ADDENDUM
REVIEW OF ENVIRONMENTAL FACTORS
SHOALWATER INFRASTRUCTURE – MOSS VALE RD URAs
PART 2: SEWER INFRASTRUCTURE
ALTERNATIVE ALIGNMENT – RAILWAY ST, BOMADERRY

This report is an addendum to a Review of Environmental Factors (REF) prepared by Shoalhaven City Council in October 2020 for the construction of Sewer Infrastructure associated with development of the Moss Vale Urban Release Areas (MVURAs). The 2020 REF is attached as Appendix A. The current addendum was necessary to assess changes to the proposed activity as defined in the 2020 REF namely:

- An alternative Sewer and/or Water Main alignment between the Bomaderry Sewage Treatment Plant (STP) and Edwards Ave, in the vicinity of Railway St.

Note: This addendum addresses only the existing environment, likely impacts and relevant prescribed safeguards associated with the alternative alignment and as such, this addendum must be read in conjunction with the 2020 REF (Appendix A).

Contents

1. PROPOSAL AND LOCATION

1.1 Overview of activity

Shoalhaven Water is currently planning and undertaking the development of water and sewerage infrastructure to service and facilitate development of the Moss Vale Rd Urban Release Areas (URAs).

Review of Environmental Factors (REF) Shoalwater Infrastructure – Moss Vale Rd URAs Part 1: Moss Vale Rd Water Lead-in (Council reference D20/402515) provided environmental assessment for the construction of a water main from Cambewarra, running approximately 1.575km eastward along Main Rd and the south-east along Moss Vale Rd, as a water lead-in, to service the Moss Vale Rd Urban Release Areas (URAs).

Review of Environmental Factors (REF) Shoalwater Infrastructure – Moss Vale Rd URAs Part 2: Sewer Infrastructure (Council reference D20/456925) provided environmental assessment for the construction of sewage infrastructure including three sewer pump stations, rising mains and gravity mains, to service the Moss Vale Rd Urban Release Areas (URAs).

Review of Environmental Factors (REF) Shoalwater Infrastructure – Moss Vale Rd URAs Part 3: Cambewarra Reservoir (Council reference D21/ 427043) provided environmental assessment for the construction of an additional 3.5ML reservoir with associated infrastructure and site works at the site of an existing 2.3ML reservoir, on Reservoir Lane, Cambewarra, to provide additional storage for the Moss Vale Road URAs, in addition to providing operational flexibility for the Cambewarra water supply.

Review of Environmental Factors (REF) Shoalwater Infrastructure – Moss Vale Rd URAs Part 4: Water Reticulation Infrastructure (Council reference D21/470203) provided environmental assessment for the proposed construction of water reticulation infrastructure to support the development of the Moss Vale Rd Urban Release Areas (URAs).

The subject of the current addendum REF is the proposed alternative alignment of Sewer Main between the Bomaderry Sewage Treatment Plant (STP) and Edwards Ave, in the vicinity of Railway St (refer to Figures 1 and 2).

The originally proposed alignment travelled northward from the STP along Railway St and aligned unformed road reserves, parallel and adjacent to the railway corridor, to Edwards Ave.

Conflict with other existing and proposed services in this location has required consideration of an alternative alignment.

The alternative alignment would travel through agricultural land via an arcing unformed road reserve up to 180m (approx.) east of the originally proposed alignment.

Note that the currently proposed alternative Sewer Main alignment may instead or additionally, be utilised for a Water Main if found to be a more practical solution to resolving services conflict. In this case, the alignment, construction methodology, impacts, safeguards and mitigation measures would remain consistent for the purpose of this assessment, whether Sewer and/or Water Main. The connection point at the southern end of the alignment would involve a minor deviation within cleared and modified land, and would not involve any additional impacts.

The proposal would include the following works:

- Construction of approx. 1.32km Sewer (and/or Water) Main;
- Excavation (combination of trenching and underbore);
- Removal of regrowth native vegetation;
- Management of Acid Sulfate Soils may be required

Additional prescribed environmental safeguards and impact mitigation measures associated with the alternative alignment are listed in Section 7 of this report.

Shoalhaven City Council (SCC) is the proponent and the determining authority under Part 5 of the EP&A Act. The environmental assessment of the proposed activity and associated environmental impacts has been undertaken in the context of Clause 228 of the *Environmental Planning and Assessment Regulation 2000*. In doing so, this Review of Environmental Factors (REF) helps to fulfil the requirements of Section 5.5 of the Act that SCC examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment resulting from the activity.

1.2 Location

The proposal would occur primarily within an unnamed and unformed road reserve, for which Shoalhaven City Council is the road authority, and within Council owned Lot 16 DP 259169.

The unnamed road reserve cuts through Lot 24 DP 746244 (privately owned, zoned RU1-Primary Production and managed for agricultural purposes) and Lot 1 DP 774892 (privately owned, zoned IN1-General Industrial and RU1-Primary Production with the western portion developed for industrial purposes). The road reserve is not currently fenced or otherwise delineated through these lots. Consultation and notification will be carried out with the respective landowners to minimise disruption and potential impacts to current land uses.

Table 1. Land affected by the proposal

Lot / DP	Description	Land owner / manager	Comments
-	Unnamed road reserve	Council	
Lot 16 DP 259169	Bomaderry STP	Council	Freehold Operational Land; Zoned SP2-Sewage Treatment Plant

Figure 1. MVURA Proposed Sewer Infrastructure – subject area of current alternative alignment assessment circled in red

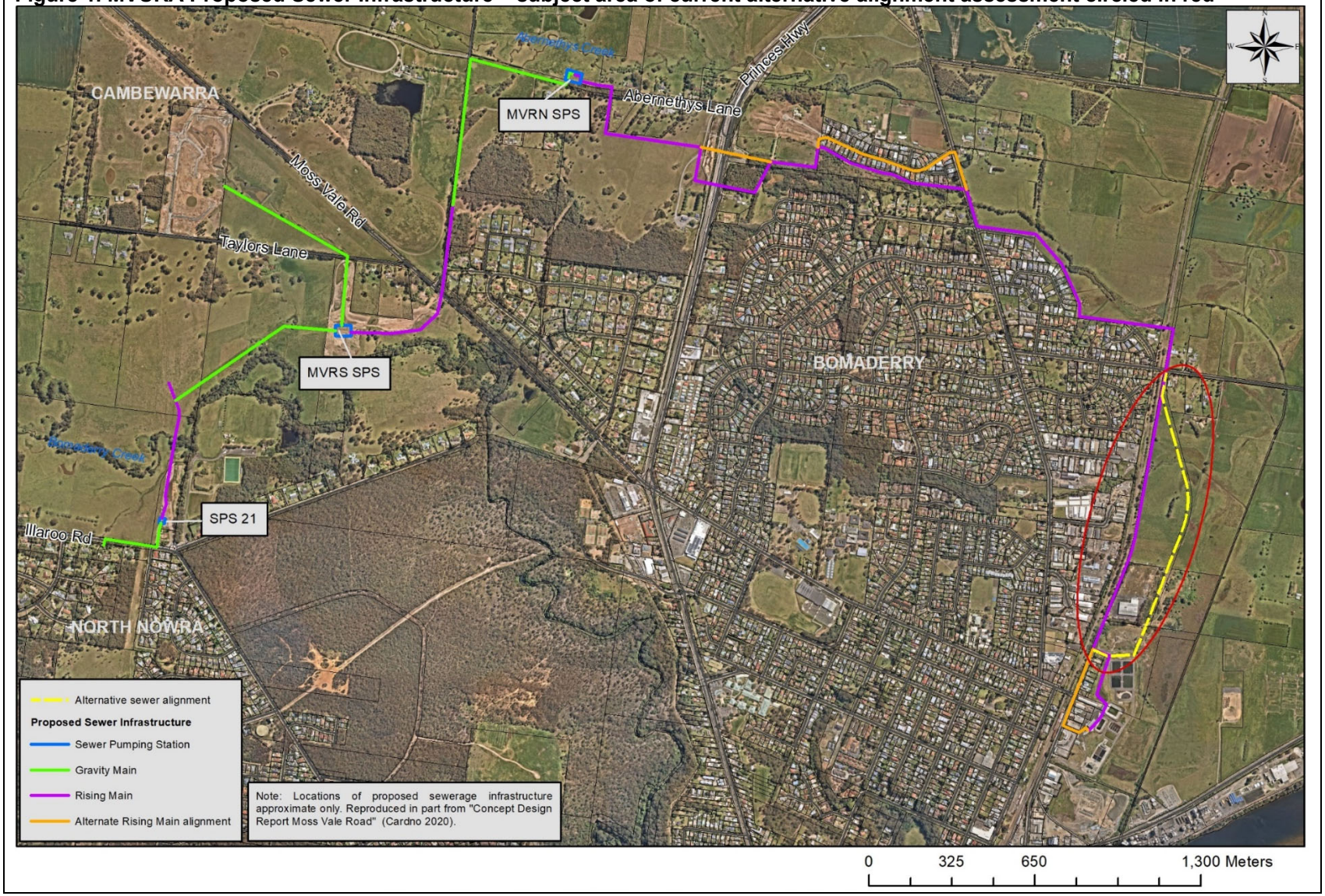
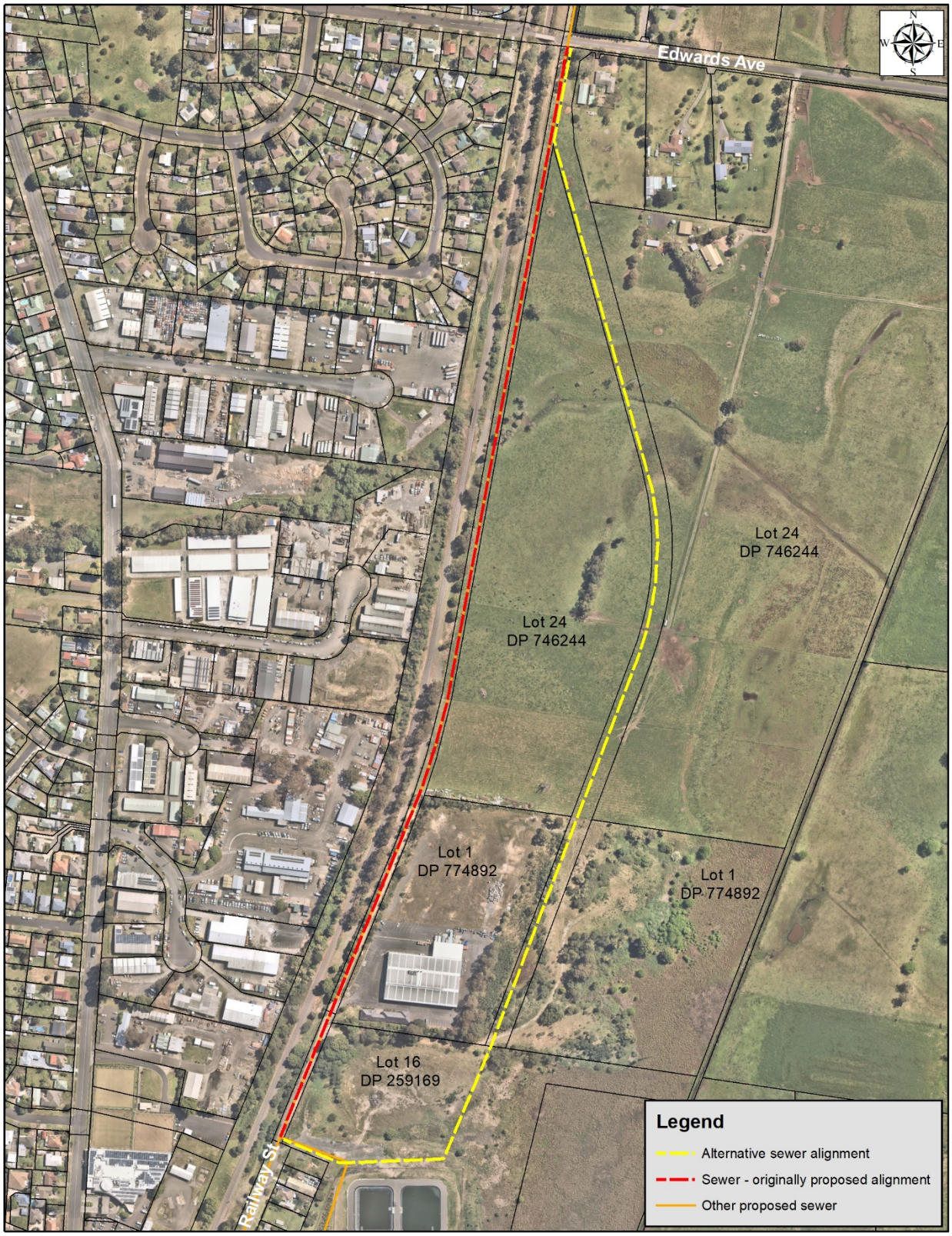


Figure 2. Site showing originally proposed and alternative alignments



2. EXISTING ENVIRONMENT

2.1 Habitat and vegetation assessment

The site of the proposed alternative alignment was surveyed by a Council Environmental Officer on 25th August 2021. Surveys undertaken involved vegetation and habitat assessment, recording of all flora species within and immediately adjacent to the subject site, determination of vegetation communities and the location and extent of endangered ecological communities, and investigation of habitat availability on site with particular regard to potential habitat for threatened flora and fauna species.

The northern portion of the site (adjacent to Lot 24 DP 746244) is cleared, agricultural land which is currently used for cattle grazing. The vegetation is comprised of exotic grasses and herbs, dominated by Kikuyu (*Cenchrus clandestinus*).

Mulgen Creek crosses through the site from the west toward Abernethys Creek in the east, fanning out into a wetland in the vicinity of the site, with an ephemeral swamp area adjoined to the south.

Aerial photography suggests the watercourse has both natural and constructed components, with a defined, narrow and straight channel apparent through parts of the broader wetland.

The wetland is partly treed, with Swamp Mahogany (*Eucalyptus robusta*), and Flax-leaved Paperbark (*Melaleuca linearis*) occurring, and an understorey of dense Knotweed (*Persicaria* spp.) and patchy Cumbungi (*Typha orientalis*) occuring with exotic grasses. Sea-rush (*Juncus krausii*) occurs somewhat densely through the adjoined ephemeral swamp. Swamp She-oak (*Casuarina glauca*) occur in nearby boggy areas.

The southern portion of the site shows evidence of past disturbance, with areas of scrubby native regrowth (including *Acacia filicifolia, Hakea gibbosa* and *Kunzea ambigua*) containing no large trees, among areas of cleared and disturbed land dominated by exotic invasive grasses and shrubs including African Lovegrass (*Eragrostis curvula*), Parramatta Grass (*Sporobolus africaus*), Kikuyu (*Cenchrus clandestinus*), Lantana (*Lantana camara*), Blackberry (*Rubus anglocandicans*) and Fireweed (*Senecio madagascariensis*).

The Mulgen Creek wetland area was noted to contain hollow bearing trees and stags, offering suitable potential habitat for medium sized, threatened, hollow-dependent birds (e.g. Cockatoos) and threatened, hollow-dependent microbats.

Nankeen Kestrels were observed roosting and hunting through the area during site survey.

No threatened flora or fauna species were observed during survey.

No targeted species were undertaken for threatened nocturnal birds or arboreal mammals.

Photos 1 through 8 below show the site, available habitats and relevant features.

Photo 1. Site facing north along approx. alignment from Mulgen Creek

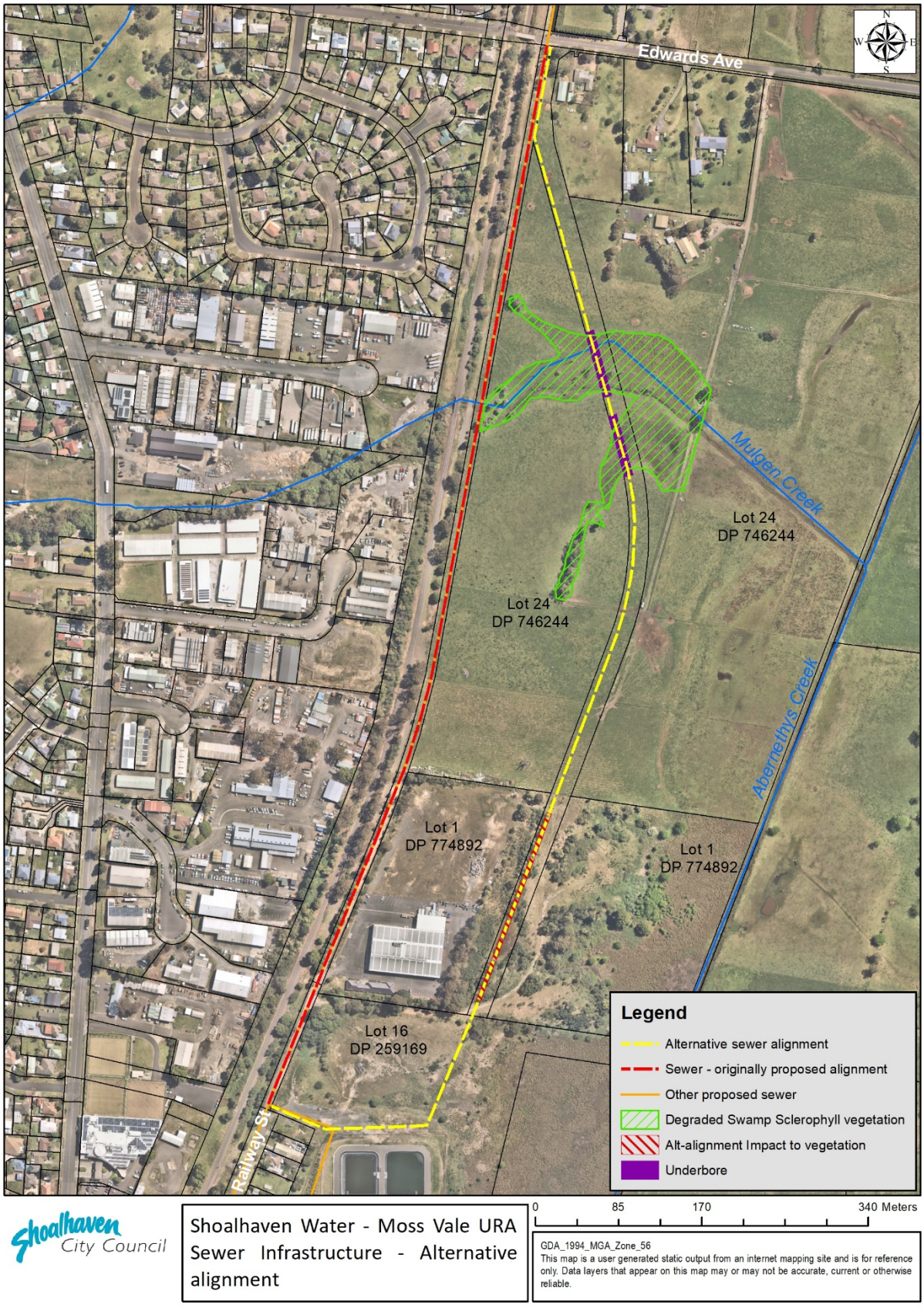
Photo 2. Mulgen Creek (facing north-east) showing wetland containing Paperbark and Swamp Mahogany

Photo 3. Ephemeral swamp (facing east)

Photo 4. Site facing north along approx. alignment from approx. boundary between Lot 24 DP 746244 and Lot 1 DP 774892

Photo 5. Site facing south along approx. alignment from approx. boundary between Lot 24 DP 746244 and Lot 1 DP 774892, showing scrubby regrowth and disturbed land with invasive exotic grasses and shrubs

Figure 3. Site showing ecological constraints & likely vegetation removal



3. ASSESSMENT OF LIKELY ENVIRONMENTAL IMPACTS

3.1 Impacts associated with the proposal

Refer to the 2020 REF (Appendix A) for previously assessed impacts.

