - for the Dural Land Snail in PCT 3616.

Due to the removal of potential habitat for Dural Land Snail and Cumberland Plain Land Snail, a SIC assessment has been completed for the EPBC Act listed Dural Land Snail (Appendix 4 of Appendix C) and a Test of Significance (ToS) has been completed for both the BC Act listed Cumberland Plain Land Snail and Dural Land Snail (Appendix 5 of Appendix C). These assessments determined that a significant impact is unlikely to occur. Taking all these factors into consideration, there is a low likelihood of impact for the above listed species. The priority weeds which were recorded in the study area are outlined in Table 6-5.

Table 6-5 Priority Weeds recorded in the study area

Priority Weeds
African Olive *Olea europaea subsp. cuspidate*
Blackberry *Rubus fruticosus sp. agg.*
Bridal Creeper *Asparagus asparagoides*
Common pear *Opuntia stricta*
Fireweed *Senecio madagascariensis*
Green Cestrum *Cestrum parqui* (adjacent to study area)

Potential impacts – Construction

As a result of the proposed change, the total project will impact 1.3 hectares of native vegetation, including:

Riverstone WRRF

- removal of 0.85 ha of TECs at Riverstone WRRF – no change from the approved REF and all within certified land according to the biodiversity certification order (former SEPP Sydney Region Growth Centres 2006)

Rouse Hill WRRF

- removal of 0.34 ha of PCT 3616 Sydney Hinterland Grey Gum Transition Forest
- removal of 0.06 ha of PCT 3320 Cumberland Shale Plains Woodland, which meets the criteria for Cumberland Plain Woodland in the Sydney Basin Bioregion (CEEC, BC Act)
- removal of 0.05 ha of PCT 835 Cumberland River-flat Forest, which meets criteria for River-flat Eucalypt Forest in the Sydney Basin Bioregion (CEEC, EPBC and BC Act).

The above native vegetation communities to be impacted are shown on Figure 3-1. In addition, trimming may occur of up to 10% to a 0.03 ha patch of PCT 3321 Cumberland Shale-Sandstone Ironbark Forest, which meets the criteria for Shale Sandstone Transition Forest in the Sydney Basin Bioregion (CEEC, BC Act).

As per the approved project, there is other vegetation which may require removal within the WRRF operational boundaries. This does not conform to a PCT and has been classified as Urban Native/Exotic.

The removal of the proposed 16.5 kilometre sludge pipeline connecting the Castle Hill WRRF, Rouse Hill WRRF and Riverstone WRRFs from the scope of works represents a substantial reduction in the 9.56 hectares of native vegetation clearing identified in the approved REF. An updated table detailing the remaining native vegetation impacts of the proposed change is detailed in Table 6-6 below.

Table 6-6 Total native vegetation impacts

PCT		Associated TEC	BC Act listed	EPBC Act listed	Area to clear
Riverstone WRRF*					
849	Cumberland Shale Plains Woodland**	Cumberland Plain Woodland	CEEC	CEEC	0.24
724	Castlereagh Shale - gravel Transition Forest**	Shale Sandstone Transition Forest	CEEC	CEEC	0.37

PCT		Associated TEC	BC Act listed	EPBC Act listed	Area to clear
1800	Cumberland Swamp Oak riparian forest**	Swamp Oak Floodplain Forest	EEC	-	0.24
Rouse Hill WRRF					
835	Cumberland River-flat Forest**	River-flat Eucalypt Forest	CEEC	CEEC	0.05
3320	Cumberland Shale Plains Woodland	Cumberland Plain Woodland	CEEC	-	0.06
3616	Sydney Hinterland Grey Gum Transition	-	-	-	0.34
3321	Cumberland Shale-Sandstone Ironbark Forest	Shale Sandstone Transition Forest	CEEC	-	Trimming
				Total	**1.3 hectares**

*The Riverstone WRRF is located wholly within the NWGA. All PCTs being impacted within this facility are mapped as certified land and will not be offset.

**Legacy PCTs were used in previous assessments for the approved REF. These PCTs have since been decommissioned however they still align with current TECs detailed in Appendix C.

Potential impacts – Operation

No impacts to terrestrial flora and fauna during operation are anticipated.

Safeguards – Construction

The following is a consolidated list of safeguards from the approved REF and new ones from this REFA (**noted in bold)**:

- prepare site restoration management plans
- all workers are provided with an environmental induction prior to starting construction activities on site. This will include information on the biodiversity values of the site, protection measures to protect biodiversity during construction, ID characteristics of threatened species that may be encountered and instructions not to handle fauna species under any circumstances during toolbox talks

- minimise vegetation clearance and disturbance, including impacts to standing dead trees and riparian zones. Where possible, limit clearing to trimming rather than the removal of whole plants
- **physically delineate vegetation to be cleared and/or protected/retained on site and install appropriate signage prior to works commencing**
- monitor and record vegetation clearance and provide to Sydney Water in accordance with SWEMS0015.26
- **offset residual impacts in accordance with the Sydney Water Biodiversity Offset Guideline at the following ratios:**
    - **anticipated 0.11 ha of TEC to be offset using a 3:1 ratio**
    - **anticipated 0.34 ha of non-threatened native vegetation to be offset using a 2:1 ratio**
    - **anticipated one HBTs is to be offset using 2 nest boxes or salvaged hollows for each removed at the location of removal or nearby**
    - **planted native trees (not part of existing PCTs) to be offset using a 3:1 ratio**
    - **non-local native or exotic trees to be offset using a 1:1 ratio.**

  The location of offsets will be determined during detailed design in consultation with Sydney Water and/ or local Council
- **any additional stockpile and compound areas are to be located within existing cleared areas and existing access tracks. Temporary compound sites and access tracks will be rehabilitated at the end of construction. Temporary storage of materials including pipe lengths is to occur in cleared, previously disturbed areas and not within tree protection zones (TPZs)**
- inspect vegetation for potential fauna prior to clearing or trimming. If fauna is present, or ecological assessment has determined high likelihood of native fauna present, including removal of hollow-bearing trees, engage a licenced ecologist to inspect and relocate fauna before works
- if native fauna is encountered on site, stop work and allow the fauna to move away un-harassed. Engage a licenced ecologist if assistance is required to move fauna
- **pre-clearance inspections for Dural Land Snail and Cumberland Plain Land Snail in 'high quality habitat' within PCT 3616, PCT 3321 and PCT 3320 as determined by project ecologist. High quality habitat is defined as areas with low levels of ground disturbance, with a moderate to high litter cover of bark, leaves and logs / woody debris, or grass clumps. If found, snails to be relocated to adjacent retained habitats by licenced ecologist**
- all hollow-bearing trees are to be removed in a two-stage process:
    - Stage 1: All surrounding vegetation to be cleared and grubbed.

- Stage 2: 24 to 48 hours later (or in accordance with approval documentation) the hollow- bearing trees are to be inspected by an ecologist. If resident fauna is observed, the hollow section is to be lowered to the ground and the animal allowed to move on of its own volition. If injured, the fauna to be taken to a WIRES carer or appropriate veterinarian for care.

- protect trees in accordance with the requirements of Australian Standard 4970-2009 for the Protection of Trees on Development Sites. Do not damage tree roots unless absolutely necessary, and engage a qualified arborist where roots > 50 mm are impacted within the Tree Protection Zone
- retain dead tree trunks, bush rock or logs in-situ unless they are in the impact area and moving is unavoidable. Reposition material elsewhere on the site or approved adjacent sites. If native fauna is likely to be present, a licenced ecologist should inspect the removal and undertake fauna relocation
- manage biosecurity in accordance with:
  - *Biosecurity Act 2015* (see NSW Weedwise), including reporting new weed infestations or invasive pests
  - contemporary bush regeneration practices, including disposal of sealed bagged weeds to a licenced waste disposal facility
- to prevent spread of weeds:
  - vehicles to be clean of mud and debris
  - wrap straw bales in geo-fabric to prevent seed spread
- excess generated green waste must not be stockpiled for long periods. Any temporary stockpiles must be located away from waterways or drainage lines.

Safeguards – Operation

- maintenance of any restored areas will occur for 2 years to ensure the areas are stabilised, native plant species establish and weeds are managed
- PEMPs will be updated to reflect new site layouts and landscaping.

6.3 Aboriginal heritage

The proposed change at Riverstone WRRF remains within the operational footprint of the approved REF. An Aboriginal heritage due diligence (AHDD) was prepared by Kelleher Nightingale Consulting in May 2024 (KNC, 2024) (Appendix D) for the proposed change area at Rouse Hill WRRF. The study area of the assessment includes:

- the proposed compound site at 7 Money Close, Rouse Hill
- a strip of land to the north of the current WRRF fence
- Rouse Hill WRRF.

The study area was assessed under the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* ('Due Diligence Code of Practice') (DECCW, 2010). The AHDD included a review of background information, existing assessments, and database searches as well as a visual inspection of the site in April 2024.

Existing environment

Landscape assessment identified the presence of landforms considered archaeologically sensitive under the Due Diligence Code of Practice, as the existing WRRF facilities are located adjacent to the Second Ponds Creek waterway. Review of historical aerial photos and an assessment of previous land use determined that most of the study area has been severely disturbed by construction of the existing WRRF, roads, vegetation clearing and former cultivation.

A search on Aboriginal Heritage Information Management System (AHIMS) showed 8 Aboriginal sites recorded in or near the study area. Of these, the closest recorded site was 45-5-0906 (RH/SP 7 Rouse Hill) an open context artefact site partially located within the proposed compound area. A review of the AHIMS site record of RH/SP 7 Rouse Hill showed that the site has previously been destroyed. As such, the site is not a constraint to the current proposed change or use of the compound area.

All other sites were over 200 m from the study area.

Review of previous investigations including the 2021 due diligence assessment (KNC, 2021) identified an area of Potential Archaeological Deposit (PAD 1) recorded adjacent to the southern study area boundary. The northern extension of the PAD 1 into the WRRF property remains valid and displays moderate potential for subsurface archaeological deposit. This area has been identified as a no-go zone and will not be impacted by the proposed change.

The visual inspection did not identify any Aboriginal objects, sites, or other areas of Aboriginal archaeological potential within the study area. In general, the study area comprises a severely disturbed and modified landscape with low to no potential for Aboriginal archaeology.

Potential impacts – Construction

Provided that the identified PAD 1 area at the Rouse Hill WRRF is avoided by the proposed works, there are no archaeological constraints to the proposed change within the study area. PAD1 is already fenced off for the Compliance Upgrade project and located well away from any works associated with this project. No impacts will occur to PAD1.

As a result of the removal of the sludge transfer main scope, as well as avoidance of any impact to PAD 1, no Aboriginal archaeological sites/ PADs will be impacted. The proposed change will no longer require an Aboriginal heritage impact permit (AHIP) under the *National Parks and Wildlife Act 1974.*

Safeguards – Construction

The safeguards in the approved REF are superseded by the following new safeguards.

- 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 is found, cease all excavation or disturbance in the area and notify the Environmental Representative and Sydney Water Heritage Advisor in accordance with SWEMS0009, and implement the unexpected finds procedure.

Safeguards – Operation

As there are no ongoing operational impacts, safeguards during operation are not applicable.

6.4 Noise and vibration

An addendum noise and vibration impact assessment (NVIA) was undertaken in May 2024 by Aecom (2024) (Appendix E). The NVIA provides an updated assessment of all noise and vibration impacts associated with construction and operation of the proposed change. The results and recommendations of the NVIA supersede those presented in the previous NVIA prepared for the approved REF. It should also be noted that this assessment considers the cumulative impacts from the Compliance Upgrade (currently in construction) and the proposed change as detailed in this REFA.

Existing environment

The proposed change is located within mainly suburban environments. The closest sensitive receivers are located:

- residents about 320 m from Riverstone WRRF
- residents about 200 m from Rouse Hill WRRF to the north west and south east. A childcare centre, two places of worship and various commercial buildings are also located within 400 m of Rouse Hill WRRF.

Attended and unattended noise monitoring (for over seven days) was conducted in 2021, as part of the previous noise assessment for this project. As the noise environment in each NCA has largely stayed the same over the last three years no updated background noise monitoring was necessary. Monitoring was conducted at representative residential locations in surrounding noise catchment areas (NCAs) including at the WRRFs (Figure 6-1).

All 3 NCA are generally affected by road traffic noise and natural sounds such as wind and bird noises. Some construction noise was audible in NCA 3 from current construction works occurring in the area.

There are no ongoing vibration impacts characterising the existing environment.

Figure 6-1 Noise catchment areas

Noise and vibration criteria – Construction

Background noise levels (RBL) were established for the NCAs and are provided in Table 6-7.

Construction noise management levels (NML) for residential receivers were derived from the RBL + 10dB(A) for standard daytime hours, as per the EPA's *Interim Construction Noise Guidelines* (DECC, 2009). A level of 75dB(A) is considered to represent 'highly noise affected' receivers. NMLs for outside recommended standard hours are derived as the RBL + 5dB(A).

Based on measured background noise levels during the night, sleep disturbance criteria for the nearest noise sensitive residential receivers are provided in Table 6-7.

Construction NMLs for non-residential receivers are provided in the *Interim Construction Noise Guidelines* and are also shown in Table 6-7.

Table 6-7 Background Noise Levels (RBL), Construction Noise Management Levels (NML)

Area	Period	RBL, L_{A90} dB(A)	Construction NML (standard hours) $L_{Aeq, 15min}$, dB(A)	Sleep disturbance screening level (awakening reaction) dB(A)
NCA 1 (Riverstone WRRF)	Day	37	43	-
	Evening	33	38	-
	Night	30	35	45 (65)
NCA 2 (Rouse Hill WRRF)	Day	44	49	-
	Evening	43	48	-
	Night	36	41	51 (65)
NCA 3 (Rouse Hill WRRF)	Day	41	46	-
	Evening	35	40	-
	Night	30	35	45 (65)
Places of worship	Non-residential receivers – NML applies when properties are in use		55 dB(A)	-
Childcare centres			55 dB(A)	-
Active recreation			65 dB(A)	-
Commercial premises			70 dB(A)	-
Industrial premises			75 dB(A)	-

Vibration criteria is provided in Table 6-8 for maximum and preferred vibration dose values (VDVs) based on *Assessing Vibration: A Technical Guideline* (DEC, 2006). The VDV criteria are based on the likelihood that a person would be annoyed by the level of vibration over the entire assessment period.