The alternative Mains alignment would involve the following impacts (refer to Figure 3 above):

- Clearing of regenerating native scrub to approx. 210m x 5m corridor (1050m^2);
- Trenching of approx. 1.2km;
- Approx. minimum 135m (likely 155m) of the alignment would be underbored to avoid impacts to the Mulgen Creek and associated wetland / swamp sclerophyll areas (refer to Figure 3).

3.2 Threatened species impact assessment (NSW)

Section 1.7 of the EP&A Act 1979 applies the provisions of Part 7 of the NSW *Biodiversity Conservation Act 2016* and Part 7A of the *NSW Fisheries Management Act 1994* that relate to the operation of the Act in connection with the terrestrial and aquatic environment. Each are addressed below.

3.2.1 Part 7A *Fisheries Management Act 1994*

Part 7A relates to threatened species conservation.

No marine or freshwater species listed as threatened under the Act are recorded as occurring[1] or considered likely to occur within or in close proximity to the site.

The site does not contain suitable habitat for any locally occurring threatened aquatic species or habitat protected under the Act.

Erosion and sediment controls shall be installed and maintained to minimise the risk of impacts associated with sediment movement downstream.

As there is no risk of the proposed activity affecting threatened species habitat relevant to the Act, further consideration of this section of the Act is unnecessary.

3.2.2 Part 7 *Biodiversity Conservation Act 2016*

An assessment of the potential for NSW threatened flora and fauna species occurring on-site or otherwise being impacted by the proposal was undertaken (refer to Appendix C). The following species and endangered ecological communities are known to occur on-site or are considered to have some potential to occur on-site or be otherwise impacted by the proposal, and therefore required further assessment under Part 7 of the NSW *Biodiversity Conservation Act 2016*:

- Eastern Coastal Freetail-Bat *Micronomus norfolkensis*
- Greater Broad-nosed Bat *Scoteanax rueppellii*
- Southern Myotis (Large-footed Myotis) *Myotis macropus*

[1] Fisheries NSW Spatial Data Portal https://webmap.industry.nsw.gov.au/Html5Viewer/index.html?viewer=Fisheries_Data_Portal

- Freckled Duck *Stictonetta naevosa*
- *Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* endangered ecological community (EEC)

Section 7.3 of the Act provides a 'five-part' test to determine whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. Each Part is addressed below.

Refer also to 2019 REF (Section 6.11).

Part A - In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be place at risk of extinction.

Threatened microchiropteran bats: Eastern Coastal Freetail-Bat (*Micronomus norfolkensis*) Greater Broad-nosed Bat (*Scoteanaux ruepelli*) and Southern Myotis (Large-footed Myotis) (*Myotis macropus*)

The Eastern Coastal Freetail-Bat (*Micronomus norfolkensis*) occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. The species roosts mainly in tree hollows but will also roost under bark or in man-made structures. It will usually change breeding sites regularly (every few days), rendering it very difficult to confirm breeding sites. It has been known to occasionally aggregate in large breeding groups (including in buildings). It is usually solitary but has also been recorded roosting communally. The Eastern Freetail-Bat is considered to be probably insectivorous (OEH 2017a).

The Greater Broad-nosed Bat (Scoteanax rueppellii) utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. The species forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January. Prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young (OEH 2017c).

Southern Myotis (*Myotis macropus*) generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. The species is dependent on waterways with pools of 3m wide or greater for foraging, with habitat surrounding the waterways (usually within 200m) being used for breeding and roosting. The species will forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December (OEH 2017d).

The site is considered to contain suitable marginal foraging habitat for each of these microbats and may contain potential roosting habitat for hollow-dependent microbats in hollow bearing trees within the Mulgen Creek wetland area.

No hollow-bearing trees would be removed as a result of the proposal.

The regenerating native scrub vegetation of which approx. 1050m^2 would be removed along a 210m x 5m corridor is considered poor quality habitat, which is disconnected and unlikely to be relied upon by foraging microbats.

Works would occur during normal construction hours and therefore not affect the nocturnal foraging activities of these species.

It is therefore considered unlikely that Eastern Coastal Freetail-Bat, Greater Broad-nosed Bat and Southern Myotis would be impacted by the proposed works, and the proposed activity is unlikely to have an adverse effect on the lifecycle of these species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Freckled Duck (*Stictonetta naevosa*)

The Freckled Duck is a dark, greyish-brown bird with a large head that is peaked at the rear, and a distinctive narrow, slightly up-turned bill. Their dark brownish-black plumage is evenly freckled all over with white or buff. During the winter-spring breeding season, the male's bill becomes crimson at the base. The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. The duck is forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat. The species may also occur as far as coastal NSW and Victoria during such times. The species prefers permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. Freckled Ducks generally rest in dense cover during the day, usually in deep water. Feed at dawn and dusk and at night on algae, seeds and vegetative parts of aquatic grasses and sedges and small invertebrates. Nesting usually occurs between October and December but can take place at other times when conditions are favourable. Nests are usually located in dense vegetation at or near water level (OEH 2017b).

The site is considered to contain low-quality potential refuge and foraging habitat for Freckled Duck, within the Mulgen Creek wetland area and the ephemeral swamp area adjoined to the south.

The site does not occur in an area the Freckled Duck is known to utilise for breeding.

Potential habitat for Freckled Duck would not be impacted by the proposal. Underboring would be utilised to construct the Mains through swamp and wetland locations to minimise the risk of impacts to these habitats.

The species is highly mobile and unlikely to be impacted as a result of construction disturbance.

It is therefore considered unlikely that the Freckled Duck would be impacted by the proposed works, and the proposed activity is unlikely to have an adverse effect on the lifecycle of these species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Part B - In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions endangered ecological community

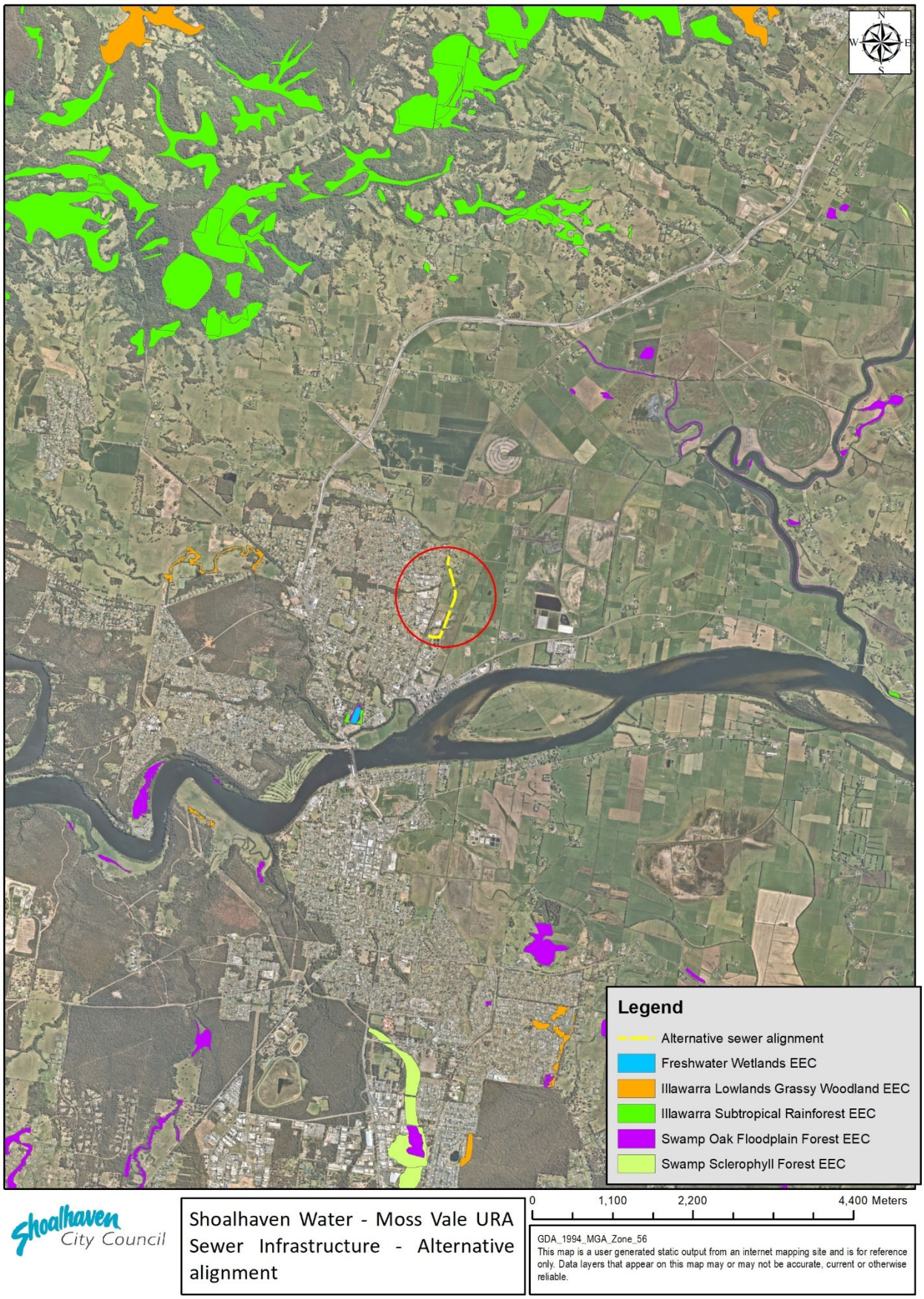
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (SFF) is the name given to the ecological community associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Swamp Sclerophyll Forest on Coastal Floodplains generally occurs below 20 m (though sometimes up to 50 m) elevation, often on small floodplains or where the larger floodplains adjoin lithic substrates or coastal sand plains in the NSW North Coast, Sydney Basin and South East Corner bioregions. This swamp community has an open to dense tree layer of eucalypts and paperbarks although some remnants now only have scattered trees as a result of partial clearing. The trees may exceed 25 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality where the tree stratum is low and dense. For example, stands dominated by *Melaleuca ericifolia* typically do not exceed 8 m in height. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent. The most widespread and abundant dominant trees include *Eucalyptus robusta* (Swamp Mahogany), *Melaleuca quinquenervia* (Paperbark) and, south from Sydney, *Eucalyptus botryoides* (Bangalay) and *Eucalyptus longifolia* (Woollybutt). Other trees may be scattered throughout at low abundance or may be locally common at few sites, including *Callistemon salignus* (Sweet Willow Bottlebrush), *Casuarina glauca* (Swamp She-oak) and *Eucalyptus resinifera* subsp. *hemilampra* (Red Mahogany), *Livistona australis* (Cabbage Palm) and *Lophostemon suaveolens* (Swamp Turpentine). A layer of small trees may be present, including *Acacia irrorata* (Green Wattle), *Acmena smithii* (Lilly Pilly), *Elaeocarpus reticulatus* (Blueberry Ash), *Glochidion ferdinandi* (Cheese Tree), *Melaleuca linariifolia* and *M. styphelioides* (Paperbarks). Shrubs include *Acacia longifolia, Dodonaea triquetra, Ficus coronata, Leptospermum polygalifolium* subsp. *polygalifolium* and *Melaleuca* spp. Occasional vines include *Parsonsia straminea, Morinda jasminoides* and *Stephania japonica* var. *discolor*. The groundcover is composed of abundant sedges, ferns, forbs, and grasses including *Gahnia clarkei, Pteridium esculentum, Hypolepis muelleri, Calochlaena dubia, Dianella caerulea, Viola hederacea, Lomandra longifolia, Entolasia marginata* and *Imperata cylindrica* (NSW Scientific Committee 2011).

The nearest mapped records of SFF occurs 5.4km to the south of the site, however indicative species of the EEC including Swamp Mahogany (*Eucalyptus robusta*), Flax-leaved Paperbark (*Melaleuca linearis*) and Swamp She-oak (*Casuarina glauca*) are present and the site can be characterised as being associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains.

The vegetation community within the site bearing resemblance to SFF is moderately to highly disturbed and modified, but for the sake of the current assessment, it is assumed to be representative of a degraded occurrence of the EEC.

SFF vegetation would not be impacted on by the proposal. Underboring would be utilised to construct the Mains through swamp and wetland locations to minimise the risk of impacts on these habitats. No trees would be removed as a result of the proposal.

Figure 4. Endangered ecological communities mapped in proximity to the site



Sediment erosion controls would be implemented to minimise the risk of sediment movement and deposition affecting waterways and wetland vegetation.

The proposal is therefore unlikely to adversely affect the extent or composition of SSF EEC such that a local occurrence of the EEC will be placed at risk of extinction.

Part C - In relation to the habitat of a threatened species or ecological community:

(iii) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity

(iv) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

(v) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

No important habitat for threatened species would be removed or otherwise significantly impacted (see Part A).

No EEC would not be fragmented or isolated, nor removed or modified to an extent that would affect the long-term survival of the EEC occurring in the locality (refer to Part B).

The proposal will therefore not affect the long-term survival of any threatened species or endangered ecological community in the locality.

Part D – Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

No "*areas of outstanding biodiversity values"* have been declared in the City of Shoalhaven.

Part E – Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Clearing of native vegetation is listed as a key threatening process, defined by the Scientific Committee's determination as

> *the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss, or long-term modification, of the structure, composition and ecological function of a stand or stands.*

Clearing of native vegetation has been shown to:

- cause widespread fragmentation of ecological communities;
- reduce the viability of ecological communities by disrupting ecological functions;
- result in the destruction of habitat and loss of biological diversity;
- lead to soil and bank erosion, increased salinity and loss of productive land.

The proposal would result in the clearing of approx. 1050m^2 regenerating native scrub through a 210m x 5m corridor of moderately to highly disturbed land, which contains no mature trees.

The clearing is required for the construction of sewage infrastructure required to support the development of the Moss Vale Urban Release Areas.

The alignment has been designed primarily through existing cleared and disturbed land to minimise impacts on native vegetation.

There would be no destruction of important habitat nor impact to any locally occurring threatened species (see Part A).

The proposed vegetation clearing would therefore not result in fragmentation of ecological communities or disrupt ecological function.

The impacts of the key threatening process of clearing of native vegetation would therefore be minimised and managed as part of the proposal.

3.3 Threatened species impact assessment (Commonwealth EPBC Act 1999)

A Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Report was generated on 22 November 2021. An EPBC Protected Matters Report provides general guidance on matters of national significance and other matters protected by the EPBC Act in the area selected. Of those threatened species and endangered ecological communities reported as likely occurring or having habitat within the area of the report, none were considered to have potential habitat on the site and requiring of further assessment.

3.4 Indigenous heritage

Under Section 86 of the NSW *National Parks and Wildlife Act 1974* (NPW Act) it is an offence to disturb, damage, or destroy any Aboriginal object without an Aboriginal Heritage Impact Permit (AHIP). The Act, however, provides that if a person who exercises 'due diligence' in determining that their actions will not harm Aboriginal objects has a defence against prosecution if they later unknowingly harm an object without an AHIP (Section 87(2) of the Act).

The site is not associated with landscape features that are regarded as indicating a higher potential for Aboriginal objects, as outlined in the NSW Department of Environment, Climate Change and Water's Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (2010):

- within 200m of waters (noting that the watercourse is ephemeral and without a clearly defined channel), or
- located within a sand dune system, or
- located on a ridge top, ridge line or headland, or
- located within 200m below or above a cliff face, or
- within 20m of or in a cave, rock shelter, or a cave mouth.

A search on the Aboriginal Heritage Information Management System (AHIMS) undertaken on 22 November 2021 indicated that there are no recorded Aboriginal Sites or Places within or in close proximity to the site, such that there is any risk of impact resulting from the proposed works (refer to Figure 5).

Site survey did not detect any potential artefacts of Aboriginal significance, although ground surface visibility was low due to vegetation coverage.

The area that would be affected by the proposal could be described as 'disturbed land' (as defined in the NSW Department of Environment, Climate Change and Water's Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales 2010) by virtue of the land being subject to past disturbance associated with clearing and farming practices.

As the proposed works would not affect any known Aboriginal artefact or site and there is a low likelihood of any artefact occurring within the area of excavation, it is concluded that reasonable steps have been taken to determine that it is unlikely that an Aboriginal object will be harmed by the proposal.

Further assessment will be required only in the event that a potential Aboriginal object is detected during works.

Figure 5. AHIMS Basic Search Results

AHIMS Web Services (AWS)
Search Result

Your Ref/PO Number : MVR Sewer Alt
Client Service ID : 640740

Shoalhaven City Council - Nowra
PO Box 42 Bridge Rd
Nowra New South Wales 2541
Attention: Jeff Bryant
Email: jeff.bryant@shoalhaven.nsw.gov.au

Date: 22 November 2021

Dear Sir or Madam:

AHIMS Web Service search for the following area at Datum :GDA, Zone : 56, Eastings : 281690.0 - 282181.0, Northings : 6140933.0 - 6142245.0 with a Buffer of 0 meters, conducted by Jeff Bryant on 22 November 2021.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.

A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

3.5 Non-indigenous heritage

No items of local heritage significance or any items on the State Heritage Register or listed in the Shoalhaven Local Environmental Plan occur in close proximity to the site such that the proposed works might impact them.

3.6 Riparian corridors

A Category 2 riparian corridor is associated with Mulgen Creek, which crosses through the site (refer to Figure 6 below).

No trees or other native vegetation occurring within the Mulgen Creek riparian corridor would be removed or otherwise impacted on.

Underboring would be utilised to construct the Mains through swamp and wetland locations (i.e. within the riparian corridor) to minimise the risk of impacts on these habitats.

Sediment erosion controls would be implemented to minimise the risk of sediment movement and deposition affecting waterways and wetland vegetation.

The proposal is therefore unlikely to adversely affect the riparian corridor, its function or connectivity.

3.7 Key Fish Habitat

The site is not mapped as Key Fish Habitat for the purposes of the *Fisheries Management Act 1994* (refer to Figure 6 below). A Fisheries Permit is therefore not required for dredging works within the unnamed watercourse.

3.8 Flood liable land

Most of the site is mapped as being flood liable. The construction of subsurface Mains through this land however, is considered unlikely to affect flood patterns other than to a minor extent.

Consultation under Part 2, Division 1 of the Infrastructure SEPP is not required and is unwarranted.

3.9 Potentially contaminated land

Potentially contaminated land records PCL269 and PCL456 exist over Lot 16 DP 259169 associated with the historic disposal of asbestos cement pipe on the land and the creation of an encapsulation site as a disposal and site remediation action (refer to Council reference D17/44531).

Investigation by a licensed asbestos assessor (ENRS) determined that non-friable asbestos contaminated soil/fill at the site exceeded 2,000 tonnes, and recommendation was made to encapsulate the waste on-site.

The encapsulation site is located on the adjacent Part Lot 1 DP 572583, over 200m south of the currently proposed alignment, and would not be disturbed by the current proposal.

Safeguards and mitigation measures shall include an asbestos unexpected finds protocol to manage any residual asbestos, which shall include remediation by a suitably licenced hygiene specialist.

Figure 6. Mapped riparian corridors and Key Fish Habitat in proximity to the site

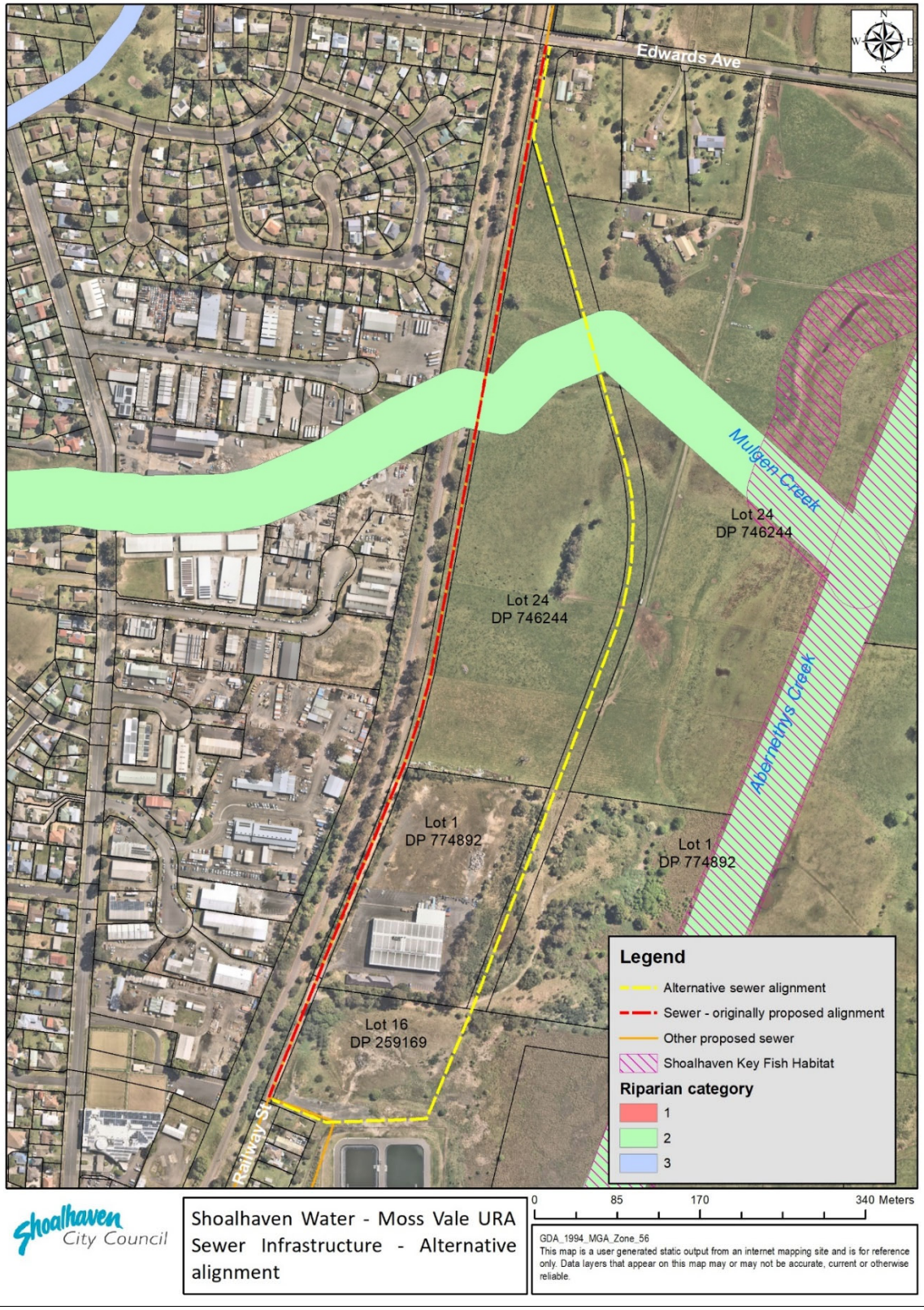


Figure 7. Location of Asbestos Encapsulation Site (from EMAP Consulting 2017)

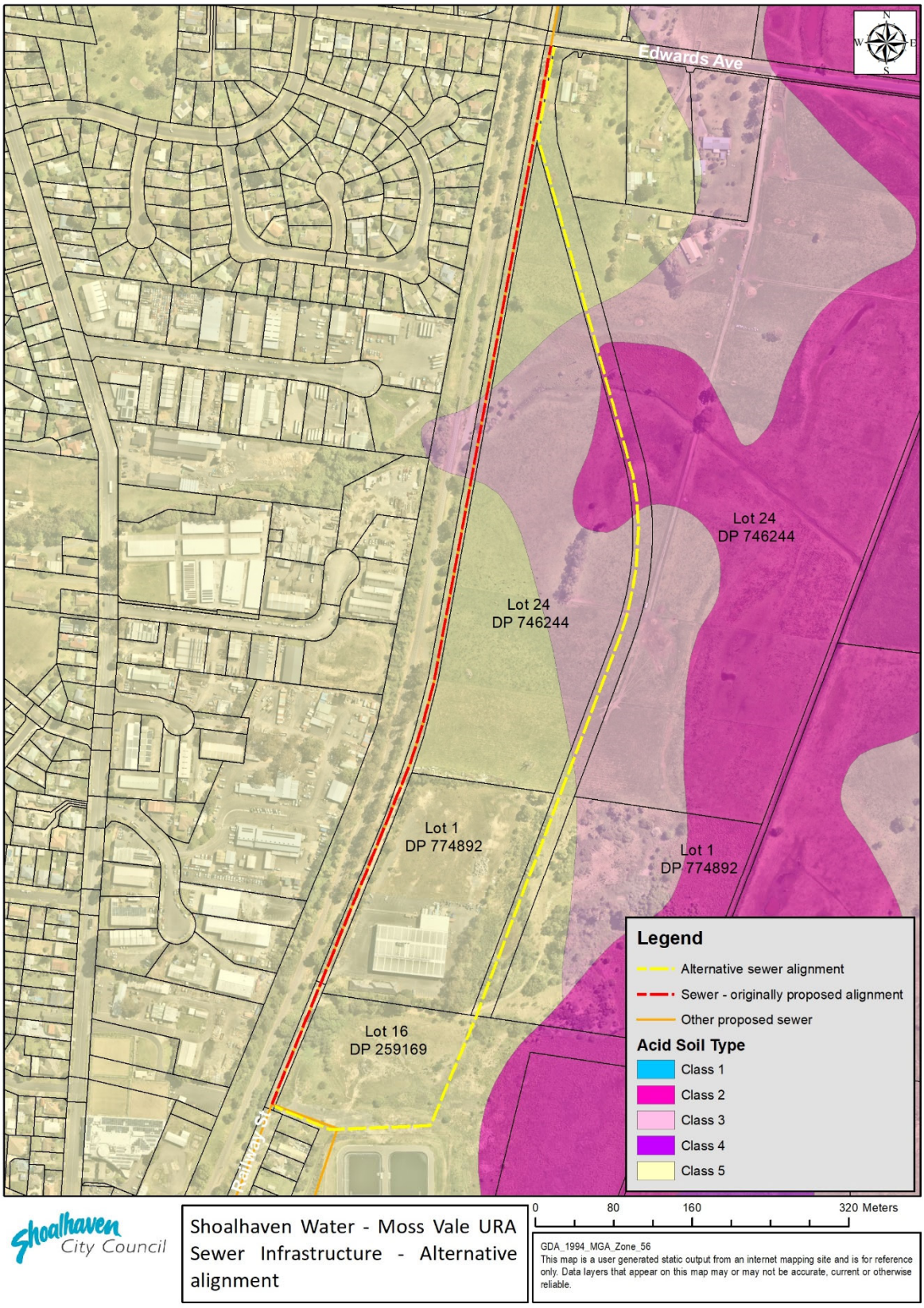
3.10 Acid Sulfate Soils

The site is mapped as containing Class 2, Class 3 and Class 5 Acid Sulfate Soils (A.S.S) (refer to Figure 7 below).

The *Shoalhaven Local Environment Plan 2014* indicates that a risk of A.S.S exposure exists for Class 2 A.S.S exists where any works would occur below the natural ground surface or would involve any lowering of the watertable. A risk A.S.S exposure exists for Class 3 A.S.S where works would occur more than 1m below the natural ground surface, or where works would involve lowering of the watertable more than 1m below the ground surface.

Sampling and analysis of soil to at least the depth of required excavation shall be undertaken from a minimum of 120m north of Mulgen Creek (along the alignment) and through to the boundary of Lot 1 DP 774892, to determine the need for an Acid Sulfate Soil Management Plan and inform the treatment of excavated soil if required.

Figure 7. Acid Sulfate Soils mapped in proximity to the site



3.11 EP&A Regulation – Clause 228 matters of consideration

Clause 228(2) of the *Environmental Planning and Assessment Regulation 2000* lists the factors to be taken into account when consideration is being given to the likely impact of an activity on the environment under Part 5 of the EP&A Act. The following assessment in Table 2 deals with each of the factors in relation to the proposed activity.

Table 2. Clause 228 Matters of consideration

Does the proposal:	Assessment	Reason
a) Have any environmental impact on a community?	Negligible	The proposed alternative alignment would involve minor impacts to previously cleared and disturbed land, part of which is an unformed road reserve which is currently utilised for agricultural purposes. A relatively small area of regenerating native scrub would be removed. The assessed impacts would not have any effect on the community. The works would occur in conjunction with previously planned works. The proposed activity would not have any impact on other community services and infrastructure such as power, water, waste management, educational, medical or social services.
b) Cause any transformation of a locality?	Negligible	The locality's current use would remain unchanged. The Mains would be subsurface. Valves would be unobtrusive. Vegetation removal would be minimal and primarily in previously cleared and modified areas which are now in stages of relatively early regeneration.
c) Have any environmental impact on the ecosystem of the locality?	Low adverse	The five-part test of significance (Section 3.2) concludes that the proposed activity would not have a significant impact upon endangered ecological communities. No hollow-bearing trees, threatened flora species, rocky outcrops, caves or water bodies would be removed or otherwise impacted. Underboring beneath Mulgen Creek would minimise impacts to this watercourse. No food resources critical to the survival of a particular species would be removed. Aquatic ecosystems are not likely to be affected by the proposed activity and there is not likely to be any long-term

		or long-lasting impact through the input of sediment and nutrient into the ecosystem. Environmental safeguards and mitigation measures (Section 7) would be employed to minimise risk of impacts.
d) Cause a diminution of the aesthetic, recreational, scientific or other environmental quality or value of a locality?	Low adverse	Impact to the aesthetic, recreational, scientific and environmental values of the site would be temporary and not significant.
e) Have any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific, or social significance or other special value for present or future generations?	Negligible	The site of the proposed activity has no significant architectural, scientific or archaeological values. No impact to historical, anthropological or cultural values would result from the proposed works. No items in the vicinity of the work site which are listed on the State Heritage Register and the Shoalhaven Local Environmental Plan would be impacted by the proposal. The site is not within an Aboriginal Place declared under the *National Parks and Wildlife Act 1974.* In accordance with the NSW Department of Environment, Climate Change and Water's Due Diligence Code of Practice, the proposed activity does not require an Aboriginal Heritage Impact Permit as harm to an Aboriginal object is unlikely.
f) Have any impact on the habitat of protected fauna (within the meaning of the Biodiversity Conservation Act 2016)?	Low adverse	The five-part test of significance (Section 3.2) concludes that the proposed activity would not have a significant impact upon threatened fauna. No important habitat would be removed or otherwise impacted as part of the proposal. The environmental safeguards (Section 7) would minimise impacts and risks to the quality of the environment.
g) Cause any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?	Low adverse	The five-part test of significance, provided in Section 3.2 above, concludes that the proposed activity would not have a significant impact upon threatened flora or fauna. It is considered that no threatened species would rely on habitat within the site. The environmental safeguards (Section 7) would minimise impacts and risks to the quality of the environment.

h) Have any long-term effects on the environment?	Low adverse	The proposed activity would not use hazardous substances or use or generate chemicals which may build up residues in the environment. Minimal maintenance corridors (approx. 5m wide) would be retained long-term, but these are primarily in areas where vegetation growth is prevented and/or managed (e.g. farmland and industrial land), and would not affect the potential for future significant habitat.
i) Cause any degradation of the quality of the environment?	Low-adverse	No significant habitat would be removed or otherwise impacted. Works would be undertaken through previously cleared and modified land. The proposal would not intentionally introduce noxious weeds, vermin, or feral animals into the area or contaminate the soil. Environmental safeguards and mitigation measures (Section 7) would be employed to minimise risk of impacts.
j) Cause any risk to the safety of the environment?	Low-adverse	The proposed activity would not involve hazardous wastes and would not lead to increased bushfire or landslip risks. Acid sulfate soils would be managed and treated as required in accordance with an A.S.S Management Plan.
k) Cause any reduction in the range of beneficial uses of the environment?	Low-adverse	The site and local environment will remain unchanged.
l) Cause any pollution of the environment?	Low-adverse	The proposal would involve a temporary and local generation of noise. However, this is not anticipated to negatively affect any sensitive receivers such as schools, childcare centres and hospitals. It is unlikely that the activity (including the environmental impact mitigation measures) would result in water pollution, spillages, dust, odours, vibration or radiation. The proposal does not involve the use, storage or transportation of hazardous substances or the use or generation of chemicals which may build up residues in the environment.

m) Have any environmental problems associated with the disposal of waste?	Low-adverse	There would be no trackable waste, hazardous waste, liquid waste, or restricted solid waste as described in the NSW *Protection of the Environment Operations Act 1997*. Acid sulfate soils would be managed and treated as required in accordance with an A.S.S Management Plan. A.S.S would be disposed of at a licenced facility or reinstated on-site following treatment.
n) Cause any increased demands on resources (natural or otherwise) which are, or are likely to become, in short supply?	Low-adverse	The amount of resources that would be used are not considered significant and would not increase demands on current resources such that they would become in short supply.
o) Have any cumulative environmental effect with other existing or likely future activities?	Low adverse	The assessed low adverse or negligible impacts of the proposal are not likely to interact. Mitigation measures (Section 7) shall be implemented to minimise the risk of cumulative environmental effects. The current proposal would not significantly affect habitat connectivity or reduce any significant vegetation.
p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions	Negligible	The proposed activity would have no effect on coastal processes including those projected under climate change conditions. The site of the proposal is not located in a coastal area.

4. PERMISSIBILITY

4.1 Environmental Planning & Assessment Act 1979

Section 4.1 (Development that does not need consent) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) states that:

> *"If an environmental planning instrument provides that specified development may be carried out without the need for development consent, a person may carry the development out, in accordance with the instrument, on land to which the provision applies."*

In this regard, clause 106(3B) of the NSW *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP) provides that:

> *Development for the purpose of sewage reticulation systems may be carried out without consent on any land in the prescribed circumstances.*

Where:

*(1) Development is carried out in the **prescribed circumstances** if the development—*

(a) is carried out by or on behalf of a public authority,

As the proposal does not require development consent, and as it constitutes an 'activity' for the purposes of Part 5 of the EP&A Act, being carried out by (or on behalf of) a public authority, environmental assessment under Part 5 of the EP&A Act is required. This REF provides this assessment.

4.2 Other

A summary of other relevant legislation and permissibility is provided in Table 3 below.

Refer also to 2020 REF (Section 4, Table 6).

Table 3. Summary of other relevant legislation and permissibility

NSW STATE LEGISLATION
***Environmental Planning and Assessment Act 1979* (EP&A Act)**
Permissible √ Not permissible ☐
Justification: The Infrastructure SEPP provides for the proposed works to be undertaken without development consent (refer above). In circumstances where development consent is not required, the environmental assessment provisions outlined in Part 5 of the Act are required to be complied with. This REF fulfils this requirement.
Shoalhaven Local Environmental Plan 2014 (SLEP)
Permissible √ Not permissible ☐

Justification:

Under the SLEP the proposed activity may have required development consent. The provisions of SEPP Infrastructure, however, prevail over the SLEP where there is an inconsistency by virtue of Section 3.28 of the EP&A Act. Consequently, development consent is not required.

Protection of the Environment Operations Act 1997

Permissible √ Not permissible ☐

Justification:

The proposed activity does not constitute scheduled development work or scheduled activities as listed in Schedule 1 of the Act. The proposed activity therefore does not require an environmental protection licence.

Roads Act 1993

Permissible √ Not permissible ☐

Justification:

Under Section 71, a "*Roads authority may carry out road work on any public road for which it is the roads authority and on any land under its control".* Shoalhaven City Council would be the roads authority for the FNCR and the subject land is under its control.

***National Parks and Wildlife Act 1974* (NP&W Act)**

Permissible √ Not permissible ☐

Justification:

- The proposed activity would not encroach into National Park estate.
- The Act provides the basis for the legal protection and management of Aboriginal sites in NSW. Under Sections 86 and 90 of the Act it is an offence to disturb an Aboriginal object or knowlingly destroy or damage, or cause the destruction or damage to, an Aboriginal object or place, except in accordance with a permit of consent under section 87 and 90 of the Act.

Fisheries Management Act 1994

Permissible √ Not permissible ☐

Justification:

The proposed activity:

- would not affect declared aquatic reserves (Part 7, Division 2 of the Act);
- would not involve dredging or reclamation in Key Fish Habitat (Part 7, Division 3); Refer to Section 4.3 above for more information.
- would not involve blocking the passage of fish (s.219);
- would not impact mangroves and marine vegetation (Part 7, Division 4);
- would not involve disturbance to gravel beds where salmon or trout spawn (s.208 of the Act);
- does not involve the release of live fish (Part 7, Division 7);
- does not involve the construction of dams and weirs (s.218);
- would not result in the blocking of the passage of fish;

- would not impact declared threatened species of endangered ecological communities (Part 7A);
- does not constitute a declared key threatening process (Part 7A); and
- would not use explosives in a watercourse (Clauses 70 and 71 of the *Fisheries Management (General) Regulation 2019).*

Heritage Act 1977

Permissible √ Not permissible ☐

Justification:

- The proposed activity would not disturb an item of state heritage significance.
- The Act also provides statutory protection to relics, archaeological deposits, artefacts or deposits. Section 139 to 146 of the Act require that excavation that is likely to contain, or is believed may contain, archaeological relics is undertaken in accordance with an excavation permit issued by the Heritage Council. The Act defines an archaeological relic as "*any deposit, artefact, object or material evidence that:*

  a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement; or
  b) *is of state and local heritage significance"*

  As the site has little to no archaeological potential, a permit is not required.

Biodiversity Conservation Act 2016

Permissible √ Not permissible ☐

Justification:

- The proposed activity is unlikely to have a significant impact on species and communities listed in the schedules of the Act (refer to Section 3.2).
- The proposed development is not within an area declared to be of "outstanding biodiversity value" as defined in the Act.
- The design and mitigation measures (Section 7) would ensure that no *serious and irreversible impacts on biodiverstiy values* (as defined by the BC Act) occur at the site of the proposed activity.

The proposed activity therefore is not deemed to be *likely to significantly affect threatened species* and an environmental impact statement (EIS) or a Biodiversity Development Assessment Report (BDAR) is not required.

It is also a defence to a prosecution for an offence under Part 2 of the Act (harming animals, picking plants, damaging the habitat of threatened species or ecological communities *etc*) if the work was essential for the carrying out of an activity by a determining authority within the meaning of Part 5 of the Environmental Planning and Assessment Act 1979 after compliance with that Part. The activity will not remove vegetation that is listed under Schedule 1 Threatened Species, Schedule 2 Threatened ecological communities and Schedule 6 Protected Plants. Therefore the activity is considered permissible as this REF has been prepared and determined in accordance with the EP&A Act.

Water Management Act 2000

Permissible √ Not permissible ☐
Justification: • Local councils are exempt from s.91E(1) of the Act in relation to all controlled activites that they carry out in, on or under waterfront land by virtue of clause 41 of the *Water Management (General) Regulation 2018.* • The proposal would not interfere with the aquifer and therefore an interference licence is not required (s.91F).
COMMONWEALTH LEGISLATION
Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EP&BC Act)
Permissible √ Not permissible ☐
Justification: The proposed activity would not be undertaken on Commonwealth land and no matters of National Environmental Significance are likely to be significantly impacted by the proposed activity (Section 3.3). The proposed activity is therefore not a controlled action and does not require commonwealth referral.
Commonwealth *Native Title Act 1993*
Permissible √ Not permissible ☐
Justification: As the works would be undertaken on Freehold Title land (Lot 16 DP 259169) and within an unnamed Council road reserve, it is anticipated that Native Title has been extinguished as a Previous Exclusive Possession Act – Freehold Title (Section 23B). SCC is unlikely to be liable for compensation.