Table 6-8 Preferred and Maximum VDVs for intermittent vibration (m/s$^{1.75}$)

Location	Daytime (defined as 7am to 10pm)		Night time (defined as 10pm to 7am)	
	Preferred	Maximum	Preferred	Maximum
Critical areas[1]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

1. *Locations with vibration sensitive equipment such as hospitals/ laboratories*

Noise criteria – Operation

Operational noise trigger levels for the proposed change were derived as the lower of the intrusive and amenity criteria following the *Noise Policy for Industry* (NPfI) (EPA, 2017) and are provided in Table 6-9. These apply to environmental noise emissions from operation of the WRRFs, following commissioning of the project. Sleep disturbance screening levels are based on the measured night-time RBL.

Table 6-9 Operational project noise trigger levels and sleep disturbance screening levels

Area	Period	Project noise trigger levels L_{Aeq}, dB(A)	Sleep disturbance screening levels	
			$L_{Aeq, 15\ min}$, dB(A)	L_{AFmax}, dB(A)
NCA 1 (Riverstone WRRF)	Day	42	-	-
	Evening	38	-	-
	Night	35	40	52
NCA 2 (Rouse Hill WRRF)	Day	49	-	-
	Evening	43	-	-
	Night	38	41	52
NCA 3 (Rouse Hill WRRF)	Day	46	-	-
	Evening	40	-	-

Area	Period	Project noise trigger levels L_{Aeq}, dB(A)	Sleep disturbance screening levels	
			$L_{Aeq, 15\ min}$, dB(A)	L_{AFmax}, dB(A)
	Night	35	40	52
School classroom	Noisiest 1-hour period when in use	48	-	-
Place of worship	When in use	53	-	-
Commercial premises	When in use	68	-	-
Active recreation area	When in use	58	-	-

Potential noise and vibration impacts – Construction

During construction all equipment would not be operating simultaneously and in the one location. The results of noise levels predicted are therefore conservative.

For Rouse Hill WRRF and Riverstone WRRF, modelled results show that construction noise levels are not expected to exceed the NMLs during standard hours at the closest sensitive or residential receivers.

This REFA has not modelled noise impacts for activities occurring outside of standard daytime hours. At this stage, no works are expected outside of standard hours, but will be subject to additional assessment if required.

Table 6-10 Construction noise levels – standard hours work

NCA	LAeq NML dB(A)	Maximum LAeq noise level dB(A)	Number of properties where noise levels are expected to exceed the NML			Highly noise affected
			1-10 dB(A) exceedance	11-20 dB(A) exceedance	> 20 dB(A) exceedance	
Riverstone WRRF						
NCA1	47	49	1	0	0	0
Rouse Hill WRRF						
NCA2	54	46	0	0	0	0
NCA3	51	49	0	0	0	0

Results show construction noise levels are not expected to exceed the NMLs during standard hours at Riverstone WRRF and Rouse Hill WRRF at any receivers, except for 6 Ashford Road, Vineyard where a minor exceedance (2 dB) is predicted.

The numbers of construction vehicle movements likely are:

- Riverstone WRRF – up to 105 light and 20 heavy vehicles per hour during peak construction periods via Bandon Road.
- Rouse Hill WRRF – up to 150 light and 30 heavy vehicles per hour during peak construction periods via Mile End Road, Money Close and Withers Road.

These vehicle movements are expected to coincide with the commuter peak traffic periods. It should also be noted that these are peak traffic volumes. Actual construction vehicle movements are expected to be less for large periods during the works.

For both the WRRFs the increase in road traffic noise levels could be greater than 2 dB(A) at residential receivers (Table 6-11). Measures to mitigate the impact of this noise increase are detailed in the safeguards further below.

Table 6-11 Predicted maximum road traffic noise increase due to construction traffic

Road	Type	Residential receivers	Estimate maximum change in noise level, dB(A)
Bandon Road	Sub Arterial	Yes	2.5
Withers Road	Sub Arterial	Yes	3.4
Mile End Road	Sub Arterial	Yes	3.4
Money Close	Sub Arterial	No	NA

Vibration intensive works may include the use of jackhammers or excavators with hammers at Riverstone WRRF and Rouse Hill WRRF. Table 6-12 outlines the minimum working distances which could potentially lead to either cosmetic damage or human response from vibration. Due to the distance to sensitive receivers located outside the WRRF sites, no impacts are likely.

Table 6-12 Minimum working distances of vibration intensive equipment

Equipment	Rating/ description	Cosmetic damage Residential/ commercial	Human response
Jackhammer	Hand held	1 m (nominal)*	2 m
Large hydraulic hammer	18 to 34 tonne excavator	22 m	73 m

*based on recommendations of the *TfNSW Construction Noise and Vibration Strategy* (TfNSW, 2016)

Potential noise impacts – Operation

Operational noise levels as a result of the proposed change were modelled, and noise levels at the receiver most likely to be affected, were predicted (Table 6-13 and Table 6-14). The results show that the modelled noise levels do not exceed the daytime operational noise trigger levels under all weather conditions and do not exceed the operational noise trigger levels or exceed by a negligible amount (<2dB) under adverse weather conditions.

Sleep disturbance noise levels were predicted at nearby receivers under calm meteorological conditions and worst case weather conditions. Typical operations at Rouse Hill WRRF will comply with sleep disturbance criteria.

Under adverse weather conditions (worst case scenario), an exceedance is predicted at one of the identified receivers around the Riverstone WRRF during the night-time. However, with the recommended noise attenuation treatments in place (refer to below safeguards – operation), existing facility equipment will typically dominate the predicted noise levels, and the exceedance is negligible (less than 2 dB is unlikely to be discernible to the human ear).

The Riverstone WRRF and Rouse Hill WRRF upgrades are predicted to comply with the operational noise criteria at all noise sensitive receivers, assuming recommended noise treatment options are implemented.

In total there will be approximately 20 truck movements per day for daily chemicals deliveries at Riverstone WRRF and Rouse Hill WRRF including for waste outloading at Rouse Hill WRRF during operation. The existing traffic flow on Bandon Road and Withers Road is substantially greater than the proposed operational traffic numbers. Therefore, the traffic will have a minor impact on existing road traffic noise in these roads. Vehicle movements generated by the proposed change is expected to comply with the *Road Noise Policy* (DECCW, 2011).

Table 6-13 Predicted operational noise levels – Riverstone WRRF

Location	Distance from WRRF (m)	Sound pressure level, L_{Aeq} dB(A)				
		Current	Proposed	Criteria	Exceedance	Increase
Daytime – Neutral weather						
21 Clyde Street Vineyard	550	32	33	42	-	1
6 Ashford Road Vineyard	320	33	36	42	-	3
8 Dulwich Road Vineyard	400	30	34	42	-	4
3 St James Road Vineyard	400	30	35	42	-	5
Night-time – Neutral weather						

Location	Distance from WRRF (m)	Sound pressure level, L_{Aeq} dB(A)				
		Current	Proposed	Criteria	Exceedance	Increase
21 Clyde Street Vineyard	550	32	32	35	-	-
6 Ashford Road Vineyard	320	33	34	35	-	1
8 Dulwich Road Vineyard	400	30	32	35	-	2
3 St James Road Vineyard	400	30	32	35	-	2
Daytime – Adverse weather						
21 Clyde Street Vineyard	550	34	37	42	-	3
6 Ashford Road Vineyard	320	36	39	42	-	3
8 Dulwich Road Vineyard	400	33	38	42	-	5
3 St James Road Vineyard	400	32	38	42	-	6
Night-time – Adverse weather						
21 Clyde Street Vineyard	550	34	34	35	-	-
6 Ashford Road Vineyard	320	36	37	35	2	1
8 Dulwich Road Vineyard	400	33	35	35	-	2
3 St James Road Vineyard	400	32	35	35	-	3

Table 6-14 Predicted operational noise levels – Rouse Hill WRRF

Location	Distance from WRRF (m)	Sound pressure level, L_{Aeq} dB(A)				
		Current	Proposed	Criteria	Exceedance	Increase
Daytime – Neutral weather						
20 Mailey Cct Rouse Hill	400	40	41	49	-	1

Location	Distance from WRRF (m)	Sound pressure level, L_{Aeq} dB(A)				
		Current	Proposed	Criteria	Exceedance	Increase
95 Mile End Rd Rouse Hill	350	32	37	46	-	5
133 Mile End Rd Rouse Hill	480	31	35	46	-	4
328 Annangrove Rd Rouse Hill	460	37	39	49	-	2
Night-time – Neutral weather						
20 Mailey Cct Rouse Hill	400	28	33	38	-	5
95 Mile End Rd Rouse Hill	350	20	32	35	-	12
133 Mile End Rd Rouse Hill	480	20	30	35	-	10
328 Annangrove Rd Rouse Hill	460	25	32	38	-	7
Daytime – Adverse weather						
20 Mailey Cct Rouse Hill	400	43	44	49	-	1
95 Mile End Rd Rouse Hill	350	35	40	46	-	5
133 Mile End Rd Rouse Hill	480	34	38	46	-	4
328 Annangrove Rd Rouse Hill	460	40	42	49	-	2
Night-time – Adverse weather						
20 Mailey Cct Rouse Hill	400	32	36	38	-	4
95 Mile End Rd Rouse Hill	350	23	35	35	-	12
133 Mile End Rd Rouse Hill	480	23	34	35	-	11
328 Annangrove Rd Rouse Hill	460	28	36	38	-	8

Safeguards – Construction

The below list of safeguards remain the same as the approved REF:

- works must comply with the Draft Construction Noise Guideline (EPA 2020), 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 Proposed change will also be carried out in accordance with:
  - Sydney Water's Noise Management Procedure SWEMS0056
  - Noise Policy for Industry (EPA, 2017).
- all site inductions shall brief workers, contractors, and visitors by identifying neighbouring sensitive receivers (if applicable) and general noise safeguards and compliance obligations relating to the site
- affected non-residential receivers will be consulted prior to commencement of works to identify any periods of sensitivity such as church services or children' rest times
- reasonable and feasible noise safeguards should be implemented to mitigate noise impacts and include selection of low-noise construction equipment or quieter and less vibration emitting construction methods (e.g. rubber wheeled instead of steel tracked plant)
- for large deliveries or heavy vehicle movements that may generate excessive noise outside of standard construction hours, the Alliance must seek written approval from Sydney Water's Project Manager and demonstrate how this activity will be in line with requirements for working outside of standard construction hours in the EPA's Draft *Construction Noise Guidelines* (CNG) (EPA, 2020)
- 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 (e.g. 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
  - implement a range of source controls including:
    - select appropriate plant for each task, to minimise the noise impact (e.g. all stationary and mobile plant fitted with residential type silencers and additional fittings including residential grade mufflers and silenced air parking brake engagement)
    - regularly inspect and maintain equipment in good working order

- the noise levels of plant and equipment will have operating sound power or sound pressure levels that will meet the predicted noise levels
- simultaneous operation of noisy plant within discernible range of a sensitive receiver will be avoided
- the offset distance between noisy plant and adjacent sensitive receivers will be maximised
- plant used intermittently will be throttled down or shut down
- noise-emitting plant will be directed away from sensitive receivers where reasonable and feasible
- plan works site and activities to minimise noise and vibration such as by minimising reversing movements within the site
- non -tonal reversing beepers (or equivalent) to be fitted on all construction work vehicles and mobile plant regularly used on site and for extended work hours construction work where possible and subject to safety requirements
- deliveries to occur as far as possible from sensitive receivers and vehicles to be fitted with straps rather than chains for unloading, wherever possible
- limit vehicle speed and use of engine compression brakes
- plant or machinery will not be permitted to warm-up near residential dwellings before the nominated working hours.

- if works beyond standard daytime hours, or night works are needed, we will:
  - justify the need for out of standard daytime or night work
  - consider potential noise impacts (refer to out of hours NMLs provided above in Table 6-7) and implement the relevant 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, we will:
  - 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.

Safeguards – Operation

The safeguards in the approved REF are superseded by the following new safeguards.

The following noise treatments required for the proposed change at Riverstone WRRF:

- **install an attenuator for the foul air fan to reduce the external sound power levels power levels to 90 L_{Aeq} dB(A)**

The following noise treatments are required for the proposed change at Rouse Hill WRRF:

- **install attenuator for the blowers and membrane aeration blowers to reduce the external 'blow off' sound power levels power levels to 90 L_{Aeq} dB(A)**

Any treatments or attenuation required to meet this will be installed during construction and noise levels would be verified during commissioning to make sure operational noise levels for the WRRF have been achieved (refer to modelled operational noise levels in Table 6-13 and Table 6-14).

6.5 Air quality

An addendum air quality impact assessment (AQIA) was completed in May 2024 (WSP, 2024 and 2024a) for the following:

- Rouse Hill WRRF (Appendix F) – potential odour from the operation of the proposed change, including consideration of the Compliance Upgrade currently under construction.
- Riverstone WRRF (Appendix G) – potential odour and other emissions from the operation of the remaining scope and the proposed carbonisation facility.

Both AQIAs superseded the AQIAs prepared for the approved REF. The assessment of operational impacts below supersedes the approved REF assessment.

Existing environment

Riverstone WRRF

Riverstone WRRF is in a rural residential environment. The nearest residential properties are located about 320 m of the eastern facility boundary (or 200 m to the residential property boundary), across Riverstone Parade.