5. CONSULTATION WITH GOVERNMENT AGENCIES

5.1 Infrastructure SEPP

Refer to 2020 REF (Section 5.1).

No additional consultation under the Infrastructure SEPP is required or warranted in relation to the subject of this Addendum REF.

6. COMMUNITY ENGAGEMENT

Refer to 2020 REF (Section 5.2).

Consultation and notification was targeted to identified key stakeholders to minimise disruption and potential impacts to current land uses. Targeted key stakeholders notified and consulted have been summarised in Table 4.

Table 4 Targeted Key Stakeholders

Lot / DP	Description	Owner / Land Manager
Lot 1 DP 231142	39 Hanigans Lane, BOLONG	Private land
Lot 242 DP 1130535	19 Hanigans Lane, BOMADERRY	Private land
Lot 141 DP 1069758	Bolong Rd, BOMADERRY	Manildra Energy Australia Pty Ltd
Lot 1 DP 774892	100 Railway St, BOMADERRY	Cottee Jersey Group Pty Ltd
Lot 2 DP 231142	41 Hanigans Lane, BOLONG	Private land
Lot B DP 384736	Hanigans Lane, BOLONG	Private land
Lot 23 DP 746244	72B Edwards Av, BOMADERRY	Private land
Lot 22 DP 746244	72A Edwards Av, BOMADERRY	Private land
Lot 21 DP 746244	62 Edwards Av, BOMADERRY	Private land

This Addendum REF was issued to the above noted Targeted Key Stakeholders, with submissions invited between 30 November 2021 to 22 December 2021. Two (2) responses were received during the consultation period. Table 5 below provides an overview of concerns raised and responses provided.

Table 5 Summary of concerns with provided responses from consultation exhibition

Issue / concern	Response
Request for extension to consultation submission period.	Extension provided to respondent to COB 15 January 2022.
Concern of long term disruptions to the agricultural activities carried out on Lot 24 DP746244, specifically implication to rotation of livestock across Council's Road Casement (acknowledging that Council's Road Casement runs through Lot 24 DP746244.	Council clarified that the works could proceed without the need to limit livestock rotations across Council's road casement, with a Notice of Proposed Works provided nominating the requirement for Council to maintain safe passage for the livestock across the road casement for the duration of the works. Council also offered an onsite meeting with the concerned landowner, Council and Council's Contractor to further clarify and discuss the proposed works, intended construction methodology and any temporary fencing and access requirements. To further minimise potential impacts to agricultural activities, Council has also amended the depth of the proposed pipeline through Lot 24 DP746244 to maintain a minimum depth of cover of 1200mm, to avoid any potential ploughing activity impacts across the proposed service.

Issue / concern	Response
Questioned if the proposed pipeline(s) run within the existing road casement adjacent the railway line?	Council highlighted that the proposed wastewater pipeline was initially intended to run within the existing Council 10m road casement adjacent the railway line, however due to the presence of existing services (incl. high pressure gas, 2x Council sewer mains, 1x Council water main and 1x Private sewer main) and proposed new high pressure gas main associated with Manildra Energy Australia Pty Ltd Major Project, there was insufficient provision within this road casement to accommodate the new wastewater pipeline proposed.

It has been determined that no additional community engagement is required or warranted in relation to the subject of this Addendum REF.

7. ENVIRONMENTAL SAFEGUARDS AND MEASURES TO MINIMISE IMPACTS

Note that the following prescribed safeguards and mitigation measures must be read and applied in conjunction with those from the 2020 REF (Section 6) (refer to Appendix A).

Safeguard / Measure	Responsibility
Planning and notification	
1. Detailed design of the Sewer (or Water) Main construction shall include underboring of Mulgen Creek and associated wetland / swamp sclerophyll areas (refer to Figure 3) to minimise impacts on these areas.	SCC Project Manager
2. Sampling and analysis of soil to at least the depth of required excavation shall be undertaken from a minimum of 120m north of Mulgen Creek (along the alignment) and through to the boundary of Lot 1 DP 774892, to determine the need for an Acid Sulfate Soil Management Plan and inform the treatment of excavated soil if required.	SCC Project Manager
3. Consultation and notification will be carried out with the respective landowners of Lot 24 DP 746244 and Lot 1 DP 774892, to minimise disruption and potential impacts to current land uses.	SCC Project Manager
Construction works	
4. Erosion and sediment controls in accordance with the 'Blue Book' (Landcom 2004) shall be installed and maintained to prevent the entry of sediment into waterways i.e. water diversion, minimising disturbance, erosion control and rapid re-establishment. In particular, sediment controls shall be installed adjacent to Erosion and sediment controls shall be maintained in good working order for the duration of the works and subsequently until the site has been stabilised and the risk of erosion is minimal.	Construction Site Manager; Contractor
5. All machinery to be used shall be cleaned, degreased and in good working order prior to entering the site.	Construction Site Manager; Contractor

Safeguard / Measure	Responsibility
6. The contractor shall keep an emergency spill kit on-site at all times with procedures to contain and collect any leakage or spillage of fuels, oils and greases from plant and equipment.	Construction Contractor
7. No major equipment maintenance works shall be undertaken on-site.	Construction Contractor
8. To avoid the risk of pollution from machinery, refuelling shall generally be done off site, however if refuelling on site is required, due care shall be taken to avoid spilling fuel and a tray shall be used to catch any accidentally spilt fuel.	Construction Contractor
9. Machinery and works shall not encroach into the water.	Construction Site Manager
10. Stockpiled material and machinery shall not encroach into the drip line (canopy) of trees that are to be retained.	Construction Site Manager; Construction Contractor
11. Pruning of trees where required is to be undertaken in accordance with AS 4373-1996 "Pruning of Amenity Trees".	Construction Contractor;
12. Staff and contractors working on Lot 16 DP 259169 shall be advised of the potential for residual asbestos fragments in the soil.	SCC Project Manager; Construction Site Manager
13. In the event that any residual asbestos is located within works areas, the following unexpected finds protocol shall be implemented: a) Immediately cease work and notify construction site manager and SCC project manager b) Cordon area with high-visibility para-webbing or similar c) Engage a suitably licenced occupational hygiene specialist to assess the site and determine if remediation is required d) (If required) Engage a suitably licenced contractor to undertake remediation under the supervision of the occupational hygiene specialist e) Remove para-webbing and recommence works only after issue of a clearance report from the occupational hygiene specialist, confirming that it is safe to carry out works in the area.	Construction Site Manager; Construction Contractor

Safeguard / Measure	Responsibility
14. In the event that any wildlife be significantly disturbed or injured during works, Council's Environmental Officers are to be contacted on 4429 3405, or if unavailable, Wildlife Rescue – South Coast should be contacted on 0418 427 214, to rescue and relocate the animal(s).	Construction Site Manager; Contractor;
15. Staff working at the site will be instructed to stop work immediately on identification of any suspected Aboriginal heritage artefact. If any objects are found, NSW Department of Planning, Industry and Environment (ph:131 555) shall be contacted.	Construction Site Manager; Contractor;
Post construction	
16. An asset form shall be trimmed to file 44574E on commissioning of each facility within the proposed activity in accordance with POL15/8 Asset Accounting Policy section 3.1.4 and POL16/79 Asset Management Policy section 3.3. Asset forms are available are webpage http://sccintranet/AssetsWorks/TechnicalServices/AssetStrategy/AssetForms.aspx	SCC Project Manager

8. SIGNIFICANCE EVALUATION & CONCLUSION

This Addendum Review of Environmental Factors has assessed the likely environmental impacts, in the context of Part 5 of the Environmental Planning and Assessment Act 1979, of a proposed alternative alignment of Sewer and/or Water Main between the Bomaderry Sewage Treatment Plant (STP) and Edwards Ave, in the vicinity of Railway St.

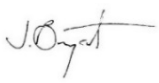
In consideration of the proposal as described in Section 1, in accordance with any design plans referred to in this report, and assuming the implementation of all proposed safeguards and mitigation measures (Section 7), it is determined that:

1. It is unlikely that there will be any significant environmental impact as a result of the proposed work and an Environmental Impact Statement is not required for the proposed works.
2. The proposed activity is not likely to significantly affect threatened species, populations or ecological communities, or their habitats and a Species Impact Statement / BDAR is not required.
3. No additional statutory approvals, licences, permits and external government consultations are required.

In accepting and adopting this REF, Shoalhaven City Council commits to ensuring the implementation of the proposed safeguards and mitigation measures identified in this report (Section 7) to minimise and/or prevent detrimental environmental impacts.

Robert Horner
Executive Manager
Shoalhaven Water
Shoalhaven City Council Date: 2 February 2022

Document Review:

	Name	Signature	Date
Author:	Jeff Bryant		23/11/2021
Reviewed by:	Geoff Young		25/11/2021

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APPENDIX A – Parent REF (2020)

Review of Environmental Factors (REF) Shoalwater Infrastructure – Moss Vale Rd URAs Part 2: Sewer Infrastructure

(Council reference D20/456925)

REVIEW OF ENVIRONMENTAL FACTORS (REF)

SHOALWATER INFRASTRUCTURE – MOSS VALE RD URAs

PART 2: SEWER INFRASTRUCTURE

Contents

1. PROPOSAL AND LOCATION

1.1 Proposed activity

Shoalhaven Water is currently planning and undertaking the development of water and sewerage infrastructure to service and facilitate development of the Moss Vale Rd Urban Release Areas (URAs).

Review of Environmental Factors (REF) Shoalwater Infrastructure – Moss Vale Rd URAs Part 1: Moss Vale Rd Water Lead-in (Council reference D20/402515) provided environmental assessment for the construction of a water main from Cambewarra, running approximately 1.575km eastward along Main Rd and the south-east along Moss Vale Rd, as a water lead-in, to service the Moss Vale Rd Urban Release Areas (URAs).

The subject of the current report is the proposed construction of sewage infrastructure to service the Moss Vale Rd Urban Release Areas (URAs). Sewer Rising Mains, Gravity Mains and two Sewer Pumping Stations (SPSs) would be constructed to deliver sewage from the Moss Vale URAs to the Bomaderry Sewage Treatment Plant (STP). Additionally, a new SPS (named New SPS21) would be constructed in North Nowra, adjacent to the future Far North Collector Rd, and the existing SPS21 (located on Illaroo Rd) would be decommissioned.

The key components of the proposal include (adapted from Cardno 2020):

- 2022 - Construction of the MVRS SPS (located in Lot 262 DP 794245 on Far North Collector Rd approx. 480m west of Moss Vale Rd), with the following features:
    - Access from the Far North Collector/Taylors Lane Roundabout
    - Site approx. 60x40m with level to be built up to exceed flood occurrence requirements
    - An all-weather access track
    - 1.8m high fence around the site
    - Concrete wet well, concrete valve pit and concrete flow meter chamber
    - Underground concrete emergency storage tank, with an overflow discharge to vegetated swale (directed to Bomaderry Creek)
    - 2 x 10kL Chemical dosing tanks to be provided within a concrete bunded area
    - Electrical cabinet, 300mm above the flood level with Electrical supply from Moss Vale Road
    - Emergency generator
    - Potable Water Supply from Moss Vale Road
- 2022 - Installation of 1.3 km of rising main from MVRS to MVRN SPS site. Potential to inject into the terminal rising main, allowing MVRN SPS to be staged, but should be further reviewed in Concept Design, when development timings are better understood. Gravity Main also running north and then north-west from MVRS SPS to provide connection to MVR South URA.
- 2022 - Installation of 2.7 km of DN525 rising main to SPS08. Dual DN375 mains could potentially be installed to provide better interim performance and minimise retention times.

- 2022 – installation of 1.6 km of DN675 main from SPS08 to the Bomaderry WWTP
- 2022 – Divert North Nowra flows via a DN300 gravity line that utilises the Far North Collector Bridge across Bomaderry creek.
- 2022/2023 – Construction of the New MVRN SPS (located in Lot 2 DP1134376, along Abernethys Lane, approximately 350m west of the Bells Lane and Abernethys Lane intersection), with the following features:
    - Site approx. 60x40m
    - An all-weather access track from the intersection of Bells Lane and Abernethys Lane to the SPS site along the road reserve. Culvert bridging of watercourse required.
    - 1.8m high fence around the site
    - Concrete wet well, concrete valve pit and concrete flow meter chamber
    - Underground concrete emergency storage tank, with an overflow discharge to a vegetated swale (directed to Abernethys Creek)
    - 2 x 10kL Chemical dosing tanks to be provided within a concrete bunded area
    - Electrical cabinet, 300mm above the flood level with Electrical supply from Bells Lane
    - Emergency generator
    - Potable Water Supply from Bells Lane
- 2022/2023 – Connection of Cambewarra rising main (SPS23) into the MVRN gravity system
- Construction of New SPS21 (located in Lot 1 DP848630 adjacent to the future Far North Collector Rd near the intersection with Illaroo Rd) with the following features:
    - All weather access track into the site from Illaroo Road
    - Concrete slab adjacent to the wet well
    - 1.8m high fence around the site
    - Concrete wet well, concrete valve pit and concrete flow meter chamber
    - Underground concrete emergency storage tank, with an overflow discharge to a vegetated swale (directed to Bomaderry Creek)
    - Electrical cabinet, with Electrical supply from Illaroo Road
    - Emergency generator
    - Potable Water Supply from Illaroo Road
- Construction of rising main / gravity main connecting SPS21 to MVRS SPS and provision of connection to MVR South URA.
- Three offset air valves would be constructed between MVRN SPS and Bomaderry WTP, for regular (daily) venting of odorous air.
- 5m wide easements shall be established where required. A 20m construction corridor would generally be provided
- Excavation for the installation of pipes would generally be in the form of trenching. Underboring (micro tunnel or horizontal directional drilling (HDD)) would be applied where

the crossing of creeks, roads and the railway line is required, and would comply with relevant authority approvals

- Clearing of vegetation would be minimal – the proposal has been designed to align with existing and future road easements and existing cleared corridors to every practical extent to minimise the potential for impact to native vegetation and habitat;

Further details of the proposal including layout plans with longitudinal sections are provided in Cardno 2020 (see Appendix A, D20/450654), with offset air valve indicative design and location details provided in Appendix E.

Shoalhaven City Council (SCC) is the proponent and the determining authority under Part 5 of the EP&A Act. The environmental assessment of the proposed activity and associated environmental impacts has been undertaken in the context of Clause 228 of the *Environmental Planning and Assessment Regulation 2000*. In doing so, this Review of Environmental Factors (REF) helps to fulfil the requirements of Section 5.5 of the Act that SCC examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

1.2 Location

The proposed activity would be undertaken within Council owned land, road reserves and easements to be established over privately owned lots, from the future Far North Collector Rd, northward along Bells Lane, westward along part of Abernethys Lane and through Council, RMS and private land to the railway line, before running south adjacent to Railway St to the Bomaderry STP. The New SPS21 would be constructed adjacent to the future Far North Collector Rd near the Illaroo Rd intersection, with gravity mains running along Illaroo Rd to the connection point of the old SPS21 and rising mains from the New SPS21 running north to connect with existing gravity mains (refer to Figures 1, 2, 3 and 4). Details of affected property is presented in Table 1.

Table 1. Affected property

Lot / DP	Owner / Land Manager	Comments
Lot 262 DP 794245	SCC	Freehold Council operational land
Lot 122 DP 3060	Private	Creation of a services easement required
Lot 2 DP 1134376	Private	Land acquisition required for SPS; Creation of a services easement required
Lot 1 DP 1134376	Private	Creation of a services easement required
Lot 601 DP 1223625	Private	Creation of a services easement required
Lot 602 DP 1223625	RMS	Designated road - Creation of a services easement not required

Lot 435 DP 1210528	RMS	Designated road - Creation of a services easement not required
Lot 415 DP 1210528	SCC	Freehold Council community land
Lot 502 DP 1221372	Private	Creation of a services easement required
Lot 73 DP 1047274	SCC	Freehold Council community land
Lot 202 DP 1180659	Private	Existing services easements occur; Creation / modification of a services easement likely required
Lot 1 DP 1164576	SCC	Freehold Council operational land
Lot 13 DP 708513	SCC	Freehold Council operational land
Lot 16 DP 259169	SCC	Freehold Council operational land
Lot 1 DP 572583	SCC	Freehold Council operational land
Lot 1 DP 848630	SCC	Freehold Council operational land
Lot 2 DP 848630	Private	Land acquisition in progress associated with Far North Collector Rd. Sewer infrastructure would be entirely within Council acquired land.
Lot 8 DP 1256748	Private	Land acquisition in progress associated with Far North Collector Rd. Sewer infrastructure would be partially within Council acquired land; Creation of a services easement required
Moss Vale Rd	SCC	Road reserve – rising main would cross beneath Moss Vale Rd via micro tunnel
Bells Lane	SCC	Road reserve
Abernethys Lane	SCC	Road reserve
Princes Hwy	RMS	Road reserve – rising main would cross beneath Princes Hwy via HDD or micro tunnel; Authorisation required
Meroo Rd	SCC	Road reserve
(unnamed road reserve adjacent to railway reserve)	SCC	Road reserve
Railway St	SCC	Road reserve
Illaroo Rd	SCC	Road reserve
DP Ms1611Sy	Railcorp	Railway reserve – rising main would cross beneath railway reserve via HDD under bore; Authorisation required

Figure 1. Site location

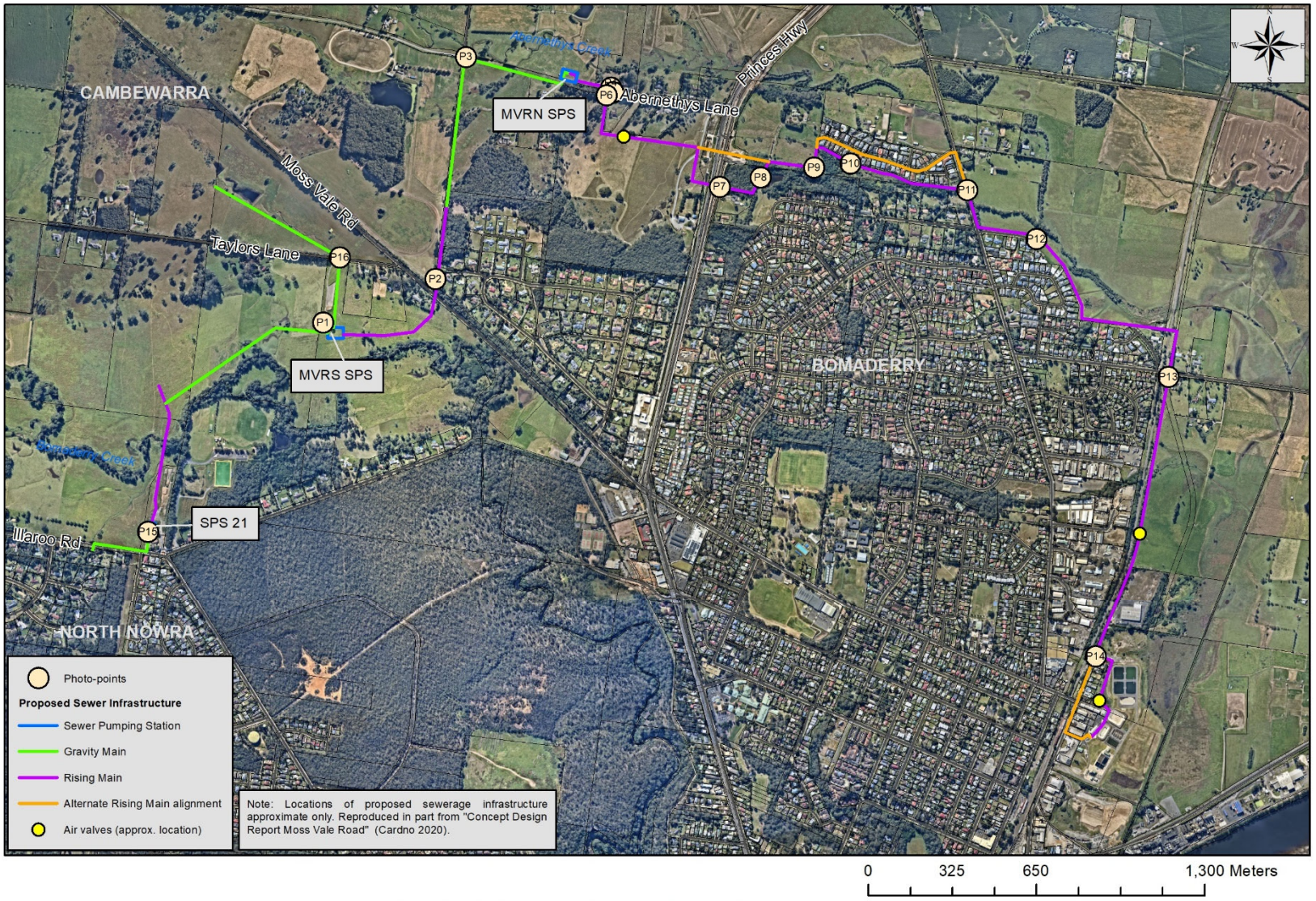


Figure 2. Proposed works showing photo-point locations (north-west portion)