No additional odour complaints have been received since the approved REF.

Rouse Hill WRRF

Rouse Hill WRRF is surrounded by commercial/ industrial land uses and bushland to the north east. Residential properties are located over 400 m to the south east and south west. Prevailing winds in the area are from the north, southwest and south east.

Two odour complaints were received in 2022/23 since the approved REF. These were in the vicinity of the Rouse Hill WRRF, however, were found to be related to the wastewater networks and not the operation of the Rouse Hill WRRF.

Potential impacts - Construction

The approved REF included two AQIAs by Jacobs Group (Australia) Pty Ltd (Jacobs, 2022 and 2022a), which assessed potential air quality impacts during construction. Construction of the proposed change at the Riverstone WRRF and Rouse Hill WRRF are expected to be of a similar nature to those assessed in this REFA. As such no further construction AQIA has been undertaken. Refer to Section 6.9 the approved REF.

6.5.1 Odour – Rouse Hill and Riverstone WRRFs

Sensitive receptors

The Approved Methods (NSW EPA, 2022) describes a sensitive receptor as '*A location where people are likely to work or reside; this may include a dwelling, school, hospital, office, or public recreational area. An air quality impact assessment should also consider the location of any known or likely future sensitive receptor*.'

The location of the sensitive receptors in relation to the Rouse Hill WRRF is presented in Figure 6-2. The closest sensitive receptors to the project site were identified and include residential properties, three childcare facilities and commercial properties.

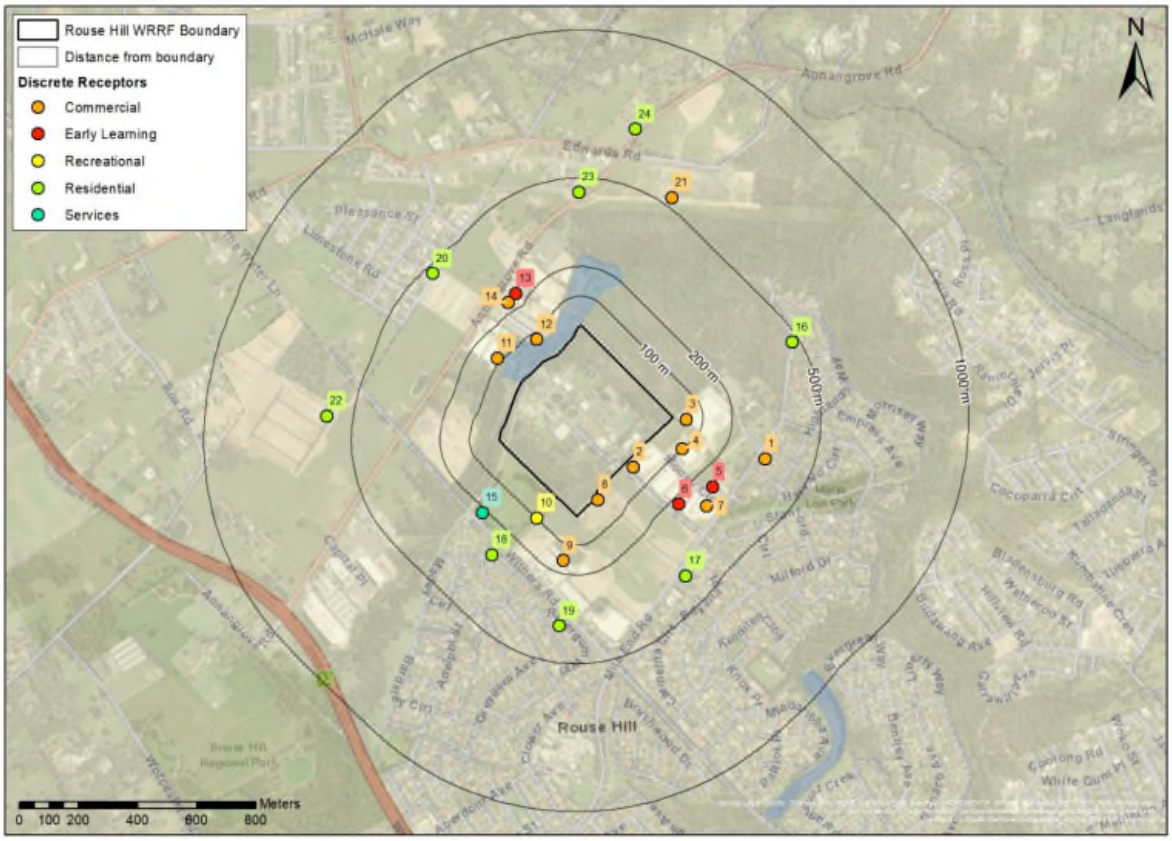

Figure 6-2 Sensitive receptors identified in the vicinity of Rouse Hill WRRF

The location of the sensitive receptors in relation to the Riverstone WRRF is presented in

Figure 6-3. The closest sensitive receptors to the project site were identified and include residential properties, a childcare facility and the Vineyard railway station.

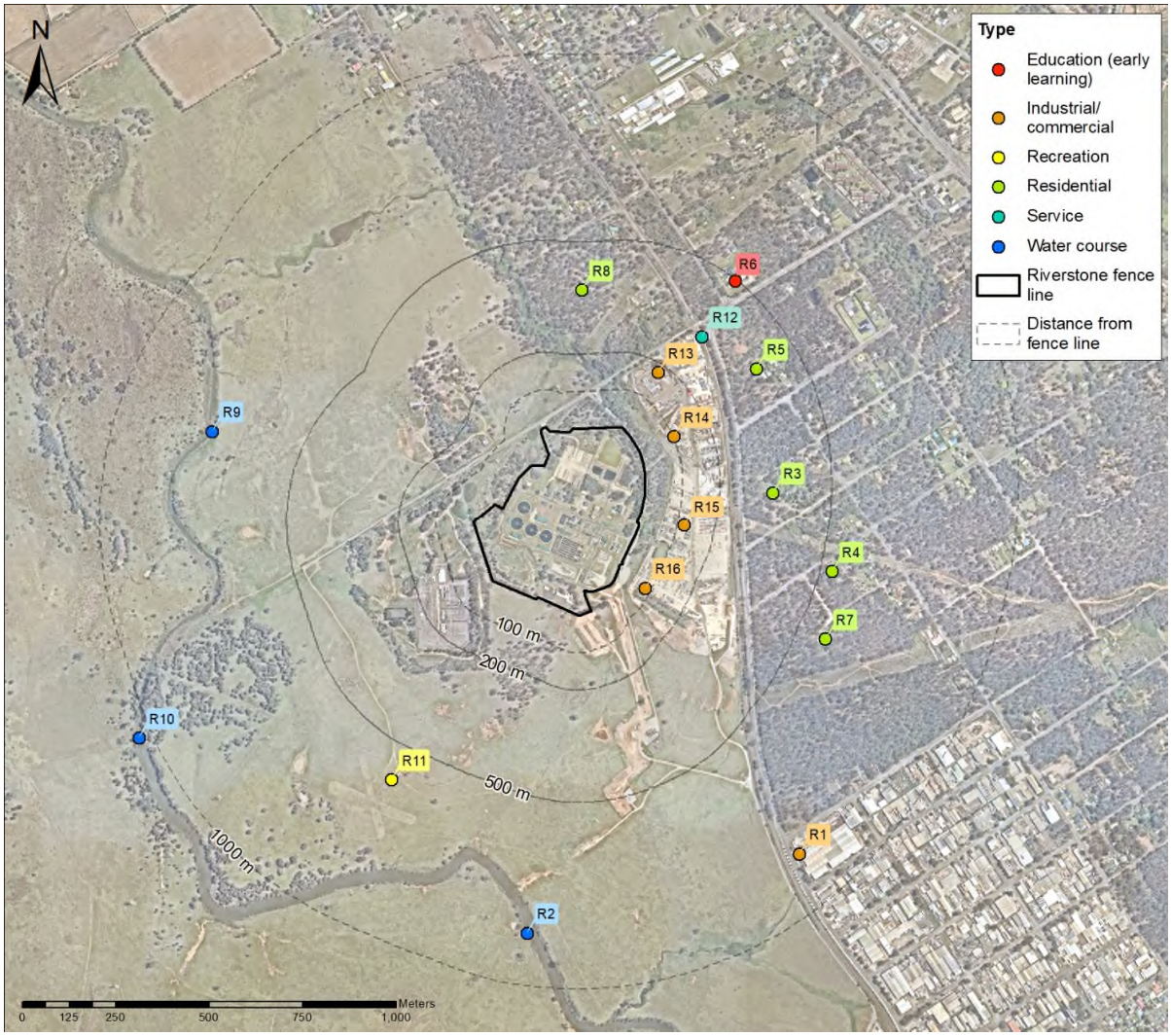

Figure 6-3 Sensitive receptors identified in the vicinity of Riverstone WRRF

Source of odour and other emissions

During operation, odour generating sources at Rouse Hill WRRF are shown on

and include:

- Existing sources (previously modelled)
  - Bioreactor (BIOR)
  - Sludge Averaging Tank (SLUD)
  - Aerobic digestor (AEROB)

- Clarifiers (CLAR1, CLAR2, CLAR3)
- SP1139 Odour Control Unit (SP1139OCU)

- Proposed additional sources:
  - Inlet Works (compliance) (IW-C) and Odour Control Facility (compliance) (OCF2-C)
  - Upgraded Dewatering Plant (DWP), including:
  - Sludge silo's (SS1, SS2)
  - Out-loading Bay (OUT)
  - Out-loading odour control unit (OUTOCU)
  - MBRs and associated infrastructure (MBR1_X, MBR1_B, MBR2_X, MBR2_B, MBR3_X, MBR3_B, MBR4_X, MBR4_B)
  - Equalisation Basin (EQB)
  - De-aeration (DAER1, DAER2)
  - Feed Channel (Raw Sewage) (FC)
  - Secondary Anoxic Tank (ANOX)
  - Aerated Membrane Trains (MBR)
  - MBR RAS Channel (RAS).

During operation, odour generating and other emission sources at Riverstone WRRF are shown on Figure 6-5 and include:

- The new sources associated with the carbonisation facility:
  - carbonisation vent shaft: GAS1 and GAS2
  - gas heaters: GH1, GH2, and GH3
  - the scrubber shaft serving the two dryers: DRYER.
- The existing odour emissions sources, as per (Jacobs, 2022):
  - thickening building fan: TBFAN
  - dewatering building fan: DBFAN
  - odour control unit: OCU
  - biological reactor: BIOR
  - three secondary clarifiers: SC1, SC2, and SC3.