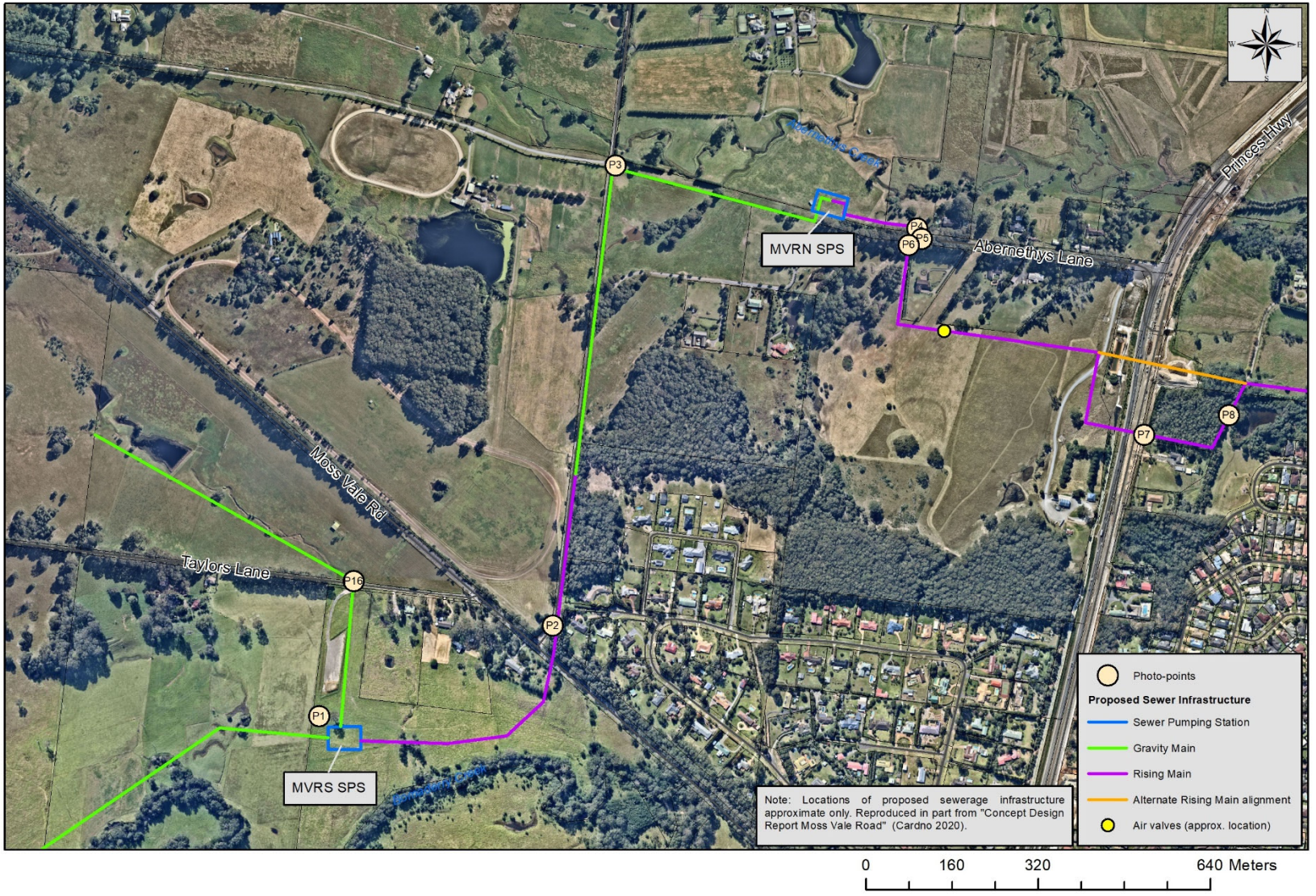


Figure 3. Proposed works showing photo-point locations (east portion)

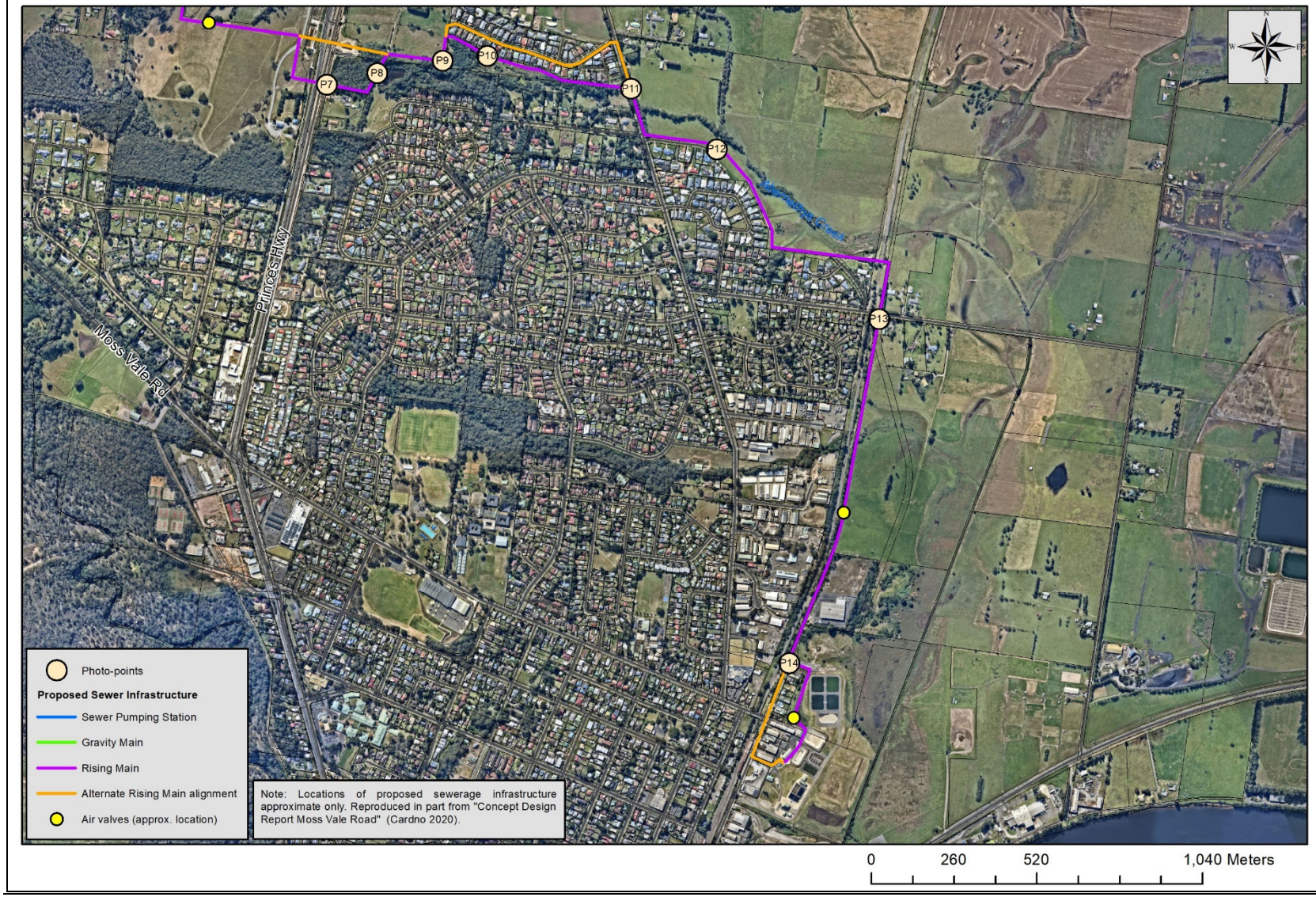


Figure 4. Proposed works showing photo-point locations (south-west portion – SPS21)

2. EXISTING ENVIRONMENT

2.1 Habitat and vegetation assessment

Site surveys were undertaken by a Council Environmental Officer for the purpose of an environmental constraints assessment (Technical Services, Shoalhaven City Council 2020) to inform a preferred design on 9th and 10th January 2020. Further survey was undertaken on 8th October 2020 and 6 April 2021 focusing on the proposed alignment of the preferred design. The surveys involved vegetation and habitat assessment, recording of all flora species within and immediately adjacent to the subject site, determination of vegetation communities, investigation of fauna signs, and targeted survey for potentially occurring threatened flora species (including *Solanum celatum, Rhodamnia rubescens* and *Hibbertia stricta* subsp. *furcatula*).

Targeted surveys were undertaken in areas of potential habitat for Green and Golden Bell Frog, *Genoplesium baueri, Pterostylis gibbosa* and *Hibertia stricta* subsp. *furcatula*. More detail on targeted surveys is provided below.

The project has been designed to align with existing cleared land and corridors to minimise the impact to native vegetation and habitat. The site is therefore mostly cleared, with cover of exotic grasses (predominantly Kikuyu and Paspalum).

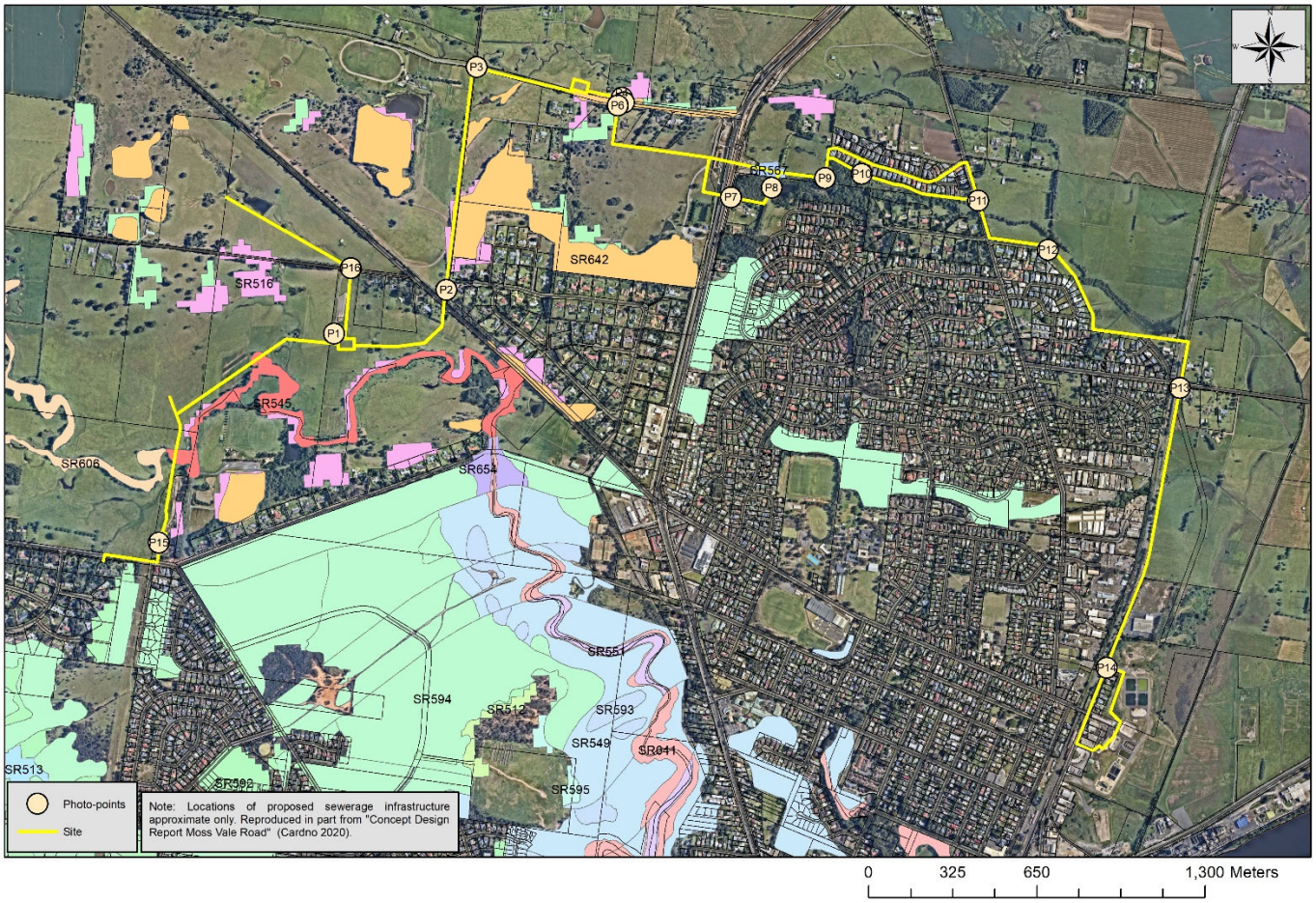
Vegetation communities mapped as occurring within and immediately around the site are shown in Figure 5 and include:

- PCT1212 (Biometric SR642) *Spotted Gum - Grey Ironbark - Woollybutt grassy open forest on coastal flats, southern Sydney Basin and South East Corner*
- PCT694 (Biometric SR516) *Blackbutt – Turpentine – Bangalay moist open forest on sheltered slopes and gullies, southern Sydney Basin*
- PCT1082 (Biometric SR594) *Red Bloodwood – Hard-leaved Scribbly Gum – Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin*
- PCT838 (Biometric SR545) *Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin.* This community is associated with *Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion* endangered ecological community.
- PCT1105 (Biometric SR606) *River Oak open forest of major streams, Sydney Basin and South East Corner*

Along the northern end of the future Far North Collector Rd (in the vicinity of photo-point P1 – refer also to Photo 1), vegetation is predominantly exotic grassland dominated by Paspalum. Two hollow-bearing trees occur (Spotted Gum and Rough-barked Apple) occur in close proximity to the proposed location of the MVRS SPS. A small patch of *Forest Red Gum – Thin-leaved Stringybark grassy woodland* occurs within a minor, unnamed watercourse to the east. This patch of vegetation is in a degraded condition, being small, open and exposed and containing reduced native species diversity, but is nevertheless regarded as being consistent with *Illawarra Lowlands Grassy Woodland* endangered ecological community. It is comprised of *Eucalyptus tereticornis, E.amplifolia, Angophora floribunda*, *Melaleuca linarifolia* and

M.styphelioides with the ground stratum consistent with the surrounding exotic grassland species composition. The patch is disconnected from the Bomaderry Creek riparian corridor. This watercourse would be under-bored to minimise impacts to vegetation and the waterway.

Figure 5. Vegetation communities (Biometric) mapped as occurring within and in proximity to the site



Between this area and the Bells Lane / Moss Vale Rd intersection, the rising main alignment would pass through an area of exotic ornamental vegetation associated with the residential property at 125 Moss Vale Rd (Lot 262 DP 794245). This planted vegetation includes Silky Oaks, Flame Trees, fruit trees and non-endemic Eucalypt species with an exotic grass (predominantly Kikuyu) understorey (refer to Photo 2, photo-point P2).

Northward along Bells Lane, the rising main and then gravity main alignment would occur on the eastern side of the road including along the edge of patchy *Spotted Gum - Grey Ironbark - Woollybutt grassy open forest* in varying states of integrity (refer to Photo 3, photo-point P2). Five hollow-bearing trees were recorded along the southern vegetated part of the alignment. This section would be underbored to minimise impacts to native vegetation.

Westward from Bells Lane along an unformed section of Abernethys Lane, a gravity main alignment would follow a corridor of cleared, exotic grassland dominated by Kikuyu grass (refer to Photo 4, photo-point P3). A small patch of native trees (including Spotted Gum *Eucalyptus maculata* and Cheese Tree *Glochidion ferdinandi*) occurs either side of a small unnamed creek

tributary of Abernethys Creek. This watercourse would be under-bored to minimise impacts to vegetation and the waterway.

The proposed MVRN SPS (located in Lot 2 DP1134376, along Abernethys Lane) would occur in a cleared, grassland area (refer to Photo 5, photo-point P4).

The eastern unformed portion of Abernethys Lane supports mature *Spotted Gum - Grey Ironbark - Woollybutt grassy open forest* (refer to Photo 6, photo-point P5). The understorey is somewhat degraded, however, this vegetation contains numerous large, mature Spotted Gum trees with significant hollows. This area is proposed to be under-bored between Lot 1 DP 1134376 and Lot 601 DP 1223625 to avoid impact to the native vegetation and habitat features present.

South and then east from Abernethys Lane, the proposed rising main would occur in cleared exotic grassland, requiring no vegetation removal (refer to Photo 7, photo-point P6).

East of the Princes Highway the proposed rising main would occur primarily within a cleared APZ, and then roughly follow a Shared Users Path through to the southern and eastern boundary of Lot 502 DP 1221372 (refer to Photo 8, photo-point P7; Photo 9, photo-point P8; Photo 10, photo-point P9; and Photo 11, photo-point P9). In this area, minor clearing of disturbed native understorey vegetation (including *Acacia filicifolia, A.suaveolens, A.binervata, A.floribunda, Pittosporum undulatum, Breynia oblongifolia* and *Kunzea ambigua*) and removal of several mature Two-veined Hickory trees (*A.binervata*) would be required. The removal of two Prickly-leaved Paperbark (*Melaleuca styphelioides*) may also be necessary.

The proposed rising main would then follow a largely cleared APZ (south of Emerald Drive) through to Meroo Rd (refer to Photo 12, photo-point P10). This area contains remnants of Paperbark swamp vegetation, with scattered Prickly-leaved Paperbark and Tea-tree (*Leptospermum polygalifolium*) occurring. No removal of native vegetation is required through this area.

South along Meroo Rd, the rising main alignment would occur within cleared road verge bordered by mature exotic Radiata Pine trees (refer to Photo 13, photo-point P11), crossing an unnamed tributary of Abernethys Creek and then traversing across open, cleared farm-land to the south-east (refer to Photo 14, photo-point P12), skirting residential development before crossing beneath the railway line and heading south (refer to Photo 15, photo-point P13), again through cleared exotic grassland, to the Bomaderry STP (refer to Photo 16, photo-point P14) with no native vegetation removal required.

The proposed New SPS21 would occur within and existing cleared grassland area (refer to Photo 17, photo-point P15), with a gravity main extending along the Illaroo Rd road verge to the old SPS21 site. The proposed rising main running north from the New SPS21 would parallel the future Far North Collector Rd, being attached to the bridge crossing Bomaderry Creek. Bomaderry Creek is vegetated with River Oak Open Forest in moderate condition, with a disturbed and weedy understorey. The rising main would run beyond the creek through cleared, exotic grassland to connect to MVRS SPS and provide future connection for MVR South URA. The rising main would parallel the FNCR alignment. Native vegetation occurring along this

alignment associated with Bomaderry Creek would be cleared in association with construction of the FNCR. Additional clearing would not be required for sewer infrastructure in this area.

North-west of Taylors Lane (refer to Photo 20, photo-point P16) a minor water-course and associated dams occur in managed pasture land. Sparsely scattered native and exotic trees occur along the watercourse including Coral Tree, Maiden's Wattle *Acacia maidenii,* Grey Ironbark *Eucalyptus paniculata* and Red Bloodwood *Corymbia gummifera.* The Grey Ironbark appeared to contain hollows with suitable habitat for microbats. It is assumed that all trees can be avoided.

No threatened flora or fauna species were observed during surveys and site inspections.

Habitat and targeted survey results

Targeted surveys were undertaken in areas of potential habitat as follows:

- Green and Golden Bell Frog – 6th February 2020
- *Genoplesium baueri* (Brittle Midge Orchid) – 14th April 2020
- *Pterostylis gibbosa* (Illawarra Greenhood) – 8th October 2020
- *Hibbertia stricta* subsp. *furcatula* – 8th October 2020

Targeted survey for Green and Golden Bell Frog (GGBF) was undertaken on 6 February, during the day time, in full sun, along the southern edge of Abernethys Creek in the vicinity of Roseville Rd. The creek at this point is dominated by Cumbungi (*Typha orientalis*) and while no records of the species occur in close proximity to the site, was considered to contain suitable habitat and be within an area of the Shoalhaven River floodplain with similar characteristics to local habitat utilised by known populations of GGBF. The survey was considered prudent given the lack of records in the surrounding area being potentially attributed to a lack of previous survey. The survey as part of the current assessment was undertaken during a time when the species was detectable (aurally and visibly basking) at sites associated with Brundee Swamp. No GGBF were detected within or in close proximity to the site.

Targeted survey for *Genoplesium baueri* was undertaken on 14 April 2020, in areas considered to contain potential habitat (albeit very marginal) for the species. Survey was undertaken along the eastern edge of Bells Lane and through the vegetated unformed section of Abernethys Lane (in the vicinity of photo-points P2 and P5 respectively), following confirmation of flowering at a North Nowra reference site (refer to Photo 18). Transects 3m to no more than 5m apart were undertaken through areas of potential habitat within these locations. *G.baeuri* was not detected within or in close proximity to the site.

Targeted survey for *Pterostylis gibbosa* was undertaken on 8 October 2020, in areas considered to contain potential habitat for the species. Targeted survey for *Hibbertia stricta* subsp. *furcatula* was undertaken in conjunction with this survey as the areas surveyed contained potential habitat for both species. Survey was undertaken along the eastern edge of Bells Lane, through the vegetated unformed section of Abernethys Lane (in the vicinity of photo-points P2 and P5 respectively), and within the disturbed understorey in the vicinity of photo-point P8, following confirmation of flowering at a Worrigee reference site (refer to Photo 19). Transects 3m to no more

than 5m apart were undertaken through areas of potential habitat within these locations. Neither *P.gibbosa* or *H. stricta* subsp. *furcatula* were detected within or in close proximity to the site.

Areas containing hollow-bearing trees were noted during the previous constraints assessment. HBTs were not mapped for the current assessment as there are no HBTs occurring within areas which are likely to be impacted by the proposed works.

No Glossy Black Cockatoo or Glider feed tree species (e.g. *Allocasuarina littoralis, Corymbia gummifera* and *Eucalyptus punctata*) were noted within the site. No signs of potential threatened fauna use of the site (e.g. owl whitewash, bandicoot diggings) were noted.

Photos 1 through 20 below show the site and any relevant features.

Photo 1. Site facing east from photo-point P1 – location of MVRS SPS

Photo 2. Site facing south along Bells Lane from photo-point P2 toward Moss Vale Rd

Photo 3. Site facing north along Bells Lane from photo-point P2

Photo 4. Site facing east along Abernethys Lane (unformed section) from photo-point P3

Photo 5. Site facing west toward location of MVRS SPS from photo-point P4. No vegetation removal.

Photo 6. Site facing west at Abernethys Lane from photo-point P5. Note this area would be under-bored.

Photo 7. Site facing south from photo-point P6. No vegetation removal required.

Photo 8. Site facing east from photo-point P7. No vegetation removal required.

Photo 9. Site facing north-east from photo-point P8.

Photo 10. Site facing west from photo-point P9.

Photo 11. Site facing north from photo-point P9.

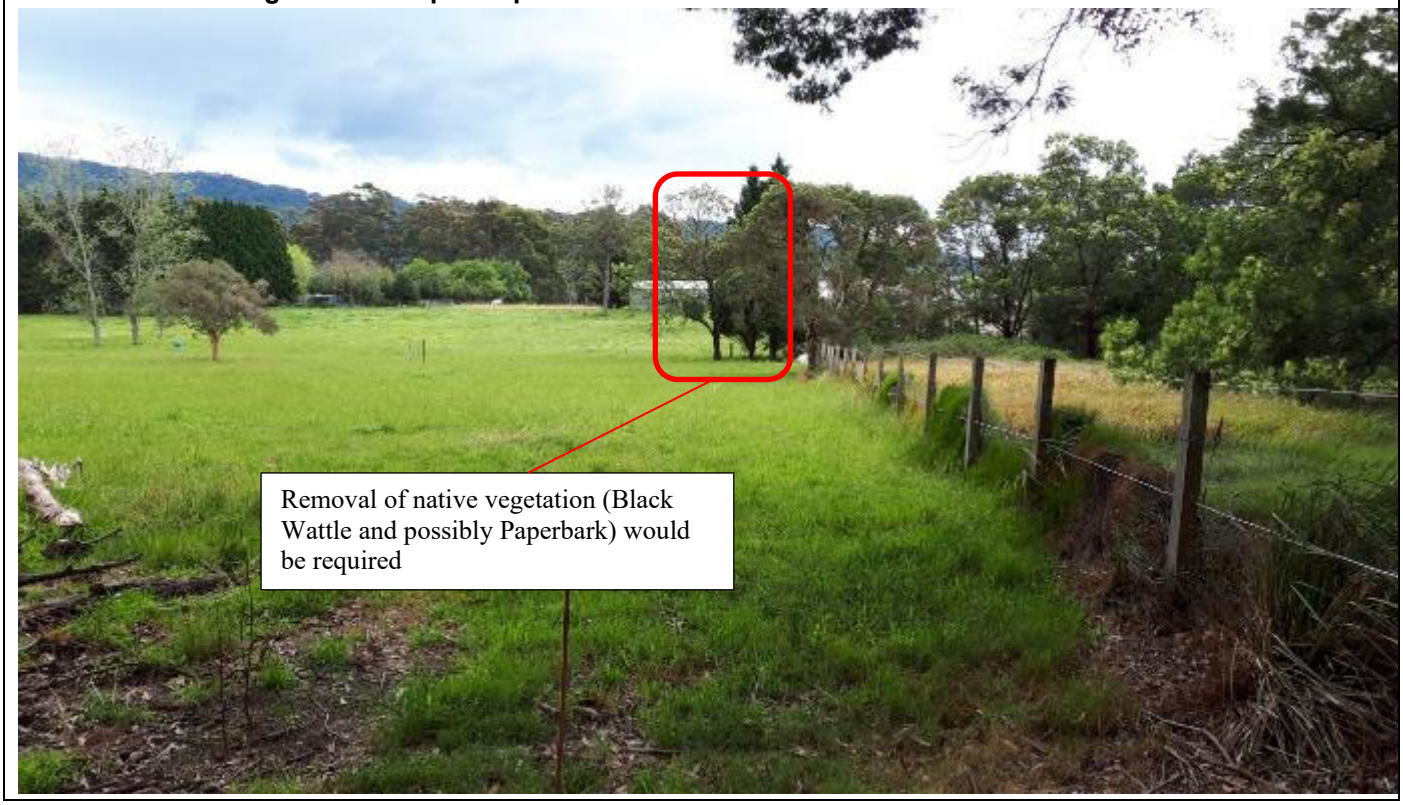


Photo 12. Site facing east from photo-point P10. No native vegetation removal required.

Photo 13. Site facing south along Meroo Rd from photo-point P11. No removal of vegetation required.

Photo 14. Site facing south-east from photo-point P12. No removal of vegetation required.

Photo 15. Site facing south from photo-point P13. No removal of vegetation required.

Photo 16. Site facing east toward Bomaderry STP from photo-point P14. No removal of vegetation required.

Photo 17. Site facing north toward location of New SPS21 from photo-point P15

Photo 18 (left). Flowering *Genoplesium baueri* at North Nowra reference site (14 April 2020)
Photo 19 (right). Flowering *Pterostylis gibbosa* at Worrigee reference site (2 October 2020)

Photo 20. Site facing north-west from Taylors Lane at Photo-point P16

3. ASSESSMENT OF LIKELY ENVIRONMENTAL IMPACTS

3.1 Impacts associated with the proposal

The project has been designed to align with existing cleared land and corridors to minimise the impact to native vegetation and habitat. The site is therefore mostly cleared, with cover of exotic grasses (predominantly Kikuyu and Paspalum).

Excavation for the installation of pipes would generally be in the form of trenching. Under-boring (micro tunnel or horizontal directional drilling (HDD)) would be applied where the crossing of creeks, roads and the railway line is required, and would comply with relevant authority approvals. Under-boring is also proposed to be utilised in areas of ecological significance and sensitivity, including vegetation on an unformed section of Abernethys Lane (between Lot 1 DP 1134376 and Lot 601 DP 1223625) containing mature HBTs. Under-boring of creeks and minor watercourses will also be undertaken to minimise the potential impacts to riparian vegetation, creek-bank stability and water quality.

Easements of 5m would be established where required. A 20m wide construction corridor would generally be provided.

The proposal would involve the following disturbance and impacts:

- Clearing of native and exotic vegetation comprising:
    - Possible removal of planted and exotic species including ornamental vegetation associated with the Council owned residential property at 125 Moss Vale Rd (Lot 262 DP 794245) – Silky Oaks, Flame Trees, fruit trees and non-endemic Eucalypt species (refer to Photo 2, photo-point P2).
    - Minor clearing of disturbed native understorey vegetation (including *Acacia filicifolia, A.suaveolens, A.binervata, A.floribunda, Pittosporum undulatum, Breynia oblongifolia* and *Kunzea ambigua*) and removal of several mature Two-veined Hickory trees (*A.binervata*) would be required east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372 (refer to Photo 8, photo-point P7; Photo 9, photo-point P8; Photo 10, photo-point P9; and Photo 11, photo-point P9). The removal of two Prickly-leaved Paperbark (*Melaleuca styphelioides*) may also be necessary.
    - No hollow-bearing trees or significant feed trees would be removed or otherwise impacted.
    - No habitat considered significant for threatened flora or any native fauna would be removed or otherwise impacted.
- Excavation comprising a combination of trenching and under-boring to depths ranging from 0.46m to 5.63m below the existing ground surface. The alignment has been designed with consideration of existing Aboriginal heritage records and informed by an Aboriginal Constraints Analysis (Young 2020) and an Aboriginal Cultural Heritage Due Diligence

Assessment (Feary 2020) to ensure avoidance of impact to known records and likely areas of significance. Refer to Section 3.4 for more information.

- Construction of all-weather access tracks to SPSs.
- Excavation, installation of culvert and stabilisation of watercourse for MVRN SPS access track along unformed section of Abernethys Lane. This work would occur in an area mapped as Key Fish Habitat for the purpose of the *Fisheries Management Act 1994* and would therefore require a Fisheries Permit. Refer to Section 3.8 for more information.

Indirect impacts associated with the proposal include contamination of waterways as a result of SPS overflows.

Council's Unit Manager Wastewater Operations provided the following additional information regarding the SPS overflows (refer to D20/450906):

> *All SPSs are designed with an overflow pipe as it is not feasible to design a system with a 100% guarantee that an overflow will never occur.*
>
> *The majority of overflows that do occur at SPSs are a result of extensive wet weather and during this time of overflow discharge the sewerage is already highly diluted. The wet weather flow then mixes with storm flows and has minimal impact on the water way.*
>
> *If an overflow occurs during dry weather the impact of the overflow is assessed and decision for the best course of action is determined. This is all in accordance with EPA requirements.*
>
> *With regards to the design of the overflow structure, the overflow pipe will have a trash grate and preference is to keep the overflow point close to the SPS and hence discharge is overland via a grass swale. So yes an open swale vegetated with sedges would be an acceptable solution. This also helps prevent small overflows form reaching the waterway and allows for some capture of inorganics that are not captured by the trash grate.*

3.2 Threatened species impact assessment (NSW)

Section 1.7 of the EP&A Act 1979 applies the provisions of Part 7 of the NSW *Biodiversity Conservation Act 2016* and Part 7A of the *NSW Fisheries Management Act 1994* that relate to the operation of the Act in connection with the terrestrial and aquatic environment. Each are addressed below.

- ***Part 7A Fisheries Management Act 1994***

Part 7A relates to threatened species conservation. As the proposed activity would not affect aquatic environments supporting vegetation or species protected under this section of the Act, further consideration is unnecessary.

- ***Part 7 Biodiversity Conservation Act 2016***

An assessment of the potential for NSW threatened flora and fauna species occurring on-site or otherwise being impacted by the proposal was undertaken (refer to Appendix B). The following species and endangered ecological communities are known to occur on-site or are considered to have some potential to occur on-site or be otherwise impacted by the proposal, and therefore required further assessment under Part 7 of the NSW Biodiversity Conservation Act 2016:

- *Genoplesium baueri* Bauer's Midge Orchid
- *Pterostylis gibbosa* Illawarra Greenhood
- Green and Golden Bell Frog *Litoria aurea*
- Eastern Bentwing-bat *Miniopterus orianae oceanensis*
- Eastern False Pipistrelle *Falsistrellus tasmaniensis*
- Eastern Freetail-Bat *Micronomus norfolkensis*
- Greater Broad-nosed Bat *Scoteanaux ruepelli*
- Large-eared Pied Bat *Chalinobolus dwyeri*
- Southern Myotis (Large-footed Myotis) *Myotis macropus*
- Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*
- Dusky Woodswallow *Artamus cyanopterus cyanopterus*
- Gang-gang Cockatoo *Callocephalon fimbriatum*
- Glossy Black-cockatoo *Calyptorhynchus lathami*
- Little Lorikeet *Glossopsitta pusilla*
- Masked Owl *Tyto novaehollandiae*
- Powerful Owl *Ninox strenua*
- Square-Tailed Kite *Lophoictinia isura*
- Varied Sittella *Daphoenositta chrysoptera*
- Grey-headed Flying-fox *Pteropus poliocephalus*
- Yellow-bellied Glider - *Petaurus Australis*
- *Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion* endangered ecological community

Section 7.3 of the Act provides a ‘five-part’ test to determine whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. Each Part is addressed below:

Part A - In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be place at risk of extinction.

Bauer's Midge Orchid (*Genoplesium baueri*)

Bauer's Midge Orchid is a small fleshy, brittle, yellowish-green or reddish terrestrial orchid to 6-15 cm high. The species grows in dry sclerophyll forest and moss gardens over sandstone, flowering in February to March. Currently the species is known from just over 200 plants across 13 sites (OEH 2018a). The number of populations of *Genoplesium baueri* is uncertain. Based on records from herbaria and sightings, there is estimated to be between 20 and 30 populations. Some plants do not regularly appear each year, despite favourable seasonal conditions. When plants do appear, they are only above ground for approximately 2 months before dying back to a dormant state. Whilst the appearance of plants above ground may fluctuate from year to year, individual plants may remain dormant in the soil. Nevertheless the number of plants of *G. baueri* is considered to be low. Flowering is usually around December to April. It has been reported that *G. baueri* is most often seen soon after fire and flowering may be enhanced by summer fires. The species usually grows in heathland to shrubby woodland on sands or sandy loams or open forest, shrubby forest and heathy forest on well-drained sandy and gravelly soils. The species does not produce a new tuber at the end of each growing season, instead it persists from the one tuber-like perennial root. Flowering usually occurs from December to April. It is reported that the species is most often seen soon after fire. Despite favourable seasonal conditions, some plants do not regularly appear each year. When they do appear, plants are visible above ground for approximately two months before dying back into dormancy (TSSC 2013).

Marginal potential habitat was considered to occur within or in close proximity to the site along the eastern edge of Bells Lane and through the vegetated unformed section of Abernethys Lane (in the vicinity of photo-points P2 and P5 respectively).

Targeted survey for the species was undertaken in these areas following confirmation of flowering at a nearby reference site (refer to Section 2.1). The species was not detected.

It is concluded that the species is unlikely to occur within the site.

Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372.

It is considered unlikely therefore that Bauer's Midge Orchid would be impacted by the proposed works and the proposed activity is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Illawarra Greenhood (*Pterostylis gibbosa*)

The Illawarra Greenhood has a rosette of rounded leaves at the base of the stem, each to 35 mm long. In addition there are up to six leaves that sheath the flower stem, which may be 45 cm high and bear up to seven flowers. The flowers are bright glossy green with transparent patches in the hood. The very broad black labellum ('lip' petal) protrudes from the front of the flower. The species

is known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). It is apparently extinct in western Sydney which is the area where it was first collected (1803). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by Forest Red Gum *Eucalyptus tereticornis*, Woollybutt *E. longifolia* and White Feather Honey-myrtle *Melaleuca decora*. Near Nowra, the species grows in an open forest of Spotted Gum *Corymbia maculata*, Forest Red Gum and Grey Ironbark *E. paniculata*. The Illawarra Greenhood is a deciduous orchid that is only visible above the ground between late summer and spring, and only when soil moisture levels can sustain its growth. The leaf rosette grows from an underground tuber in late summer, followed by the flower stem in winter. After a spring flowering, the plant begins to die back and seed capsules form (if pollination has taken place). As with many other greenhoods, male fungus gnats are believed to be the pollinator. The Illawarra Greenhood can survive occasional burning and grazing because of its capacity to reshoot from an underground tuber (OEH 2018b).

Potential habitat was considered to occur for Illawarra Greenhood within or in close proximity to the site along the eastern edge of Bells Lane, through the vegetated unformed section of Abernethys Lane (in the vicinity of photo-points P2 and P5 respectively) and within patches of woodland vegetation east of the Princes Highway through to the APZ south of Emerald drive.

Targeted survey for the species was undertaken in these areas following confirmation of flowering at a nearby reference site (refer to Section 2.1). The species was not detected.

It is concluded that the species is unlikely to occur within the site.

Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372. Other areas of potential vegetation including the vegetated unformed section of Abernethys Lane would be avoided.

It is considered unlikely therefore that Illawarra Greenhood would be impacted by the proposed works and the proposed activity is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Green and Golden Bell Frog (*Litoria aurea*)

Green and Golden Bell Frog inhabits marshes, dams and stream-sides, particularly those containing bullrushes (Typha spp.) or spikerushes (Eleocharis spp.). Optimum habitat for the species includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia holbrooki), with a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. The species is active by day and usually breeds in summer when conditions are warm and wet. Males call while floating in water and females produce a raft of eggs that initially float before settling to the bottom, often amongst vegetation. Tadpoles feed on algae and other plant-matter; adults eat mainly insects, but also other frogs (OEH 2017g).