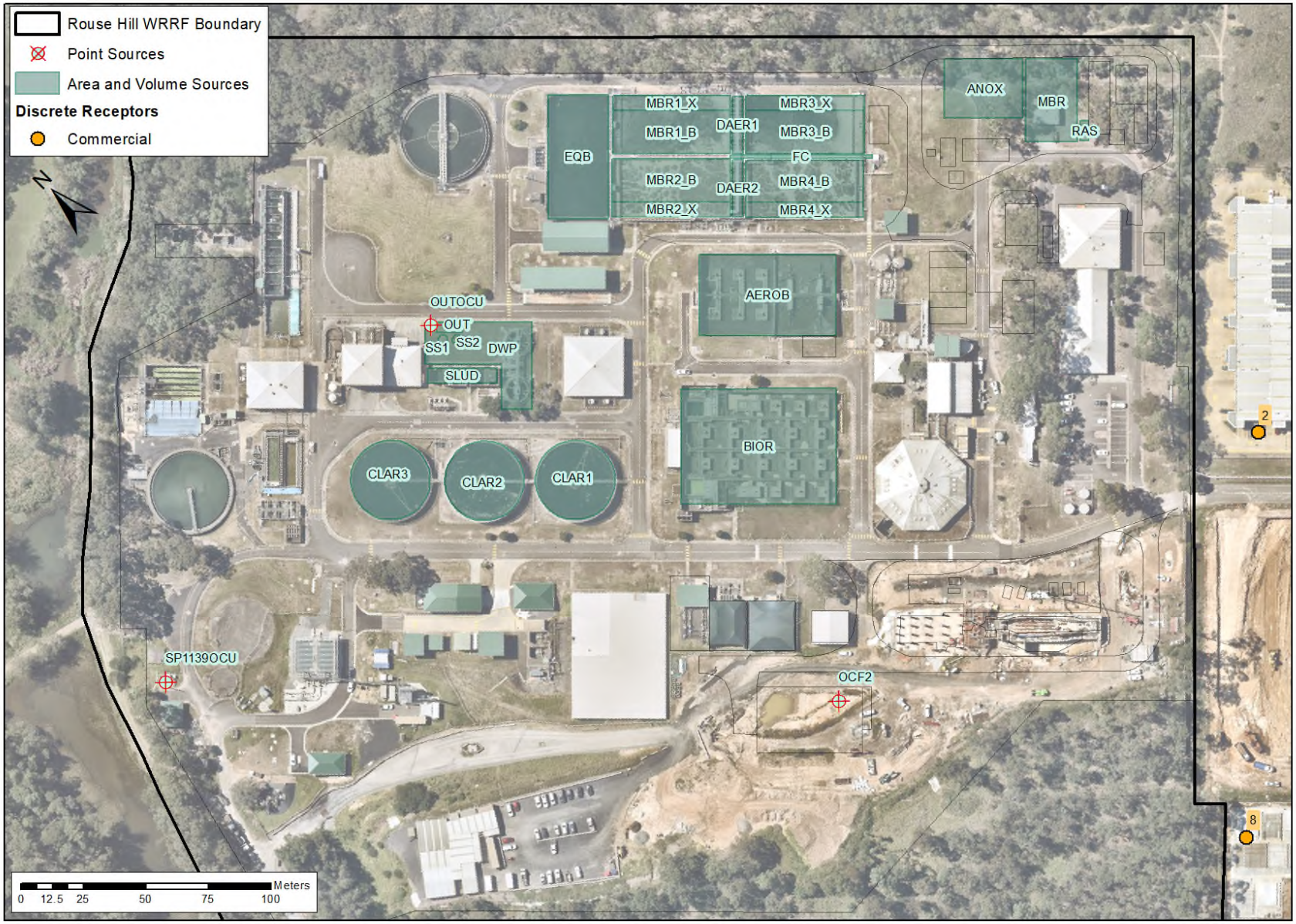

Figure 6-4 Rouse Hill WRRF emission sources

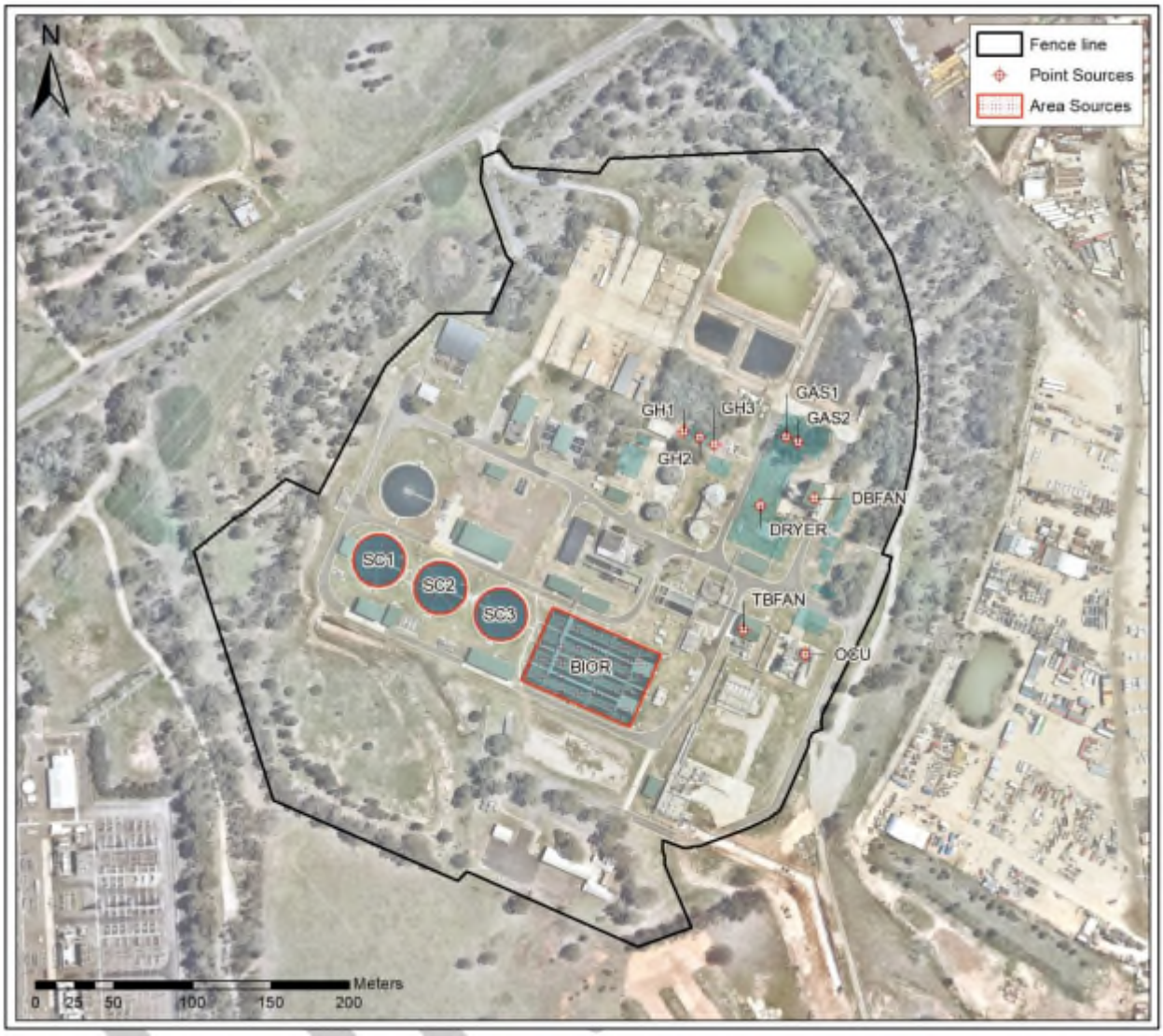

Figure 6-5 Riverstone WRRF emission sources under peak operational load scenario

Criteria

The criteria for evaluating the effects of complex odour combinations have been established to recognize the community's spectrum of odour sensitivities and to offer extra safeguards for those who are particularly reactive to odours. This is implemented through a statistical strategy that varies with the population count. An increase in population density tends to raise the fraction of odour-sensitive individuals, signifying the need for stricter assessment criteria in such conditions (NSW EPA, 2022). These criteria are population based and presented in Table 6-15.

Table 6-15 EPA air quality assessment criteria for odour

Population of affected community	Impact assessment criteria for complex mixtures of odorous air pollutants (ou)
Single rural residence (≤ ~2)	7
~10	6
~30	5
~125	4
~500	3
Urban (>2000) and/or schools and hospitals	2

Results

Rouse Hill WRRF

Dispersion modelling indicates odour emissions associated with the proposed change at Rouse Hill WRRF are largely confined to the Rouse Hill WRRF site boundary. As presented in Figure 6-6, the 2 OU contour extends by approximately 200 metres beyond the Rouse Hill WRRF boundary towards the north-east, into the bushland area surrounding Second Ponds Creek. The 4 OU contour is largely confined to the Rouse Hill WRRF, extending up to 70 metres beyond the north-eastern boundary into the bushland area.

Predicted odour concentrations do not exceed the criteria at any of the identified receptors. Odour concentrations at the neighbouring workplaces and commercial developments along Money Close range from 2.4 OU to 2.9 OU, averaging 67% of the 4 OU criterion. Odour at all remaining receptors, including commercial, services, early learning and residential receptors, are predicted to remain below the 2 OU criteria.

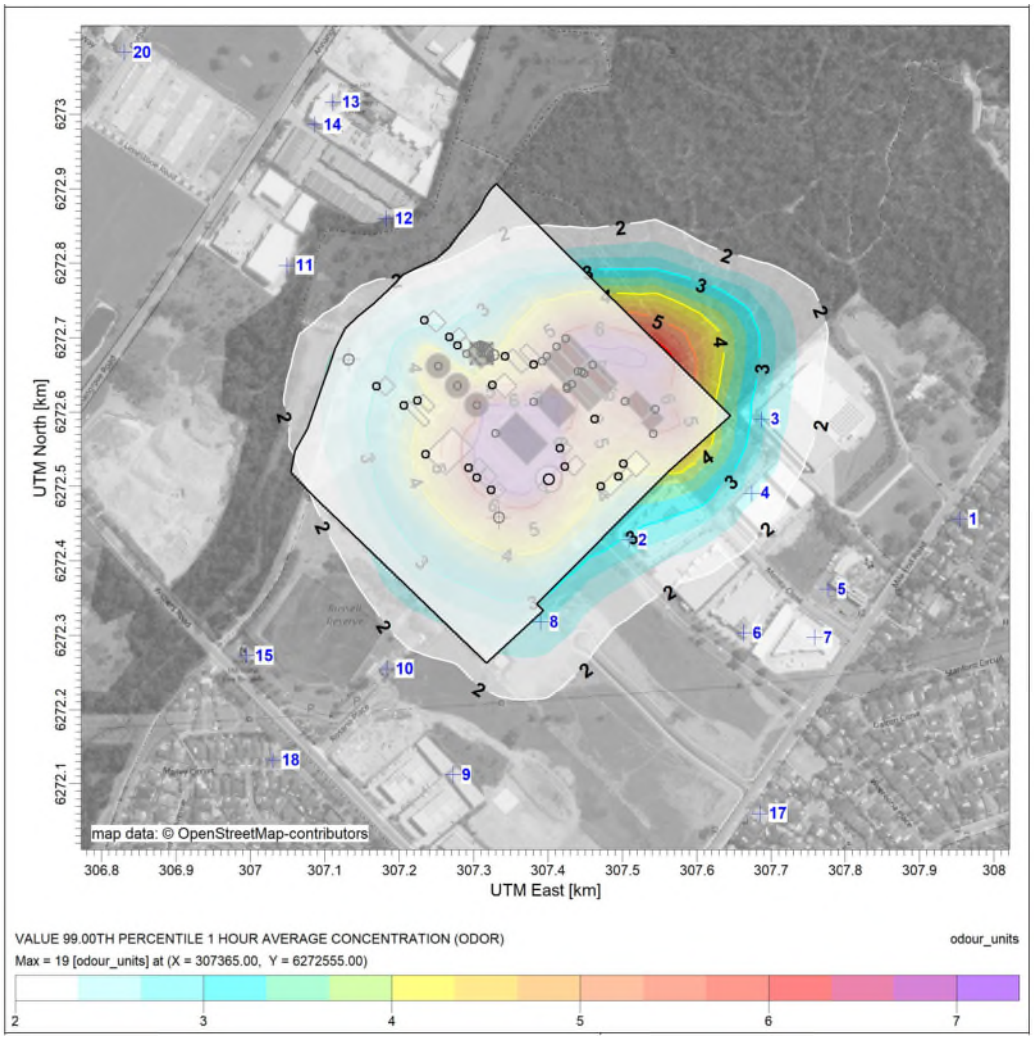

Figure 6-6 Odour dispersion modelling results for the operation of the Rouse Hill WRRF

Riverstone WRRF

Potential odour impacts have been quantified using dispersion modelling (CALPUFF modelling) to predict odour concentrations based on a year-long period (2020) of hourly meteorological data.

Dispersion modelling of the proposed change at Riverstone WRRF indicates the predicted odour concentrations are highest at the Western Storage receptors (R13 – R16) reaching a maximum of 2.1 OU (refer to Figure 6-7). However, these represent around 53% of the assessment criteria and is well within the criteria of 4 OU at an industrial premise.

A ground level concentration of 1.3 OU is predicted at the Vineyard Early Learning Centre, which is well within the criteria of 2 OU. Predicted odour concentrations at the residential receptors range from 0.3 OU to 1.3OU, also well below the assessment criteria of 2 OU.

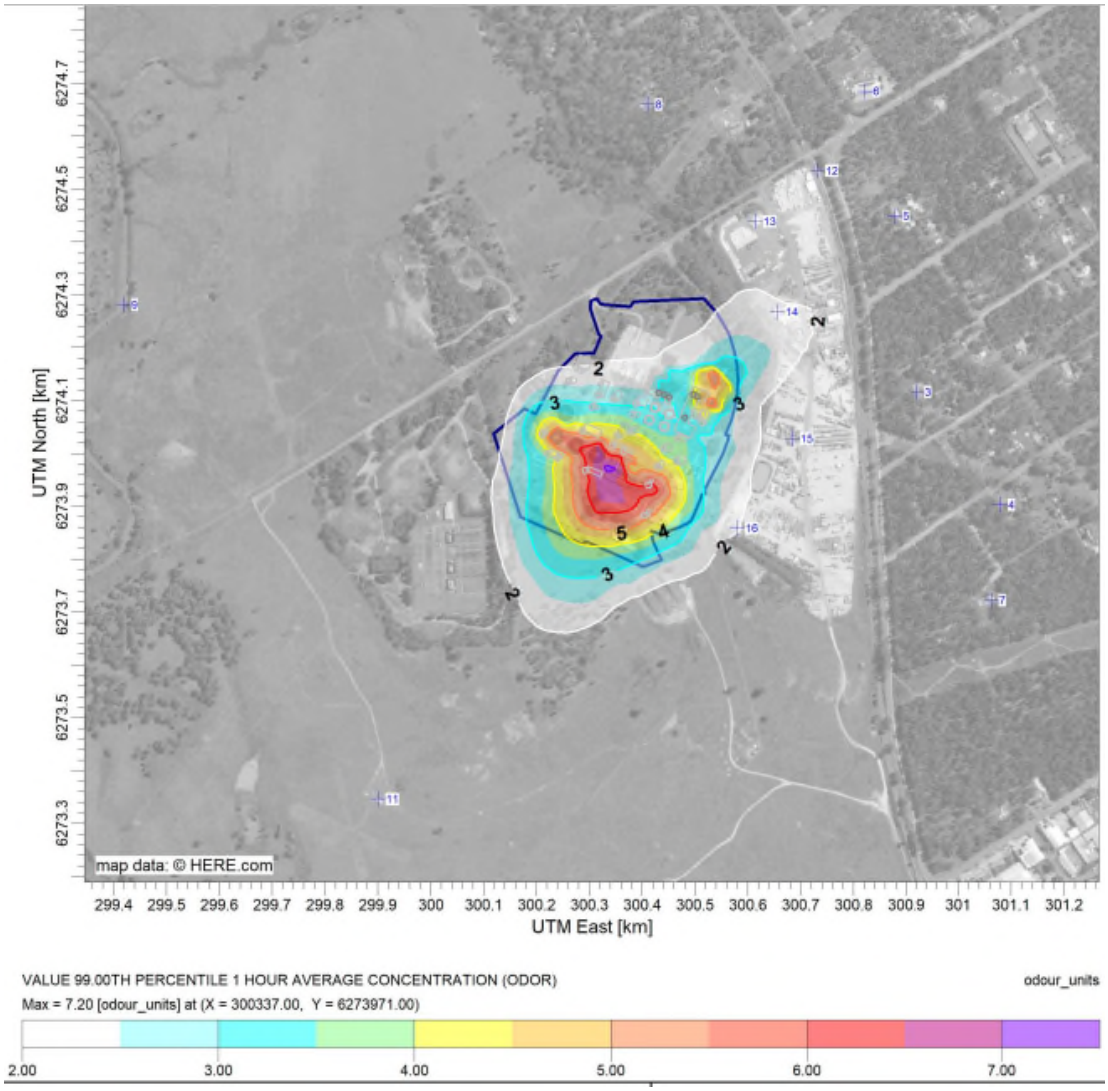

Figure 6-7 Odour dispersion modelling results for the operation of the Riverstone WRRF

Safeguards – Construction

Refer to approved REF.