Marginal potential habitat was considered to occur for Green and Golden Bell Frog along the southern edge of Abernethys Creek in the vicinity of Roseville Rd. The creek at this point is dominated by Cumbungi (*Typha orientalis*) and while no records of the species occur in close proximity to the site, was considered to contain suitable habitat and be within an area of the Shoalhaven River floodplain with similar characteristics to local habitat utilised by known populations of GGBF. Survey and further assessment was considered prudent given the lack of records in the surrounding area being potentially attributed to a lack of previous survey. The survey was undertaken during a time when the species was detectable (aurally and visibly basking) at sites associated with Brundee Swamp (refer to Section 2.1). No GGBF were detected within or in close proximity to the site.

This area of potential habitat does not have connectivity with other potential or known areas of habitat for the species.

The nearest records on the northern side of the Shoalhaven River occur over 10km to the east (associated with the Coomondery Swamp GGBF population).

It is concluded that the species is unlikely to occur within the site.

The potential habitat within the site would not be removed or otherwise impacted by the proposal.

It is considered unlikely therefore that the Green and Golden Bell Frog would be impacted by the proposed works and the proposed activity is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Microchiropteran bats: Eastern Bentwing-bat (*Miniopterus orianae oceanensis*); Eastern False Pipistrelle (*Falsistrellus tasmaniensis*); Eastern Freetail-Bat (*Micronomus norfolkensis*); Greater Broad-nosed Bat (*Scoteanaux ruepelli*); Large-eared Pied Bat (*Chalinobolus dwyeri*) and Southern Myotis (Large-footed Myotis) (*Myotis macropus*)

Eastern Bentwing-bat (*Miniopterus orianae oceanensis*) primarily roosts in caves, but it also uses derelict mines, storm-water tunnels, buildings and other man-made structures. The species forms discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals. The species hunts in forested areas, catching moths and other flying insects above the tree tops (OEH 2017i).

Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings, however roost requirements poorly known. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hibernates in winter. Females are pregnant in late spring to early summer (OEH 2017b).

Eastern Freetail-Bat (*Micronomus norfolkensis*) occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. The species roosts mainly in tree hollows but will also roost under bark or in man-made structures. It will usually change breeding sites regularly (every few days), rendering it very difficult to confirm breeding sites. It has been known to occasionally aggregate in large breeding groups (including in buildings). It is usually solitary but has also been recorded roosting communally. The Eastern Freetail-Bat is considered to be probably insectivorous (OEH 2017c).

Greater Broad-nosed Bat (*Scoteanax rueppellii*) utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. The species forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young (OEH 2017f).

Large-eared Pied Bat (*Chalinolobus dwyeri*) roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon arie*l), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. The species is found in well-timbered areas containing gullies. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy. It is likely to hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring (OEH 2017j).

Southern Myotis (*Myotis Macropus*) generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. The species is dependent on waterways with pools of 3m wide or greater for foraging, with habitat surrounding the waterways (usually within 200m) being used for breeding and roosting. The species will forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December (OEH 2017n).

Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, it flies high and fast over the forest canopy, but lower in more open country. The species forages in most habitats across its very wide range, with and without trees and appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements of the species are unknown; there is speculation about a migration to southern Australia in late summer and autumn (OEH 2017r).

The site contains suitable foraging habitat for each of the above-listed microbats and potential roosting habitat (hollow-bearing trees) for Eastern False Pipistrelle, Eastern Freetail-Bat, Greater Broad-nosed Bat, Southern Myotis and Yellow-bellied Sheathtail-bat. Suitable roosting habitat for Eastern Bentwing Bat and Large-eared Pied Bat (primarily caves) does not occur within the site.

Targeted survey associated with investigations for the Far North Collector Road (Bryant 2020) detected Southern Myotis, Eastern Bentwing-bat and Little Bentwing-bat with moderate confidence and Large-eared Pied Bat with low confidence from ANABAT data recorded in the vicinity of the two HBTs adjacent to the proposed MVRS SPS. Little Corellas were incidentally observed utilising hollows in the Spotted Gum.

No hollow-bearing trees including those adjacent to the proposed MVRS SPS and those occurring within the vegetated unformed section of Abernethys Lane would be removed or otherwise impacted as a result of the proposal.

No disturbance to riparian vegetation would occur.

Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372. The impact to native vegetation would therefore be very minimal and unlikely to affect foraging habitat for these species.

Foraging and potential roosting habitat will therefore not be removed or otherwise significantly impacted.

Works would occur during normal construction hours, so would not affect the nocturnal foraging activities of these species.

It is considered unlikely therefore that the Eastern Bentwing Bat, Eastern False Pipistrelle, Eastern Freetail-Bat, Greater Broad-nosed Bat, Large-eared Pied Bat, Southern Myotis and Yellow-bellied Sheathtail-bat would be impacted by the proposed works and the proposed activity is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)

The Dusky Woodswallow medium-sized bird (16-19.5 cm, 35 g), mostly dark grey-brown with a merging to blackish on its longish tail. The species is widespread in eastern, southern and south western Australia, occurring throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range. The Dusky Woodswallow primarily inhabits dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest, also being found in farmland, usually at the edges of forest or woodland. The species primarily eats invertebrates, mainly insects, which are captured whilst hovering or sallying above the canopy or over water and occasionally will take nectar, fruit

and seed. It also frequently hovers, sallies and pounces under the canopy, primarily over leaf litter and dead timber. Depending on location and local climatic conditions (primarily temperature and rainfall), the dusky woodswallow can be resident year round or migratory. In NSW, after breeding, birds migrate to the north of the state and to south-eastern Queensland, while Tasmanian birds migrate to south-eastern NSW after breeding. Migrants generally depart between March and May, heading south to breed again in spring. There is some evidence of site fidelity for breeding. Although dusky woodswallows generally breed as solitary pairs or occasionally in small flocks, large flocks may form around abundant food sources in winter. Large flocks may also form before migration, which is often undertaken with other species. The species nests in an open, cup-shape, made of twigs, grass, fibrous rootlets and occasionally casuarina needles, and may be lined with grass, rootlets or infrequently horsehair, occasionally unlined. Nest sites vary greatly, but generally occur in shrubs or low trees, living or dead, horizontal or upright forks in branches, spouts, hollow stumps or logs, behind loose bark or in a hollow in the top of a wooden fence post. Nest sites may be exposed or well concealed by foliage (OEH 2017a).

Marginal habitat occurs for the Dusky Woodswallow within or in close proximity to the site along the eastern edge of Bells Lane, through the vegetated unformed section of Abernethys Lane (in the vicinity of photo-points P2 and P5 respectively) and within patches of woodland vegetation east of the Princes Highway through to the APZ south of Emerald drive. The vegetation within the site occurs on edges in fragmented, disturbed and modified landscapes.

Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372. Other areas of potential vegetation including the vegetated unformed section of Abernethys Lane would be avoided. No canopy trees would be removed. The impact to native vegetation would therefore be very minimal and unlikely to affect foraging habitat for these species.

No nests were observed during surveys. The vegetation within the site occurs on edges in fragmented, disturbed and modified landscapes. It is considered unlikely that the species would utilise the site for breeding.

Foraging and potential roosting habitat will therefore not be removed or otherwise significantly impacted.

It is considered unlikely therefore that the Dusky Woodswallow would be impacted by the proposed works and the proposed activity is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Gang-gang Cockatoo (*Callocephalon fimbriatum*)

In spring and summer, the species is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. May also occur in sub-alpine Snow Gum (*Eucalyptus pauciflora*) woodland

and occasionally in temperate rainforests. Gang-gang Cockatoo favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts. Breeding is generally from Oct-Jan (OEH 2017d).

The site and adjacent areas contain suitable nesting and foraging habitat for Gang-gang Cockatoos.

Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372. No canopy trees would be removed. The impact to native vegetation would therefore be very minimal and unlikely to affect foraging habitat for these species.

No hollow-bearing trees including those adjacent to the proposed MVRS SPS and those occurring within the vegetated unformed section of Abernethys Lane would be removed or otherwise impacted as a result of the proposal. Note also that surveys in October associated with the Far North Collector Road investigations did not detect the species utilising the HBTs adjacent to the proposed MVRS SPS (Bryant 2020).

Foraging and potential roosting habitat will therefore not be removed or otherwise significantly impacted.

It is considered unlikely therefore that the Gang-gang Cockatoo would be impacted by the proposed works and the proposed activity is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Glossy Black-cockatoo *Calyptorhynchus lathami*

The Glossy Black-cockatoo inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of She-oak occur. Black She-oak (*Allocasuarina littoralis*) and Forest She-oak (*A. torulosa*) are important foods. Inland populations feed on a wide range of She-oaks, including Drooping She-oak, *Allocasuaraina diminuta*, and *A. gymnathera*. Belah is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping She-oak, but also recorded in open woodlands dominated by Belah (*Casuarina cristata*). The species feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill. Glossy Black-cockatoo is dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May (OEH 2017e).

The site and adjacent areas contain suitable nesting and foraging habitat for Glossy Black Cockatoos.

No feed trees (as evidenced by chewed Allocasuarina cones) were detected within the study area. No *Allocasuarina* species were found within areas where clearing for the project will occur.

Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372. No canopy trees would be removed. The impact to native vegetation would therefore be very minimal and unlikely to affect foraging habitat for these species.

No hollow-bearing trees including those adjacent to the proposed MVRS SPS and those occurring within the vegetated unformed section of Abernethys Lane would be removed or otherwise impacted as a result of the proposal. Note also that surveys in March associated with the Far North Collector Road investigations did not detect the species utilising the HBTs adjacent to the proposed MVRS SPS (Bryant 2020).

Foraging and potential roosting habitat will therefore not be removed or otherwise significantly impacted.

It is considered unlikely therefore that the Glossy Black Cockatoo would be impacted by the proposed works and the proposed activity is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Little Lorikeet *Glossopsitta pusilla*

The Little Lorikeet forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. The species feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards. The Little Lorikeet is gregarious, travelling and feeding in small flocks (<10), though often with other lorikeets. Flocks numbering hundreds are still occasionally observed and may have been the norm in past centuries. The species roosts in treetops, often distant from feeding areas. Nests are in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina. The nesting season extends from May to September. In years when flowering is prolific, Little Lorikeet pairs can breed twice, producing 3-4 young per attempt. However, the survival rate of fledglings is unknown (OEH 2017k).

The site and adjacent areas contain suitable nesting and foraging habitat for Little Lorikeet.

Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372. No canopy trees would be removed. The impact to native vegetation would therefore be very minimal and unlikely to affect foraging habitat for these species.

No hollow-bearing trees including those adjacent to the proposed MVRS SPS and those occurring within the vegetated unformed section of Abernethys Lane would be removed or otherwise impacted as a result of the proposal. Note the HBTs adjacent to the proposed MVRS SPS do not appear to contain suitably sized hollows for Little Lorikeet.

Foraging and potential roosting habitat will therefore not be removed or otherwise significantly impacted.

It is considered unlikely therefore that the Little Lorikeet would be impacted by the proposed works and the proposed activity is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Masked Owl (*Tyto novaehollandiae*)

The Masked Owl lives in dry eucalypt forests and woodlands from sea level to 1100 m. The species is a forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds from May-Aug in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting (OEH 2017l).

The site and adjacent areas contain suitable nesting and foraging habitat for Masked Owl.

Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372. No canopy trees would be removed. The impact to native vegetation would therefore be very minimal and unlikely to affect foraging habitat for these species.

No hollow-bearing trees including those adjacent to the proposed MVRS SPS and those occurring within the vegetated unformed section of Abernethys Lane would be removed or otherwise impacted as a result of the proposal.

Foraging and potential roosting habitat will therefore not be removed or otherwise significantly impacted.

Works would occur during normal construction hours, so would not affect the nocturnal foraging activities of these species.

It is considered unlikely therefore that the Masked Owl would be impacted by the proposed works and the proposed activity is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Powerful Owl (*Ninox strenua*)

The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The species requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in

dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. There may be marked regional differences in the prey taken by Powerful Owls. For example in southern NSW, Ringtail Possum make up the bulk of prey in the lowland or coastal habitat. At higher elevations, such as the tableland forests, the Greater Glider may constitute almost all of the prey for a pair of Powerful Owls. Flying foxes are important prey in some areas; birds comprise about 10-50% of the diet depending on the availability of preferred mammals. As most prey species require hollows and a shrub layer, these are important habitat components for the owl. Pairs of Powerful Owls demonstrate high fidelity to a large territory, the size of which varies with habitat quality and thus prey densities. In good habitats a mere 400 can support a pair; where hollow trees and prey have been depleted the owls need up to 4000 ha. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds that harass him. Powerful Owls are monogamous and mate for life. Nesting occurs from late autumn to mid-winter (generally May-Aug), but is slightly earlier in north-eastern NSW (late summer - mid autumn). Clutches consist of two dull white eggs and incubation lasts approximately 38 days (OEH 2017m).

The site and adjacent areas contain suitable nesting and foraging habitat for Powerful Owl.

Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372. No canopy trees would be removed. The impact to native vegetation would therefore be very minimal and unlikely to affect foraging habitat for these species.

No hollow-bearing trees including those adjacent to the proposed MVRS SPS and those occurring within the vegetated unformed section of Abernethys Lane would be removed or otherwise impacted as a result of the proposal.

Foraging and potential roosting habitat will therefore not be removed or otherwise significantly impacted.

Works would occur during normal construction hours, so would not affect the nocturnal foraging activities of these species.

It is considered unlikely therefore that the Powerful Owl would be impacted by the proposed works and the proposed activity is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Square-Tailed Kite *Lophoictinia isura*

The Square-tailed Kite is a reddish, medium-sized, long-winged raptor. A key character in flight is the long fingered, upswept wings with a large white patch at the base of the barred ‘fingers’. In

NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs. The Square-tailed Kite is found in a variety of timbered habitats including dry woodlands and open forests, showing a particular preference for timbered watercourses. It appears to occupy large hunting ranges of more than 100km2. In arid north-western NSW, it has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. This raptor is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage (OEH 2017o).

The site and adjacent areas contain suitable nesting and foraging habitat for the Square-tailed Kite.

Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372.

No large stick nests were observed within the site during surveys. No canopy trees would be removed as part of the proposal. No riparian vegetation would be removed or otherwise impacted.

Foraging and potential nesting habitat will therefore not be removed or otherwise significantly impacted.

It is considered unlikely therefore that the Square-tailed Kite would be impacted by the proposed works and the proposed activity is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Varied Sittella (*Daphoenositta chrysoptera*)

The Varied Sittella is a small and highly mobile species. Varied Sittellas are more active and acrobatic among branches than the larger treecreepers. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. It feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years (OEH, 2017p).

Marginal habitat occurs for the Varied Sittella within or in close proximity to the site along the eastern edge of Bells Lane, through the vegetated unformed section of Abernethys Lane (in the vicinity of photo-points P2 and P5 respectively) and within patches of woodland vegetation east of the Princes Highway through to the APZ south of Emerald drive. The vegetation within the site occurs on edges in fragmented, disturbed and modified landscapes.

Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of

Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372. Other areas of potential vegetation including the vegetated unformed section of Abernethys Lane would be avoided. No canopy trees would be removed. The impact to native vegetation would therefore be very minimal and unlikely to affect foraging habitat for these species.

No nests were observed during surveys. The vegetation within the site occurs on edges in fragmented, disturbed and modified landscapes. It is considered unlikely that the species would utilise the site for breeding.

Foraging and potential roosting habitat will therefore not be removed or otherwise significantly impacted.

It is considered unlikely therefore that the Dusky Woodswallow would be impacted by the proposed works and the proposed activity is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is the largest Australian bat, with a head and body length of 23 - 29 cm. It has dark grey fur on the body, lighter grey fur on the head and a russet collar encircling the neck. The wing membranes are black and the wingspan can be up to 1 m. It can be distinguished from other flying-foxes by the leg fur, which extends to the ankle. Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. This species occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Site fidelity to camps is high; some camps have been used for over a century. GHFF can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. They feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines, also foraging in cultivated gardens and fruit crops (OEH 2017h).

Foraging habitat occurs for the Grey-headed Flying-fox where flowering Eucalypt trees occur within or in close proximity to the site along the eastern edge of Bells Lane, through the vegetated unformed section of Abernethys Lane (in the vicinity of photo-points P2 and P5 respectively) and within patches of woodland vegetation east of the Princes Highway through to the APZ south of Emerald drive.

Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372. Other areas

of potential vegetation including the vegetated unformed section of Abernethys Lane would be avoided. No canopy trees would be removed. The impact to native vegetation would therefore be very minimal and unlikely to affect foraging habitat for these species.

No GHFF camps occur in close proximity to the site. The nearest camp currently occurs at Bomaderry Creek / Illowra Wetlands, approximately 1.3km south-west of the southern-most part of the site.

Foraging and roosting habitat will therefore not be removed or otherwise significantly impacted as a result of the proposal.

It is considered unlikely therefore that the Grey-headed Flying-fox would be impacted by the proposed works and the proposed activity is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Yellow-bellied Glider (*Petaurus australis*)

The Yellow-bellied Glider occurs in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. The species feeds primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Sap is extracted by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar. Yellow-bellied Gliders live in small family groups of two - six individuals and are nocturnal. The species use dens, often in family groups, in hollows of large trees. The Yellow-bellied Glider is very mobile and occupies large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources. Dispersal requires continuous habitat connectivity (gliding distance around 120m). Typically produce one young per year (in high quality habitat) but during poor conditions may only breed every second year. Key threats to the species include loss of hollows (generally >30cm) and important feed trees as a result of wildfire, in addition to landscape fragmentation. A highly vocal species with loud, high-pitched shrieks audible over 500m away (OEH 2017q).

The site and adjacent areas contain marginal suitable foraging habitat and potential den habitat (HBTs) for the Yellow-bellied Glider.

No feed trees (as evidenced by v-shaped or other glider scars) were detected within the study area. No typical feed tree species including Red Bloodwood (*Corymbia gummifera*) or Grey Gum (*Eucalyptus punctata*) were noted within areas where clearing for the project will occur.

Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372. No canopy trees would be removed. The impact to native vegetation would therefore be very minimal and unlikely to affect foraging habitat for these species.

No hollow-bearing trees including those occurring within the vegetated unformed section of Abernethys Lane would be removed or otherwise impacted as a result of the proposal. Note that the HBTs adjacent to the proposed MVRS SPS are too isolated to be utilised by Yellow-bellied Glider.

Foraging and potential roosting habitat will therefore not be removed or otherwise significantly impacted.

It is considered unlikely therefore that the Yellow-bellied Glider would be impacted by the proposed works and the proposed activity is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of any of these species is likely to be placed at risk of extinction.