Safeguards – Operation

Operational safeguards are consistent with the approved REF, and are listed below:

- maintain odour complaints management procedures
- conduct odour monitoring during commissioning at Rouse Hill WRRF and Riverstone WRRF to verify the proposed change meets modelled outcomes.

6.5.2 Other emissions – Riverstone WRRF

Emissions inventory and air pollutants

The Riverstone WRRF sources modelled under the peak operational loading scenario are shown in Figure 6-5 and listed in Section 6.5.1.

An emissions inventory representative of a peak operational loading scenario has been developed for each of the identified sources. The list of identified air pollutants associated which each of the sources include:

- nitrogen dioxide (NO_2)
- sulphur dioxide (SO_2)
- particulates as total suspended particulates (TSP), particulate matter $(PM)_{10}$ and $PM_{2.5}$
- carbon monoxide (CO)
- metals such as lead, arsenic, chromium VI, nickel, selenium, zinc, copper, cadmium, mercury
- organics such as polycyclic aromatic hydrocarbons (PAHs), dioxins and furans and per- and poly-fluoroalkyl substances (PFAS)
- other gases such as hydrogen fluoride (HF), hydrogen chloride (HCl), hydrogen sulfide (H_2S), ammonia and volatile organic compounds (VOC).

To conservatively estimate potential emissions from the two Riverstone WRRF carboniser treated gas vent shafts, the following applicable emissions sources were used:

- Schedule 2, Division 1 of the Clean Air Regulation group 6 concentration standards for afterburners and other thermal treatment plant, excluding flares
- data from an operational carbonisation facility in Loganholme Queensland, including:
    - the Department of Environment, Science and Innovation (DESI) licence emissions limits for the carbonisation facility
    - emissions data from their demonstration facility
    - representative emissions data from the full-scale version of the facility.
- equipment data from two potential suppliers for the Riverstone WRRF carbonisation facility
- metals composition of existing Riverstone WRRF sludge (based on sampling conducted in November 2023).

Based on a review of the above data sources, the emissions for the Riverstone WRRF carbonisation facility have been estimated to either meet or be less than the concentration limits outlined in Schedule 2, Division 1 of the Clean Air Regulation group 6 concentration standards.

The specific emission levels adopted in the modelling for the carboniser treated gas vent shafts, as well as the heaters and dryers are detailed in Appendix G.

Emissions control technology

At the time of writing of this REFA, there are at least two possible suppliers of the carbonisation equipment for Riverstone WRRF. Typical emissions control technology on the dryer units and carbonisation units would include such things as:

- wet scrubber, acidic wet scrubber and/ or alkaline/ water wet scrubber

- particulate removal with a combination of (depending on supplier)
    - filters
    - wet electrostatic precipitator
    - activated carbon filter.

Further details are found in Section 4 of Appendix G. The exact emissions control technology implemented will depend on the final supplier selected. However, all reasonable and feasible emissions controls and best available technology will be implemented for the carbonisation facility.

Criteria

Several sources were used to assign assessment criteria for potential pollutants from the carbonisation facility and associated infrastructure. The following hierarchy was used:

1 NSW EPA Approved Methods (NSW EPA, 2022) (the 'EPA approved methods')

2 guidance from other Australian States (i.e. Victoria)

3 international guidance (i.e. the Texas Commission on Environmental Quality).

The EPA approved methods list impact assessment criteria (IAC) and individual air toxics criteria for a range of pollutants against which emissions from an activity need to be assessed. The IAC and individual air toxics criteria relevant to this assessment are detailed in Section 5 of Appendix G.

Modelling methodology

The following key assumptions were made in the development of the emissions inventory and modelling:

- the carbonisation facility will operate continuously, 24 hours a day, 7 days a week.
- building heights were estimated based on Google Earth 3D building observations.

Atmospheric dispersion models are mathematical tools that link an emission source to a receptor, simulate the substance behaviour, and predict its fate. To represent the influence of terrain elevations in the dispersion of pollutants, a digital elevation file was used in CALPUFF.

To maintain consistency with the AQIA in the approved REF, meteorological data was sourced from the same meteorological station (Rouse Hill) for the same year (2020).

Results

High-level findings of the AQIA results are provided below. Detailed results of the dispersion modelling at the boundary and discrete sensitive receptors are found in Section 7 of Appendix G. The results are expressed as a percentage of the assessment criteria, coloured coded on a graduated scale, ranging from blue (< 1% of the criterion) to red (>99% of the criterion).

Results indicate that the air quality environmental outcomes for all incremental and cumulative impact assessment and toxic air pollutant concentrations are predicted to remain below the

relevant assessment criteria at all receptor locations, except for particulate matter (PM_{10} and $PM_{2.5}$).

To further understand potential particulate matter impacts due to the proposed change a Level 2 Contemporaneous Assessment was undertaken, as required by the EPA approved methods. Elevated background PM_{10} and $PM_{2.5}$ concentrations attributed to the "Black Summer" bushfires in 2019/2020, result in cumulative 24-hour PM_{10} and $PM_{2.5}$ concentrations exceeding the assessment criteria (50 µg/m^3 and 25 µg/m^3, respectively) at all discrete receptor locations, despite the nominal contribution of the proposed change to ambient particulate concentrations. The environmental outcomes of this further assessment confirmed that no additional $PM_{2.5}$ or PM_{10} exceedances were predicted for the assessment year (2020) with the addition of the proposed change at Riverstone WRRF.

Conclusion

In summary, the Riverstone WRRF AQIA for the proposed change concludes:

- emissions from the proposed carbonisation facility are predicted to meet the limits set out in Schedule 2, Division 1 of the Clean Air Regulation group 6 concentration standards for afterburners and other thermal treatment plants
- operational air quality impacts are predicted to be below all incremental and cumulative impact assessment and toxic air pollutant assessment criteria at all sensitive receptor locations, except for particulate matter
- existing background particulate matter levels in the area already exceed the assessment criteria. The proposed change is not predicted to cause any additional exceedances to these, as confirmed by a Level 2 Contemporaneous Assessment (undertaken in accordance with the EPA approved methods).

The AQIA for the carbonisation facility is considered robust by adopting conservative estimates of each pollutant of concern, as well as modelling the peak operational scenario. The AQIA has adopted an outcomes-based approach to demonstrate the emissions limits set out in the Clean Air Regulation will be met, rather than the design specifications for afterburners, which are not directly relevant to the carbonisation technology.

Prior to operation, we will request a licence variation to our existing EPL1796 at Riverstone WRRF from EPA. We will ensure the carbonisation facility is operated to meet specified emissions standards set out in the EPL1796, as well as any air monitoring or other licence requirements. This will include online air quality analysers on the equipment for continuous emissions monitoring, as well as sampling ports for the laboratory analysis of gas from vent shafts.

Safeguard – commissioning and operation

- install best available emissions control technology on all equipment for the carbonisation facility
- monitor emissions during commissioning to verify predicted air quality results. Pending the monitoring results, optimise the equipment and install additional emission treatment (where available) to ensure air quality predictions can be achieved

- obtain a licence variation to EPL 1796 (Riverstone WRRF) prior to operation of the carbonisation facility
- ensure operational monitoring of the carbonisation facility meets all requirements specified in the amended EPL 1796.

6.5.3 Human health and ecological risk assessment

A human health and environmental risk assessment (HHERA) was completed by Environmental Risk Sciences Pty Ltd (enRiskS) in June 2024 for the proposed change (Appendix H). The assessment focused on impacts to human health and the environment from air emissions during operation of the carbonisation facility.

Existing environment

Population demographics and community health data was analysed as part of the HHERA to determine if the local population may be more vulnerable to potential project related impacts.

The population surrounding the Riverstone WRRF is small and health data specifically relating to the population is not available. The site is located on the boundary of the Western Sydney Local Health District (LHD) and the Nepean Blue Mountains LHD. A review of the Western Sydney LHD (considered more representative of the study area) indicates that the population does not have any increased vulnerability to project related impacts, compared with the general data for NSW.

Methodology

The HHERA has been undertaken in accordance with:

- enHealth (2012) Environmental Health Risk Assessment, Guidelines for Assessing Human Health Risks from Environmental Hazards (enHealth 2012a)
- enHealth (2012) Australian Exposure Factor Guide (enHealth 2012b)
- ASC National Environment Protection Measure (NEPM) (1999 amended 2013) National Environmental Protection Measure – Assessment of Site Contamination (NEPC 1999 amended 2013b)
- NEPM (Ambient Air Quality) (2021) (NEPC 2021)
- NEPM (Air Toxics) (2004) (NEPC 2004)
- NSW EPA (2022) Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (NSW EPA 2022)
- Australian Drinking Water Guidelines (NHMRC 2011 updated 2022)
- Australia and New Zealand Fresh and Marine Water Quality Guidelines (ANZG 2018)
- PFAS National Environmental Management Plan (the “PFAS NEMP”), 2020 (HEPA 2020).

The HHERA has also drawn on international guidance where relevant. The focus of the HHERA relates to the assessment of impacts to human health and the environment in relation to air

emissions as modelled in the AQIA (WSP, 2024 and 2024a). The emissions evaluated include gases as well as other chemicals that may bind to particulates.

There are five main ways a community member or the environment may be exposed to a chemical substance emitted from the carbonisation facility at Riverstone WRRF:

- inhalation of gases, vapour or fine particulate matter in air
- direct contact, which may include ingestion and/ or dermal absorption of chemicals present in dust that may deposit onto surfaces or accumulate in water collected in rainwater tanks or water in recreational areas/ aquatic environments
- accumulation in animals
- accumulation into produce that may be consumed. The surrounding area is semi-rural so the evaluation considered home-grown fruit, vegetables and eggs
- direct contact to vegetation from vapour and gases.

The HHERA considered the following substances (modelled in the AQIA) and routes of exposures for both human health and ecological risks as detailed in Table 6-16.

Table 6-16 Substances considered in the HHERA and routes of exposure

Substance	Route of exposure	
	Human health	Ecological
Nitrogen dioxide	**Inhalation only** as these are vapours/ gases	**Direct contact/ inhalation/ respiration with gases** - terrestrial environments only
Sulfur dioxide		
Hydrogen sulfide		
Hydrogen chloride		
Hydrogen fluoride		
Carbon monoxide		
VOCs (assumed to comprise 100% benzene)		
$PM_{2.5}$	**Inhalation only** as these particulates are very small and will remain suspended in air	NA
Metals (as listed in s 6.5.2)	**Inhalation** of these chemicals adhered to dust/ particulates	
PAHs (assumed to comprise 100% benzo(a)pyrene, BaP		

Substance	Route of exposure	
	Human health	Ecological
PFAS (assumed to comprise 100% PFOS) Dioxins/ furans	**Ingestion and dermal contact** with these chemicals deposited to soil and present in water (rainwater tanks, recreational water and stock water) **Ingestion** of produce grown in soil potentially impacted by these chemicals. For the surrounding semi-rural properties, home consumption of produce such as fruit and vegetables and eggs have been assessed.	**Direct contact and bioaccumulation for terrestrial environments –** with chemicals that are deposited to soil **Direct contact and bioaccumulation for aquatic environments –** with chemicals that are deposited to waterways

Results

Human health

The results of the detailed assessment of potential risks to human health from the carbonisation facility can be found in Appendix H, with a summary of the key results provided below:

- Inhalation exposures -
    - Particulates – the HHERA focused on fine particulates ($PM_{2.5}$) as a worst case scenario, based on the modelling undertaken there would be no exceedance of the NEPM standard for PM2.5 as an annual average.
    - SO_2 – SO_2 is the main sulfur oxide that can have respiratory impacts on people. The NEPM standard is protective of adverse effects for all members of the population including sensitive community members such as asthmatics, children and the elderly. The HHERA found that all modelled cumulative concentrations of SO_2 were well below the NEPM criteria.
    - NOx – nitrogen oxides (NOx) refers to a collection of highly reactive gases containing nitrogen and oxygen which form when fuel is burnt including when waste is used as a fuel. Motor vehicles, as well as industrial/ commercial and even residential combustion sources are primary producers of NOx. The HHERA found that all modelled cumulative concentrations of NO_2 were below the NEPM criteria.
    - CO – carbon monoxide is produced during combustion when there is limited supply of oxygen. Motor vehicles are the dominant source of CO in the air. The HHERA found that all modelled concentrations from the project and cumulative concentrations of CO are below the NEPM and NSW EPA criteria.

- All other chemicals – inhalation exposures considered both short-term/ acute exposures as well as chronic exposures.
    - Acute exposures – the assessment of acute exposures is based on comparing the maximum predicted 1-hour average exposure concentration with health-based criteria relevant to an acute or short-term exposure (also based on a 1-hour average exposure time). The ratio of these two is termed a hazard index (HI). All maximum predicted concentrations of chemicals in the air were below the health-based criteria protective of acute effects. For each of the individual chemicals evaluated the calculated HI was well below 1, indicating a significant margin of safety.
    - Chronic exposures – for the assessment of chronic inhalation exposures, all the chemicals evaluated have a threshold guideline value that enables the predicted annual average concentration to be compared with a health based or acceptable guideline. Assessment of chronic effects has considered potential intakes of these chemical substances from other sources (i.e. background intakes). The calculated individual HI indicate that there is no chronic risk of concern in relation to inhalation exposures.

- Deposition to soil/ multiple pathway exposure
    - The following range of potential exposures were considered:
        - incidental ingestion and dermal contact with soil (e.g. dust indoors from outdoor soil)
        - ingestion of homegrown fruit and vegetables where chemicals may deposit onto plants or soils
        - ingestion of eggs from chickens that have access to backyard soil where chemicals may deposit.

The above exposures may occur in semi-rural residential properties surrounding the site. Risks were calculated for individual, as well as combined multiple pathways for exposure, where the chemicals are persistent and bioaccumulate, relevant to both adults and young children. The results indicate that all calculated risks associated with individual exposure pathways, as well as multiple exposure pathways, remain well below the target risk level of low/ acceptable.

- Deposition to water – an assessment was undertaken of the potential for chemical deposition to accumulate and impact on water quality in nearby Eastern Creek (potentially used for recreation) and rainwater tanks in semi-rural properties. Predicted concentrations in rainwater tanks were compared with drinking water guidelines, which are protective of all exposures relevant to non-potable use, as well as potable use such as ingestion, dermal contact, bathing and irrigation of homegrown crops that may be consumed. These guidelines would also be protective of the health of livestock and pets. The results indicate that the predicted water concentrations for recreational waterbodies and rainwater tanks are all well below the adopted water guideline.

Ecological health

The results of the detailed assessment of potential risks to ecological health from the carbonisation facility can be found in Appendix H. A summary of the key results are:

- Direct toxicity of air emissions – a range of gases are known to have effects on vegetation, including SO_2, HCL, HF and ammonia in air. The HHERA found that there were no exceedances of the guidelines relevant to the protection of vegetation from direct contact with concentrations predicted from the air quality modelling.
- Terrestrial environments – deposition of chemicals may cause bioaccumulation in the soil which may impact on terrestrial environments. The HHERA found that all predicted soil concentrations derived from the operation of the proposed carbonisation facility (assumed continually for a period of 35 years) are well below the relevant guidelines for the protection of terrestrial environments.
- Aquatic environments - deposition of chemicals may cause accumulation which could then impact on aquatic environments (such as nearby Eastern Creek). When assessing potential impacts to aquatic species, the dissolved phase concentration in the waterway is relevant. The HHERA found that all predicted concentrations in waterways near the Riverstone WRRF (assuming a worst case flow scenario in Eastern Creek) are below the relevant ANZG 2018 guidelines for both protection of direct toxicity and bioaccumulation effects.

Conclusion

The HHERA has considered the outcomes of modelled air emissions from the proposed facility and the potential for exposure to occur close to and in areas surrounding the site. In particular, the HHERA has considered the maximum predicted concentrations in air, along with the deposition and potential accumulation of metals, dioxins and furans, PAHs and PFAS in the semi-rural residential, commercial/industrial, open space, terrestrial and aquatic environments.

Based on the available data (including consideration of uncertainties), the HHERA concludes there is no health risk issues of concern to:

- workers at nearby industrial premises
- recreational users of areas adjacent (if any) or potential recreational exposures in Eastern Creek
- residents surrounding the Riverstone WRRF, including where residents consume homegrown fruit and vegetable and eggs or where rainwater tanks are used for non-potable purposes
- health of pets or stock, such as chickens, where water from rainwater tanks is used
- terrestrial and aquatic environments in areas adjacent to and surrounding the Riverstone WRRF.

6.6 Sustainability

The NWTH sustainability strategy has been revised for the proposed change. The strategy identifies key actions and opportunities to drive sustainability outcomes across the procurement, detailed design, delivery and operational phases. The objectives also align to key UN Sustainable Development Goals. The strategy also considers potential pathways to achieve an Infrastructure Sustainability (IS) rating.

Sydney Water is committed to reducing its carbon emissions and investing in new technologies and projects that will drive the local circular economy, along with reducing waste and increasing our ability to reuse and manage valuable resources, such as biosolid products.

The justification for switching to carbonisation is detailed in Table 2-1. The carbonisation process locks the carbon dioxide away (carbon sequestration) in the form of biochar, preventing the waste biomass from naturally decaying or being burned. The stable structure of biochar allows it to store the carbon, helping us to reduce emissions which helps abatement climate change.

Carbonisation would contribute to the circular economy in the following ways:

- resource recovery – carbonisation processes can extract energy and valuable materials such as hydrogen, carbon monoxide, and methane from wastewater. These resources can be reused within the plant or sold for other industrial applications, contributing to the circular flow of resources
- waste minimisation - carbonisation reduces the volume of wastewater sludge by converting organic matter into syngas resulting in waste reduction and resource optimisation
- energy generation - syngas produced through carbonisation can be used to generate heat and electricity to power the dryers.

Safeguards

Refer to approved REF.

6.7 Waste and hazardous materials

Biochar

We expect the biochar produced at the Riverstone WRRF will be lower in organic compounds but slightly higher in heavy metals compared to the current biosolids product. The biochar will be phosphorus rich, but low on nitrogen compared to the current biosolids. There may be opportunities to add ammonia rich dryer steam in some form to the biochar, or other biochar enhancements, depending on the reuse opportunity.

Production of biochar will reduce the volume by around 60% and mass by 80%, compared to current biosolids production. It is estimated that around 4.5 tonnes of biochar will be produced per day.

The reuse potential for the biochar will be dependent on verifying its chemical composition. We anticipate that 100% of our biochar produced will be beneficially reused for various offsite

applications. Reuse opportunities currently being investigated by Sydney Water include the following:

- agricultural reuse (existing biosolid markets) – use of biochar as a nutrient rich compound
- concrete blends – addition of biochar to existing concrete blends to enhance structural/ corrosion properties of concrete
- fuel/ carbon for steel or brick production – biochar could be used as an alternate fuel to coal and gas for production of construction materials
- compost – biochar could be used as an additive to compost
- upgrade to graphite – processing of biochar to produce a graphite product
- activated carbon – replacement of activated carbon in existing odour control systems.

These potential beneficial reuse opportunities are subject to regulation being developed to facilitate them. It also relies on broader use, research and market development of the biochar product. We will continue to work with industry to develop biochar reuse opportunities, as well as the EPA to develop the necessary RRO/ RRE for its beneficial use.

Safeguards – Construction

Refer to approved REF.

Safeguards – Operation

- testing of biochar will occur during commissioning to verify predictions and confirm classification
- a biochar reuse strategy will be developed by Sydney Water at least six months prior to project commissioning
- no off-site transport of biochar from Riverstone WRRF without a Resource Recovery Order/ Resource Recovery Exemption being approved by the EPA.

Preliminary hazard analysis

Preliminary Hazard Analysis (PHA) was undertaken by GHD in May 2024 (GHD, 2024) (Appendix I). The PHA was undertaken in accordance with State Environmental Planning Policy (Resilience and Hazards) 2021 (RH SEPP). The PHA focused on the operation of the Riverstone WRRF site because Rouse Hill WRRF operation will not result in any change to the current handling and storage of dangerous goods. As carbonisation is a new technology for a Sydney Water WRRF, an assessment was undertaken to determine if the upgrades will be considered a 'potentially hazardous or offensive' industry. The assessment included a:

- summary of Dangerous Goods (DGs) used on-site during construction and operation
- risk screening of DGs
- Level 1 Preliminary Hazard Analysis (PHA).

The methodology for the PHA included risk screening as per State Environmental Planning Policy (Resilience and Hazards) 2021 (RH SEPP) to determine if the proposed change at Riverstone WRRF is classed as “potentially hazardous or offensive”.

The PHA focused on the operational phase because only small volumes of fuels or chemicals will be required during construction. These small volumes can be stored and handled in accordance with safety data sheets (SDS) requirements which means there is negligible risk of impact to human health during this phase.

The PHA has been completed in accordance with the following legislation and guidelines:

- State Environmental Planning Policy (Resilience and Hazards) 2022 (RH SEPP)
- Applying State Environment Planning Policy No. 33 Guideline, NSW DPHI (DPHI, 2011a).
- Hazardous Industry Planning Advisory Paper (HIPAP) No. 6 – Hazard Analysis, NSW DPIE (DPHI, 2011d).
- HIPAP 4 – Risk Criteria for Land Use Safety Planning, NSW DPHI (DPHI, 2011c).

Risk Screening

A summary of the chemicals proposed to be used or stored on-site during operation of the proposed change is shown in Table 6-17.

Table 6-17 Chemicals proposed to be stored on site during operation - Riverstone WRRF

Chemical Class	DG Class (Packing group)	On site storage			Transportation		
		Anticipated volume quantities (tonnes)	RH SEPP Combined storage threshold (tonnes)	Threshold Exceeded	Combined transport movements (annual)	Transport movements threshold (annual)	Exceedance of RH SEPP threshold
Liquefied Petroleum Gas (LPG)	2 (I)	11.7	40	Below the threshold[1]	12	>500	Below the threshold
Sodium Hydroxide (Caustic soda - liquid (5%-45%))	8 (II)	37.1	25	Above the threshold	12	>500	Below the threshold
Sulfuric acid (>10% - 51%)	8 (II)	14.0			12	>500	Below the threshold
Sodium Hypochlorite Solution (10-15% Available Chlorine)	8 (II)	18.0			12	>500	Below the threshold
Ammonia Solution 25% w/w	8 (III)	0.9	50	Below the threshold[2]	48	>500	Below the threshold
SINOPEC Aqueous Urea Solution AUS 32	NA	Not Classified as DG					

(1) The threshold for LPG is based on the storage being buried.

(2) Ammonia solution is an alternative to urea. It is proposed that only one will be stored on site. However, both have been included in the screening for completeness.

The results of the dangerous goods screening indicate that during operation, the proposed Riverstone WRRF plant upgrades does exceed the thresholds within the SEPP (Resilience and Hazards) requirements for DG storage. As per Applying SEPP 33, if any of the screening thresholds are exceeded then the proposed development should be considered a 'potentially hazardous industry' and a PHA is required. The results of the transport screening, however, do not exceed the dangerous good movement thresholds as there are expected to be minimal deliveries. Given the type of dangerous goods that have exceeded the threshold (class 8 – corrosive liquids), a Level 1 PHA (qualitative hazard identification) was developed.

Additionally, as the Riverstone WRRF plant upgrades will be operated in accordance with an amended EPL 1796, the proposed change is not considered to be 'offensive'.

Level 1 PHA

Hazard identification (HAZID) was conducted as a desktop study and focused specifically on the operational activities of the proposed change. The PHA identified no hazards with the potential for off-site impact. However, there were five risks scenarios with a potential for a single on-site fatality identified. These are:

- vehicle interaction within the proposed change area
- natural hazards
- fire started within the proposed change area
- loss of containment of LPG during re-filling of the tank
- explosion due to the biogas generated from the digesters.

The Sydney Water risk criteria was used to assess the consequence and likelihood of each risk scenario. The likelihood of a scenario with this consequence is estimated to be very unlikely or rare.

Any change to the separation distance, the proposed design or increase in DG inventories will require a review of the PHA.

Safeguards – Construction

Refer to approved REF.

Safeguards – Operation

Any risks will be managed through the implementation of existing Sydney Water procedures and safeguards listed below:

- prepare traffic management plans including standard traffic rules and signage for construction and operation and maintenance
- site speed limits
- site layout to minimise vehicle reversing
- designated pedestrian areas for construction and operation

- driver competency
- Safe Work Method Statements (SWMS)
- machine inductions/licensing
- Bushfire Management Plan
- earthing and bonding strategy, including provision of lightning arrestors
- housekeeping standards
- site drainage
- construction emergency response plan
- manage fuel for vehicles and machinery on site to appropriate standards
- hot work permit process
- site security
- housekeeping standards
- inspection and maintenance regime
- fire management and emergency response procedures
- store chemicals in line with appropriate standards, such as AS1940 for flammable and combustible liquids, and AS3780 for corrosives.
- regular inspection and maintenance regime for chemical storage areas
- standard handling procedures
- SWMS detailing safe methods and procedures for chemical handling and transfer
- spill kits to be used in the event of an incident involving release of chemicals
- personal protective equipment (PPE) to all staff handling chemicals
- SDS available on-site
- comprehensive emergency plan and procedures provided for handling corrosives
- pallet bunds used for Intermediate Bulk Container storage
- appropriate biochar storage (covered to limit dust release, away from oxidising agents) to control moisture and ash content
- regular inspection and maintenance regime for the biochar storage
- SWMS detailing safe methods & procedures for biochar handling and transfer
- PPE to all staff handling or around the biochar
- should ignition of biochar occur, monitoring post ignition for 72 hours to minimise risk of re-ignition (due to ability to retain heat)

- ventilation within the bag house
- regular inspection and maintenance regime for the digesters
- leak detection
- excess biogas will be used in the process to provide supplementary heat to the dryer and gas heaters
- where appropriate pipework should be buried or above vehicle height to minimise likelihood of vehicle interaction or external forces.

6.8 Traffic and access

An addendum traffic and transport technical report was prepared by Aurecon Arup (2024) (Appendix J).

Existing environment

The existing environment at Riverstone WRRF and Rouse Hill WRRF is consistent with the approved REF.

Potential impacts - Construction

Peak construction traffic will occur in the morning peak hour (6:45 am to 7:45 am). Traffic, generated by nearby construction projects, is expected to be relatively low. Traffic and transport impacts were classed according to classifications outlined in Table 6-18.

Table 6-18 Traffic impact classifications

Classification	Impact
Low	Minimal impact with low frequency.
Moderate	Likely impacts to the transport network, however generally more localised. Recommended that these impacts be monitored prior to the implementation of safeguards.
High	Frequent impacts may cover larger areas on the road network. Will require further safeguards.

Riverstone WRRF

The indicative construction vehicle route for Riverstone WRRF is provided in Figure 6-8. The proposed access route would travel near Vineyard Public School, which is located on Bandon Road.

Typical construction would involve up to 85 workers per day. This may increase to up to 150 workers during peak construction periods.

The peak period of construction traffic is expected to occur in the AM peak hour. Peak construction periods are expected to generate 105 inbound light vehicle movements and 20 heavy vehicle movements in the AM peak hour. Therefore, the proposed change is expected to generate an additional 55 light vehicle movements in the AM peak hour and an additional 28 light vehicle movements in the PM peak hour (an average of less than one additional movement per minute) compared to the approved REF. Light vehicle movements are largely driven by the number of workers on site. It should be noted these are peak values and vehicle movements are expected to be lower for large periods of the construction phase.

This increase is due to detailed construction planning since the approved REF. Construction traffic generation is expected to have a negligible impact on Bandon Road given the low existing traffic volumes. Impacts on Windsor Road are also expected to be low given the relatively low increase in traffic generation.

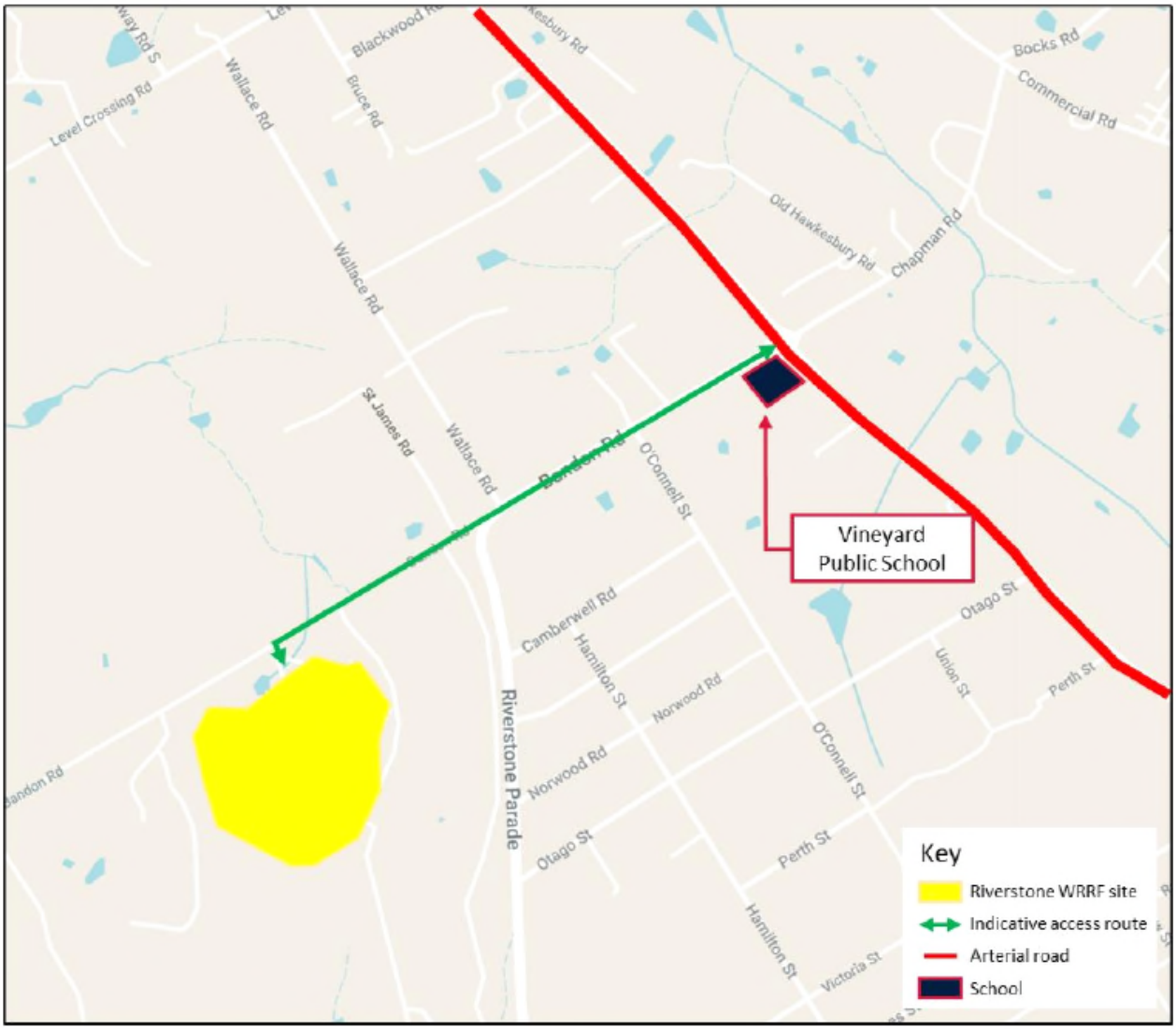

Figure 6-8 Indicative construction vehicle routes to and from Riverstone WRRF

Oversize overmass (OSOM) vehicles would be required to transport the gasifier and dryer system, membrane and large plant. Up to 12 OSOM vehicles are expected to travel to the Riverstone WRRF over the construction phase. These OSOM vehicles are expected to travel from nearby ports, which would be confirmed during detailed design. Windsor Road is the key arterial road on the OSOM network near the site. To manage OSOM vehicles, a permit will be sought from the National Heavy Vehicle Regulator (NHVR).

Due to the low number of OSOM vehicle movements, combined with the fact that these OSOM vehicles would travel outside of peak periods, it is expected that the traffic impact of OSOM vehicles on the road network would be minimal.

No impacts to surrounding roads are expected from construction worker parking, which will be wholly accommodated on site. Minimal impacts on bus services are expected given the low volumes of traffic being generated. No impacts are anticipated on the operation of bus stops.

No impacts to pedestrians or cyclists are expected given that no footpath or cycleway closures are proposed. Heavy vehicle movements may also impact the morning school drop-off period between 8 am and 9:30 am near Vineyard Public School, which is located on Bandon Road.

The following potential impacts are assessed as a low-level impact, provided the recommended safeguards are implemented:

- construction vehicles reducing performance of surrounding road network
- OSOM vehicles reducing performance of surrounding road network
- heavy vehicles travelling past Vineyard Public School, on Bandon Road.

Rouse Hill WRRF

The indicative construction vehicle route for Rouse Hill WRRF is provided in Figure 6-9. The proposed access route would travel near Rouse Hill Public School, which is located on Mile End Road.

Typical construction would involve up to 30 workers per day. This may increase to up to 105 workers during peak construction periods (6 to 8 months).

The peak period of construction traffic is expected to occur in the AM peak hour. When compared to the approved REF, the proposed change is expected to generate an additional 120 light vehicle movements and 26 heavy vehicle movements in the AM peak hour and 50 light vehicle movements in the PM peak hour (an average of up to three additional movements per minute). Light vehicle movements are predominately driven by the number of workers on site.

Construction traffic generation is expected to have a negligible impact on Withers Road and Mile End Road given the low existing traffic volumes. Impacts on Windsor Road are expected to be moderate during peak construction periods given the moderate increase in traffic generation. Windsor Road also carries higher volumes of traffic near the Rouse Hill WRRF, noting that construction traffic generation is expected to only form a small percentage of overall traffic on Windsor Road.

No impacts to surrounding roads are expected from construction worker parking, which will be wholly accommodated on the site compound. Minimal impacts on bus services on Windsor Road,

Withers Road and Mile End Road are expected given the low volumes of traffic being generated. No impacts are anticipated on the operation of bus stops.

Pedestrians do occasionally access the wetlands (behind the Rouse Hill WRRF) which are accessed via Withers Road. There is potential impact from additional construction vehicles using this secondary access route to site. This potential impact is currently being managed using speed limit restrictions and signage as part of the construction access for the Compliance Upgrade project.

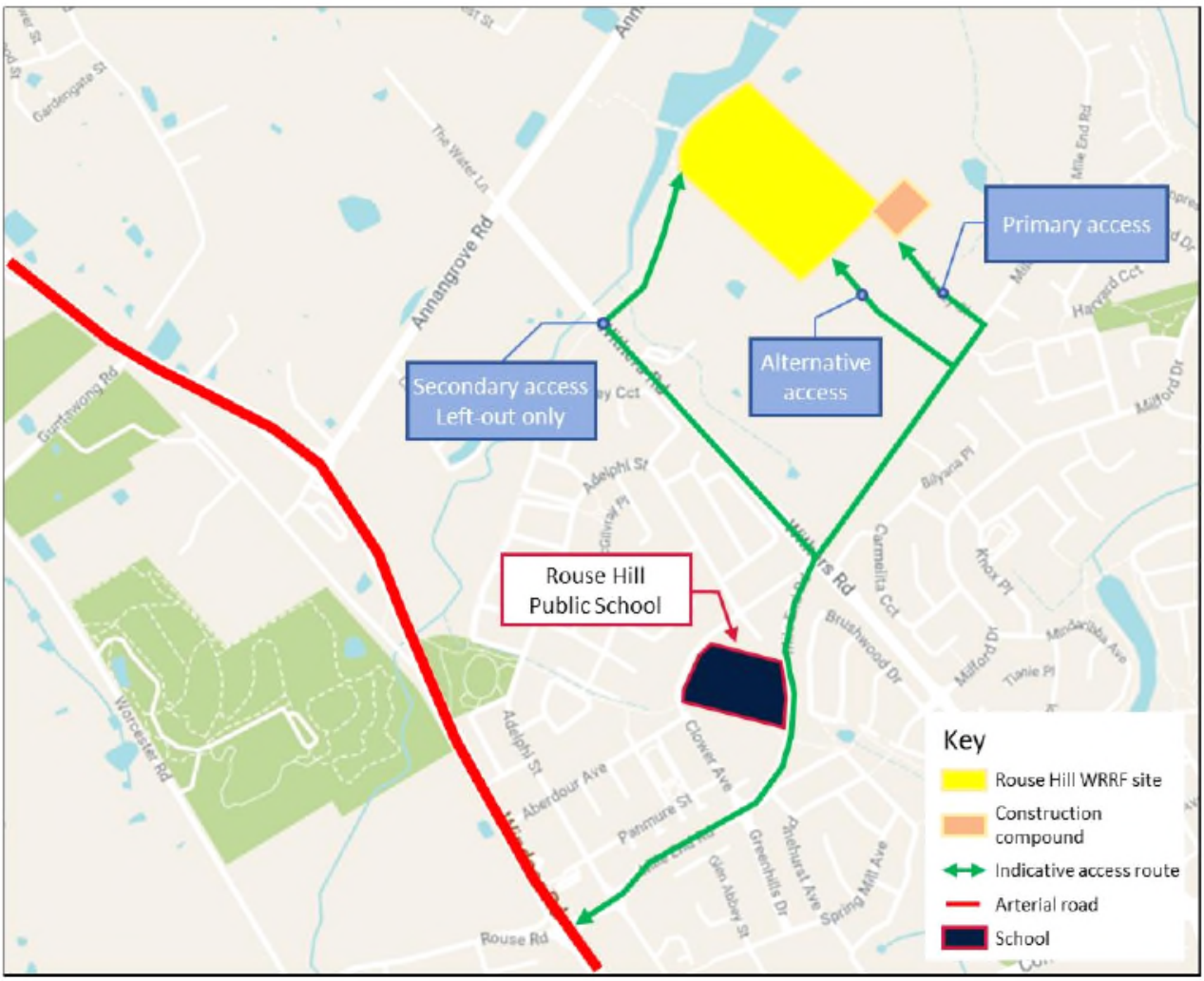

Figure 6-9 Indicative construction vehicle routes to and from Rouse Hill WRRF

Oversize overmass (OSOM) vehicles would be required to transport material and equipment including large plant. Up to 10 OSOM vehicles are expected to travel to the Rouse Hill WRRF over the construction phase. These OSOM vehicles are expected to travel from nearby ports, which would be confirmed during detailed design. Windsor Road is the key arterial road on the OSOM network near the site. To manage OSOM vehicles, a permit will be sought from the National Heavy Vehicle Regulator (NHVR).

The following potential impacts are assessed as having a low potential for occurrence, provided the recommended safeguards are implemented:

- construction vehicles reducing performance of surrounding the road network, particularly Windsor Road
- safety concerns due to poor sight distance for vehicles existing the secondary access road onto Withers Road
- OSOM vehicles reducing performance of surrounding road network
- heavy vehicles accessing the secondary access route off Withers Road which is also utilised by pedestrians and walking groups
- heavy vehicles travelling past Rouse Hill public school, on Mile End Road.

Potential impacts - Operation

During operation, traffic generation would include light vehicle movements for staff travelling to and from the Riverstone WRRF and Rouse Hill WRRF, as well as heavy vehicle movements to transport chemicals and materials (including biochar).

As a result of the proposed change, heavy vehicle movements at Rouse Hill WRRF during operation are expected to have a minor increase from 2 movements to 4 movements per hour due to the increased sludge handling compared to the approved REF. Smaller trucks may be used to transport biochar from Riverstone WRRF compared to the larger biosolid trucks currently used.

Altogether, the operation of the upgraded WRRFs is expected to have a negligible impact on the surrounding road network performance during operation. Similarly, impacts on public transport and active transport are expected to be negligible during operation. No changes to parking or access are expected during operation as parking would be accommodated on-site.

Safeguards – Construction

The following is a consolidated list of safeguards from the approved REF and any new ones from this REFA (**in bold**):

All sites

- a traffic and pedestrian management plan will be developed where there is interaction between construction vehicles and pedestrians, noting schools near vehicle access routes. Traffic management measures may include temporary closures and the need for any detours
- minimise construction traffic movements through school zones during pick up and drop off times
- prepare a Traffic Control Plan (TCP) in consultation with the relevant traffic authority to meet NSW Roads and Maritime Service's Traffic Control at Worksites Manual V4 requirements. The Alliance will obtain a Road Occupancy Licence (ROL) from TfNSW and local Councils, including if works are within 100m of traffic signals when construction commences

- minimise traffic impacts near residential properties, schools and businesses by consulting with them (e.g. no major materials deliveries at school drop off or pick up times, maintaining driveway access etc.)
- manage sites to allow people to move safely past the works, including alternative pedestrian, bicycles, pram and wheelchair access
- consult with the relevant traffic authority about managing impacts to pedestrian traffic, signposting, meters, parking, line-marking or if traffic control or pavement restoration is required
- erect signs to inform road users of the proposed works and any temporary road closures
- 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
- schedule construction traffic movements outside of peak periods where possible
- reinstate damaged trails / tracks to pre-existing or better condition
- **consider commuter peak traffic congestion when finalising transport routes**
- **encourage the use of carpooling and public transport, particularly during peak construction periods**
- **where required, obtain a permit for oversized vehicles with NHVR.**

Riverstone WRRF

- cover loaded trucks to mitigate dust impacts on local roads and nearby properties
- use signage to alert pedestrians and road users of increased vehicle traffic conditions, where appropriate
- where practical, avoid heavy vehicle movements between Vineyard train station and Windsor road during school zones hours.

Rouse Hill WRRF

- **the traffic and pedestrian management plan will consider shared or alternative pedestrian access routes to maintain connectivity around the wetlands where possible. The Alliance will continue to engage with the Walking Group Volunteers and communicate these changes to the public**
- left out only for vehicles leaving the Rouse Hill WRRF via the secondary access road. Use signage to alert vehicles on Withers Road of the informal access point
- consider left-in only access for vehicles entering the Rouse Hill WRRF via the secondary access road
- use signage to alert pedestrians of heavy vehicle access, changed footpath conditions, bus stop locations and temporary closure of walking tracks.

6.9 Social and visual

Existing environment

The existing environment at Riverstone WRRF and Rouse Hill WRRF is consistent with the approved REF.

Potential impacts - Construction

The proposed change will result in a substantial reduction in the social and visual impacts to the community during construction. The removal of the sludge transfer main from the scope will result in all construction impacts being in and around the two WRRFs.

Rouse Hill WRRF

The site compound and additional vegetation removal at Rouse Hill WRRF will temporarily impact the visual character of Money Close. The proposed change will not be visible to residential receivers and will be visually consistent with the industrial estates along Money Close.

Changes to movement of vehicles and machinery, traffic conditions and noise impacts have been assessed in Section 6.4 and Section 6.8. Construction vehicles accessing the site will travel via a new access track off Money Close. Only minor impacts are anticipated to other traffic users on Money Close. All construction parking will be within the compound site and there will be no reduction in parking on Money Close.

Riverstone WRRF

Social and visual impacts of construction at Riverstone WRRF are consistent with the approved REF. As detailed in Section 6.8, increased construction traffic is expected have a minor impact to local residents.

Potential impacts – Operation

Rouse Hill WRRF

The proposed change at Rouse Hill WRRF will result in an additional odour control shaft next to the new dewatering building, approximately 23m in height.

All other aspects of the proposed change will not impact the visual character of the WRRF. Given that there is no to low visibility from residential properties and its consistent with the visual character of the adjacent commercial/industrial area, minimal visual impact is anticipated.

Riverstone WRRF

The additional above ground infrastructure, including the carbonisation facility and two treated gas vent shafts, would be consistent with the type of structures currently on the Riverstone WRRF. The vent shafts would generally consist of a 0.25 m diameter supported pipe about 18 m tall. The shafts will be within the Riverstone WRRF and not in proximity to either existing or future residential receivers.

Views of the Riverstone WRRF are currently restricted in all directions from sensitive receivers due to intervening vegetation and higher ground east of the WRRF. While the proposed change would result in a minor alteration to the visual characteristic of the area, the visual impact of above

ground structures, including shafts, will be consistent with the industrial area surrounding the WRRF. Potential social impacts due to noise, air pollution, odour and hazards and risks arising from the proposed change have been assessed and identified as low (refer to Section 6.4 - 6.8).

Safeguards

All safeguards listed in the approved REF will continue to be implemented.

7 Conclusion

Sydney Water has prepared this REFA to assess the potential environmental impacts of the NWTH Upgrades (Growth Package) - Biosolids Processing and Construction Compound.

Since the approved REF, we have identified an opportunity to diversify our methods for biosolids processing. A review of technology available for advanced processing of biosolids to reduce contaminants of concern found that carbonisation with upstream dewatering and drying was the preferred technology for the NWTH Upgrades (Growth Package). The proposed change of installing carbonisation at Riverstone WRRF is a proactive measure, in anticipation of more stringent Biosolids Guidelines being released. The proposed sludge pipeline connecting Castle Hill WRRF, Rouse Hill WRRF and Riverstone WRRF, as detailed in the approved REF, will no longer be needed, substantially reducing native vegetation clearing, as well construction impacts for the community along the pipeline alignment.

The proposed change also includes a construction compound located at 7 Money Close, a new temporary construction road into the Rouse Hill WRRF as well as a 3 metre wide extension to the northern boundary of the WRRF for permanent operational access. The compound is required to facilitate parking and material laydown during construction as there were no suitable areas within the WRRF operational site. It also avoids clearing a large area of native vegetation on Sydney Water land to the north of the WRRF site.

The proposed change continues to include upgrades to both WRRFs, to ensure we can continue to provide an efficient wastewater system catering for Sydney's growing population in the north west and keeping our waterways clean.

The main potential construction environmental impacts of the proposed change include impacts to traffic and biodiversity (though substantially reduced from the approved REF).

The potential operational air quality impacts were assessed by modelling as part of the AQIA for Rouse Hill and Riverstone WRRFs. Both sites are predicted to meet the required odour criteria at sensitive receivers during operation.

The AQIA for the carbonisation facility is considered robust by adopting conservative estimates of each pollutant of concern, as well as modelling the peak operational scenario. The AQIA has adopted an outcomes-based approach to demonstrate the emissions limits set out in the Clean Air Regulation will be met. The design specifications for afterburners found in the Clean Air Regulation are not directly relevant to the carbonisation technology.

Using the outcomes from the AQIA, a human health and ecological risk assessment concluded that there are no health risks of concern to the surrounding receivers from operation of the carbonisation facility at Riverstone WRRF.

Given the nature, scale and extent of impacts and implementation of the safeguards outlined in the approved REF and this REFA, the proposed change is unlikely to have a significant impact on the environment. Therefore, an environmental impact statement is not required under Division 5.1 of the EP&A Act.

The REF considers how the proposed change aligns with the principles of ESD. The proposed change will result in positive long-term environmental improvements. The proposed change will not result in the degradation of the quality of the environment and will not pose a risk to the safety of the environment.

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Appendices

Appendix A – Section 171 checklist

Section 171 checklist	REF finding
Any environmental impact on a community	The proposed change will result in a substantial reduction in the environmental impact on a local community during construction. The removal of the sludge transfer main from the scope means all construction impacts will be contained to areas in and around the two WRRFs. There will be environmental improvements by continuing to provide a reliable wastewater service to service the growing local community.
Any transformation of a locality	The proposed change will not result in the transformation of a locality. All work is occurring on existing WRRFs. The temporary construction compound is located within a commercial area.
Any environmental impact on the ecosystems of the locality	The proposed change removes the proposed 16.5 km sludge pipeline connecting between the three WRRFs. This has resulted in a substantial reduction in the environmental impact on the ecosystems of the locality. The remaining vegetation removal will be offset in accordance with Sydney Water's Biodiversity Offset Guideline. The proposed change will continue to ensure we maintain and improve waterway health and meet our EPL requirements.
Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality	The proposed change has significantly reduced the impacts to native vegetation by removing the need for a sludge pipeline. All work is now occurring within or very close to the existing WRRFs and is not expected to cause any reduction in the aesthetic, recreational, scientific or environmental quality of the locality.
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 change will not have 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. With the proposed change to remove the sludge pipeline, there are no longer any impacts to Aboriginal heritage items and no AHIP is required.
Any impact on the habitat of any protected animals (within the meaning of the *Biodiversity Conservation Act 2016*)	The proposed change will impact 0.11 ha of TECs listed under the BC Act and the EPBC Act at the Rouse Hill WRRF. Native vegetation impacts at the Riverstone WRRF remain the same as the approved REF and occur entirely within certified land. Potential habitat impacts have been minimised through redesign and removal of the sludge transfer main.
Any endangering of any species of animal or plant or other form of life, whether living on land, in water or in the air	The proposed change will not be endangering any species of animal, plant or other form of life, whether living on land, in water or in the air. ToS and SIC assessments were conducted on

Section 171 checklist	REF finding
	threatened species likely to occur at the proposed change site. The assessments show that this proposed change does not have a significant impact on these species and therefore does not endanger any of the species.
Any long-term effects on the environment	The proposed change is expected to provide a long-term benefit by providing improved treatment processes and maintaining the health of local waterways as the local community grows. The proposed carbonisation facility at the Riverstone WRRF seeks to meet future regulatory requirements set by EPA on wastewater by-products such as biosolids and biochar.
Any degradation of the quality of the environment	The proposed change will not cause the degradation of the quality of the environment. Emissions and odour modelling conducted for the proposed change confirms that emissions are at an acceptable level and will not degrade the air quality of the local environment. The proposed change is consistent with the approved REF and will improve the quality of treated wastewater discharges.
Any risk to the safety of the environment	The proposed change will result in a temporary increase in traffic movements around the two WRRFs during construction. There will also be a small increase in truck movements during operation at the Rouse Hill WRRF. Consultation, signage and provision of alternative routes during construction will mitigate this potential safety risk to the environment. A comprehensive Human Health and Ecological Risk Assessment (Appendix H) was completed for the proposed change. This concluded that there are no health risk concerns for surrounding receivers including offsite workers, residents, recreational users or the environment.
Any reduction in the range of beneficial uses of the environment	The proposed change will not reduce the range of beneficial uses of the environment. The production of biochar will increase the range of potential beneficial reuse applications, compared to the production of biosolids.
Any pollution of the environment	Environmental safeguards proposed will mitigate the potential for the proposed change to pollute the environment. Modelling has been undertaken to ensure the introduction of carbonisation will not course any air quality exceedances. The proposed change will operate in accordance with the Rouse Hill WRRF EPL 4965 and the Riverstone WRRF EPL 1796 (as amended through Licence Variations to include operation of proposed change).

Section 171 checklist	REF finding
Any environmental problems associated with the disposal of waste	The disposal of wastes will be conducted in accordance with the environmental safeguards including obtaining EPA RRE/ RROs. We will aim for 100% beneficial reuse of the biochar produced from Riverstone WRRF.
Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply	The proposed change will not increase demand on resources, that are, or are likely to become, in short supply.
Any cumulative environmental effect with other existing or likely future activities	The proposed change will not have any cumulative environmental effect with other existing or likely future activities.
Any impact on coastal processes and coastal hazards, including those under projected climate change conditions	The proposed change will not have any impact on coastal processes or hazards, and coastal processes and coastal hazards will not have any impact on the proposed change.
Any applicable local strategic planning statements, regional strategic plans or district strategic plans made under the EP&A Act, Division 3.1	The proposed change services growth aligned with the applicable strategic planning context. This was considered in the system planning and options selection process (refer to Section 2.2 of the approved REF) and is discussed in Section 5.1 of this REFA.
Any other relevant environmental factors.	The proposed change has been assessed against the factors listed above, and there are no other relevant environmental factors to consider.

Appendix B – Consideration of TISEPP consultation

TISEPP section	Yes	No
Section 2.10, 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?		✓
Connect to, and have a substantial impact on, the capacity of a council owned sewerage system?		✓
Connect to, and use a substantial volume of water from a council owned water supply system?		✓
Require temporary structures on, or enclose, a public space under council's control that will disrupt pedestrian or vehicular traffic that is not minor or inconsequential?		✓
Excavate a road, or a footpath adjacent to a road, for which the council is the roads authority, that is not minor or inconsequential?		✓
Section 2.11, 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?		✓
Section 2.12, flood liable land – consultation with council		
Will the work be on flood liable land (land that is susceptible to flooding by the probable maximum flood event) and will works alter flood patterns other than to a minor extent?		✓
Section 2.13, flood liable land – consultation with State Emergency Services		
Will the work be on flood liable land (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 systems)?		✓
Section 2.14, 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?		✓
Section 2.15, consultation with public authorities other than councils		
Will the proposal be on land adjacent to land reserved under the *National Parks and Wildlife Act 1974* or land acquired under Part 11 of that Act*? If so, consult with DPE (NPWS).*		✓
Will the proposal be on land in Zone C1 National Parks and Nature Reserves or on a land use zone that is equivalent to that zone? *If so, consult with DPE (NPWS).*		✓
Will the proposal include a fixed or floating structure in or over navigable waters? *If so, consult TfNSW.*		✓
Will the proposal be 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 be on land in a Western City operational area specified in *the Western Parkland City Authority Act 2018,* Schedule 2 and have a capital investment value of $30 million or more? *If so, consult the Western Parkland City Authority*.		✓
Will the proposal clear native vegetation on land that is not subject land (ie non-certified land)? *If so, notify DPE at least 21 days prior to work commencing. (Requirement under s3.24 Chapter 3 Sydney Region Growth Centres - of the SEPP (Precincts – Central River City) 2021).*		✓

Appendix C – Flora and fauna assessment addendum

Appendix D – Aboriginal heritage due diligence

Appendix E – Noise and vibration impact assessment

Appendix F – Air quality impact assessment – Rouse Hill WRRF

Appendix G – Air quality impact assessment – Riverstone WRRF

Appendix H – Human health and ecological risk assessment – Riverstone WRRF

Appendix I – Preliminary hazard analysis – Riverstone WRRF

Appendix J – Traffic and access technical report