Part B - In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- ***(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
- ***(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction***

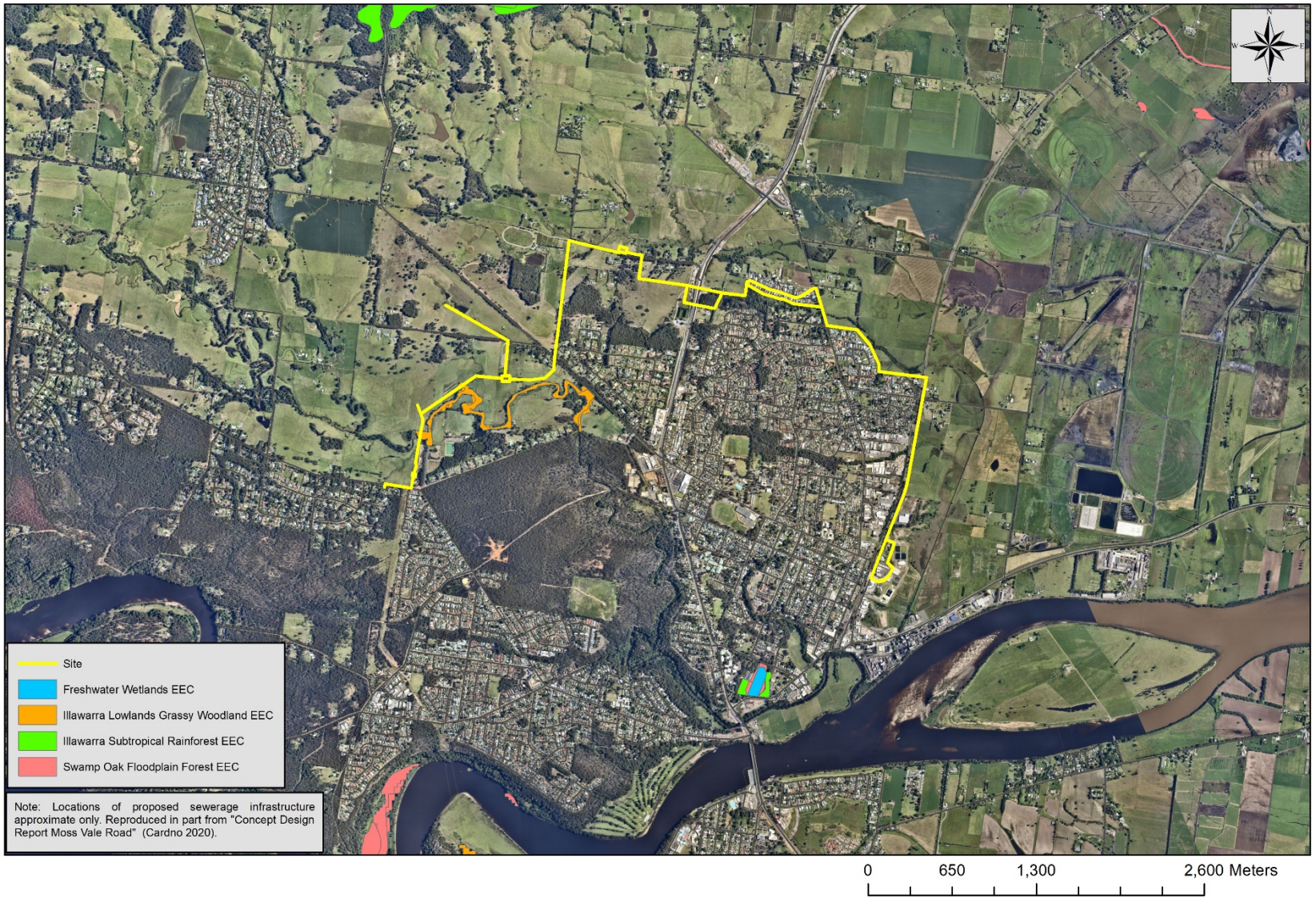
Only Illawarra Lowland Grassy Woodland EEC is mapped as occurring in close proximity to the site of the proposed works (refer to Figure 6).

Illawarra Lowland Grassy Woodland (ILGW) in the Sydney Basin Bioregion Endangered Ecological Community

This community comprises vegetation types that occupy the Illawarra coastal plain and escarpment foothills. Characteristic tree species include Forest Red Gum *Eucalyptus tereticornis*, Thin-leaved Stringybark *Eucalyptus eugenioides*, Woollybutt *Eucalyptus longifolia*, Coast Grey Box *Eucalyptus bosistoana* and White Feather Honey-myrtle *Melaleuca decora*. The understorey is not necessarily grassy as moist forest vegetation types are also included within this broad community. Common shrub species include *Acacia mearnsii* and *Dodonaea viscosa* subsp. *angustifolia*. Floodplain vegetation dominated by Casuarina species or rainforests on latite soils are not part of this community. Illawarra Lowlands Grassy Woodland occurs on relatively gently sloping to undulating lands less than about 200 m elevation on Berry Siltstone, Budgong Sandstone and Quaternary alluvium. Much of this community has been cleared and it now occurs chiefly as scattered fragments. This EEC provides habitat for the endangered orchid *Pterostylis gibbosa*. Characteristic tree species in the Illawarra Lowlands Grassy Woodland are *Eucalyptus tereticornis, Eucalyptus eugenioides, Eucalyptus longifolia, Eucalyptus bosistoana* and *Melaleuca decora* (NSW Scientific Committee 2011).

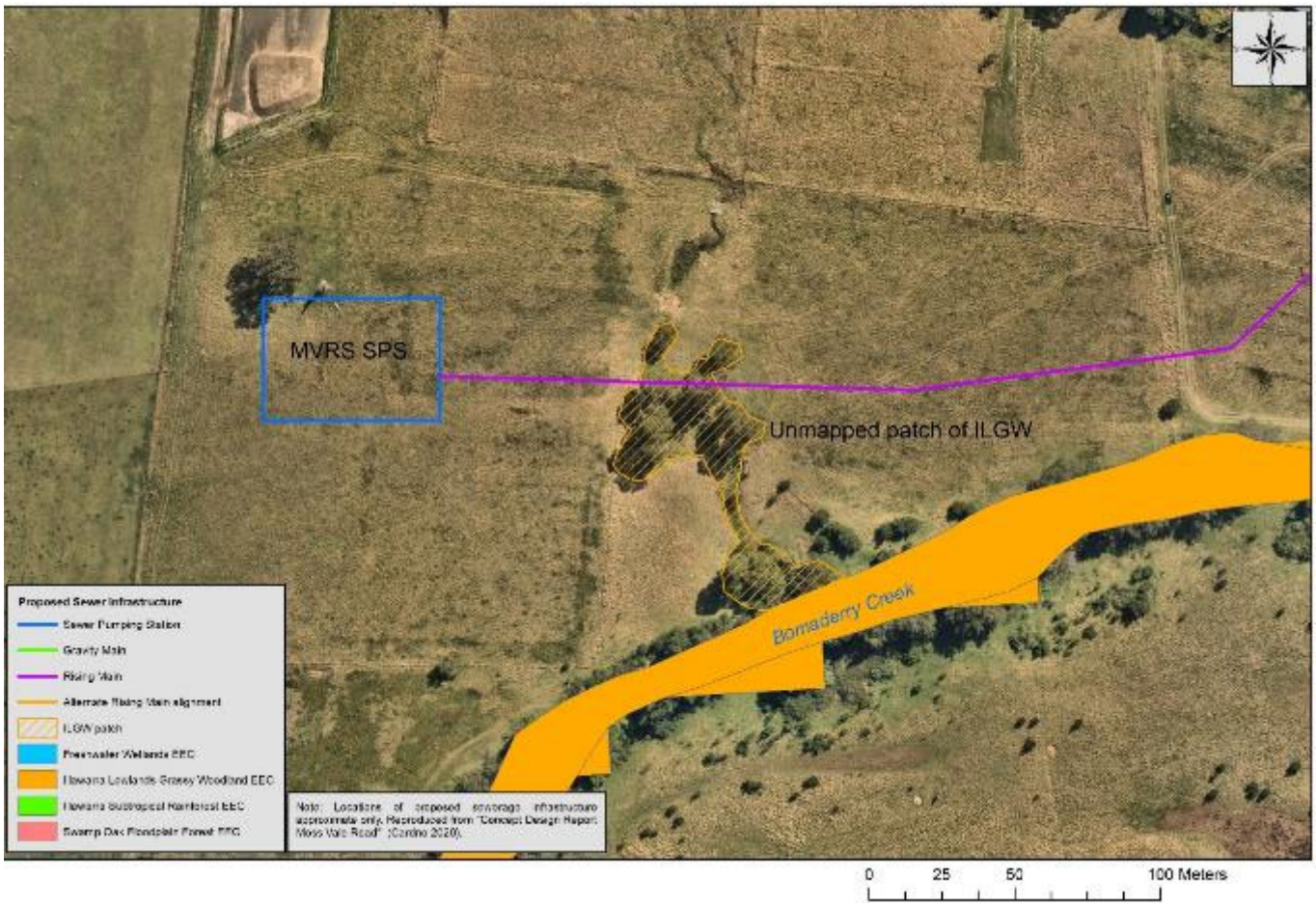
A small patch of *Forest Red Gum – Thin-leaved Stringybark grassy woodland*, regarded as being consistent with *Illawarra Lowlands Grassy Woodland* endangered ecological community, occurs within a minor, unnamed watercourse between the site of proposed MVRS SPS and Moss Vale Rd, along the future Far North Collector Rd alignment (in the vicinity of photo-point

Figure 6. Endangered Ecological Communities (EECs) mapped as occurring in the surrounding locality



P1 – refer also to Photo 1). This patch of vegetation is in a degraded condition, being small (approx. 2302m^2), open and exposed and containing reduced native species diversity. It is comprised of *Eucalyptus tereticornis, E.amplifolia, Angophora floribunda*, *Melaleuca linarifolia* and *M.styphelioides* with the ground stratum consistent with the surrounding exotic grassland species composition, dominated by Caterpillar Grass (*Paspalum dilatatum*). The patch is disconnected from the Bomaderry Creek riparian corridor, but remains a viable occurrence of the ecological community.

Figure 7. Extent of unmapped Illawarra Lowlands Grassy Woodland (ILGW) EEC in proximity to the site



It is proposed that this watercourse would be under-bored to minimise impacts to vegetation and the waterway. If it is not possible to under-bore this location, the construction corridor must be reduced to no more than 5m and all native trees and shrubs retained to every practical extent. The patch of vegetation is open (refer to Photo 21), with the northern part of the patch where the rising main would pass through (over a distance of approx. 26m), containing Paperbarks, one small Rough-barked Apple and no mature Forest Red Gum (*Eucalyptus tereticornis*) trees. Sediment and erosion controls would be installed and maintained until completion of works and stabilisation of the site has been achieved to minimise impacts on the watercourse and ecological community associated with erosion and sediment deposition. Any impacted vegetation components of the ecological community would be revegetated.

Note that while *Illawarra Lowlands Grassy Woodland* (associated with PCT838) is mapped as occurring along the length of Bomaderry Creek between the powerline easement adjacent to the southern end of the future Far North Collector Road and Bomaderry Regional Park near the eastern end of West Cambewarra Road, field survey during investigations for the Far North Collector Road determined that the vegetation in this area is River Oak Open Forest, including the riparian vegetation where the Far North Collector Road and rising main from the current proposal would bridge Bomaderry Creek (Bryant 2020). PCT838 was found to be confined to a short strip of vegetation within Bernie Regan Sporting Complex land adjacent to Lot 1 DP 848630, in addition to the small patch of remnant grassy woodland within Lot 262 DP 794245 (indicated in Figure 7 above). Beyond this, one lone *Eucalyptus tereticornis* occurs east from the remnant patch on the edge of the River Oak Open Forest adjacent to Bomaderry Creek. Other scattered Eucalypts occurring within the River Oak Open Forest are *Eucalyptus saligna x botryoides* which is not an indicative or associated species of PCT838.

Photo 21. Illawarra Lowlands Grassy Woodland (ILGW) EEC in proximity to the site

The proposal is therefore unlikely to adversely affect or modify the extent or composition of Illawarra Lowlands Grassy Woodland EEC such that its local occurrence is likely to be placed at risk of extinction.

Part C - In relation to the habitat of a threatened species or ecological community:

(iii) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity

(iv) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

(v) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

No important habitat for threatened species would be removed or otherwise significantly impacted (see Part A).

No EEC would be fragmented or isolated, nor removed or modified to an extent that would affect the long term survival of the EEC occurring in the locality (refer to Part B).

The proposal will therefore not affect the long-term survival of any threatened species or endangered ecological community in the locality.

Part D – Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

No "*areas of outstanding biodiversity values"* have been declared in the City of Shoalhaven.

Part E – Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Clearing of native vegetation is listed as a key threatening process, defined by the Scientific Committee's determination as

> *the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss, or long-term modification, of the structure, composition and ecological function of a stand or stands.*

Clearing of native vegetation has been shown to:

- cause widespread fragmentation of ecological communities;
- reduce the viability of ecological communities by disrupting ecological functions;
- result in the destruction of habitat and loss of biological diversity;
- lead to soil and bank erosion, increased salinity and loss of productive land.

The project has been designed to align with existing cleared land and corridors to minimise the impact to native vegetation and habitat. The proposal as a result, would involve minimal removal of native vegetation to facilitate installation of the proposed sewer infrastructure. Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372. No canopy trees would be removed.

The impact to native vegetation would therefore be very minimal and unlikely to affect foraging habitat for these species.

There would be no destruction of important habitat nor impact to any locally occurring threatened species (see Part 1).

The proposed vegetation clearing would therefore not result in fragmentation of ecological communities or disrupt ecological function.

The impacts of the key threatening process of clearing of native vegetation would therefore be minimised and managed as part of the proposal.

3.3 Threatened species impact assessment (Commonwealth EPBC Act 1999)

A Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Report was generated on 14 October 2020. Of those threatened species and endangered ecological communities reported as likely occurring or having habitat within the area of the report, the following were considered to have potential habitat within the site and require further assessment:

- *Genoplesium baueri* Bauer's Midge Orchid (Endangered)
- *Pterostylis gibbosa* Illawarra Greenhood (Endangered)
- Green and Golden Bell Frog *Litoria aurea* (Vulnerable)
- Large-eared Pied Bat *Chalinobolus dwyeri* (Vunerable)
- Grey-headed Flying-fox *Pteropus poliocephalus* (Vulnerable)
- Illawarra and South Coast Lowland Forest and Woodland ecological community (Critically Endangered)

Additional, highly mobile species including migratory birds may occur occasionally and transiently within the vicinity of the proposed activity but would not be affected by the proposal.

Table 2. EPBC Significant impact assessment

Critically endangered and endangered species - Significant impact criteria Species to consider: **Bauer's Midge Orchid (*Genoplesium baueri*)** **Illawarra Greenhood (*Pterostylis gibbosa*)**	
Criteria	***Assessment***
lead to a long-term decrease in the size of a population	Targeted survey for these species was undertaken in areas of suitable habitat following confirmation of flowering at a nearby reference sites (refer to Section 2.1). Neither species was detected. It was concluded that these species are unlikely to occur within the site. No population of either species would be affected.
reduce the area of occupancy of the species	No
fragment an existing population into two or more populations	No

adversely affect habitat critical to the survival of a species	Potential habitat within the site is considered marginal for Illawarra Greenhood and very marginal for Bauer's Midge Orchid. No populations of either species are known to occur in close proximity to the site.
disrupt the breeding cycle of a population	No
modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372. Other areas of potential vegetation including the vegetated unformed section of Abernethys Lane would be avoided.
result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	No invasive species will be introduced
introduce disease that may cause the species to decline	No disease is likely to be introduced
interfere with the recovery of the species	No
Summary	It is considered unlikely therefore that Illawarra Greenhood and Bauer's Midge Orchid would be impacted by the proposed works and the proposed activity is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population of any of these species is likely to be placed at risk of extinction.
Vulnerable species - Significant impact criteria Species to consider: **Green and Golden Bell Frog (*Litoria aurea*) – (GGBF)** **Large-eared Pied Bat (*Chalinobolus dwyeri*)** **Grey-headed Flying-fox (*Pteropus poliocephalus*) – (GHFF)**	
Criteria	***Assessment***
lead to a long-term decrease in the size of an important population of a species	Survey was undertaken for GGBF in area of potential habitat (Abernethys Creek in the vicinity of Roseville Rd) when species was detectable. GGBF was not detected on site and is considered unlikely to utilise the site. This area of potential habitat does not have connectivity with other potential or known areas of habitat for the species. The nearest records on the northern side of the Shoalhaven River occur over 10km to the east (associated with the Coomondery Swamp GGBF population). The proposal would therefore not impact a population of the species. No roosting and breeding habitat occurs within the site for Large-eared Pied Bat. Native vegetation removal would be minimal and not affect suitable foraging habitat. The proposal would therefore not impact a population of the species.

	No GHFF camps occur in close proximity to the site. The nearest camp currently occurs at Bomaderry Creek / Illowra Wetlands, approximately 1.3km south-west of the southern-most part of the site. No canopy trees would be removed. The impact to native vegetation would therefore be minimal and unlikely to affect foraging habitat for these species. The proposal would therefore not impact a population of the species. No fragmentation of vegetation or severing of movement corridors would occur.
reduce the area of occupancy of an important population	No
fragment an existing important population into two or more populations	No
adversely affect habitat critical to the survival of a species	No important habitat will be impacted
disrupt the breeding cycle of an important population	No
modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Native vegetation removal would be limited to disturbed understorey vegetation and several mature Two-veined Hickory trees east of the Princes Highway through to the APZ south of Emerald drive, including the southern and eastern boundary of Lot 502 DP 1221372. Other areas of potential vegetation including the vegetated unformed section of Abernethys Lane would be avoided. No canopy trees would be removed. The impact to native vegetation would therefore be very minimal and would not significantly impact available habitat for these species.
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	No invasive species will be introduced
introduce disease that may cause the species to decline	No disease is likely to be introduced
interfere substantially with the recovery of the species	No
Critically endangered and endangered ecological communities - Significant impact criteria Ecological communities to consider: **Illawarra and South Coast Lowland Forest and Woodland ecological community**	
Criteria	***Assessment***
reduce the extent of an ecological community	DoEE (2017) defines the "Extent of Occurrence" as: the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of an

	ecological community, excluding cases of vagrancy. This measure may exclude discontinuities or disjunctions within the overall distributions of the ecological community (e.g. large areas of obviously unsuitable habitat). This essentially refers to the National occurrence of an ecological community. The ecological community is known to occur from north of Wollongong to Moruya and inland to the Ettrema IBRA subregion (TSSC 2016). Any impact to the ecological community within the site would therefore not reduce the community's extent.
fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	It is proposed that this area of vegetation would be under-bored to minimise impacts to vegetation and the waterway. If it is not possible to under-bore this location, the construction corridor must be reduced to no more than 5m and all native trees and shrubs retained to every practical extent. The patch of vegetation is open (refer to Photo 20), with the northern part of the patch where the rising main would pass through (over a distance of approx. 26m), containing Paperbarks, one small Rough-barked Apple and no mature Forest Red Gum (Eucalyptus tereticornis) trees. Any impacted vegetation components of the ecological community would be revegetated. The proposal would therefore not fragment the community.
adversely affect habitat critical to the survival of an ecological community	No. See previous response.
modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	No. Sediment and erosion controls would be installed and maintained until completion of works and stabilisation of the site has been achieved to minimise impacts on the watercourse and ecological community associated with erosion and sediment deposition. The works would not affect the hydrology of the site.
cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	No. The patch of vegetation is open (refer to Photo 20), with the northern part of the patch where the rising main would pass through (over a distance of approx. 26m), containing Paperbarks, one small Rough-barked Apple and no mature Forest Red Gum (Eucalyptus tereticornis) trees. Any impacted vegetation components of the ecological community would be revegetated.
cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:	No. See previous response.

-- assisting invasive species, that are harmful to the listed ecological community, to become established, or -- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community	
interfere with the recovery of an ecological community	No.
Summary	It is considered unlikely therefore that Illawarra and South Coast Lowland Forest and Woodland ecological community would be significantly impacted by the proposed works and the proposed activity is unlikely to adversely affect, fragment or modify the extent or composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or its ecological function disrupted.

3.4 Indigenous heritage

Under Section 86 of the NSW *National Parks and Wildlife Act 1974* (NPW Act) it is an offence to disturb, damage, or destroy any Aboriginal object without an Aboriginal Heritage Impact Permit (AHIP). The Act, however, provides that if a person who exercises 'due diligence' in determining that their actions will not harm Aboriginal objects has a defence against prosecution if they later unknowingly harm an object without an AHIP (Section 87(2) of the Act). To this effect, the NSW Department of Environment, Climate Change and Water have prepared the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wale*s (hereafter referred to as the 'Due Diligence Guidelines) to assist individuals and organisations to exercise due diligence when carrying out activities that may harm Aboriginal objects and to determine whether they should apply for an AHIP.

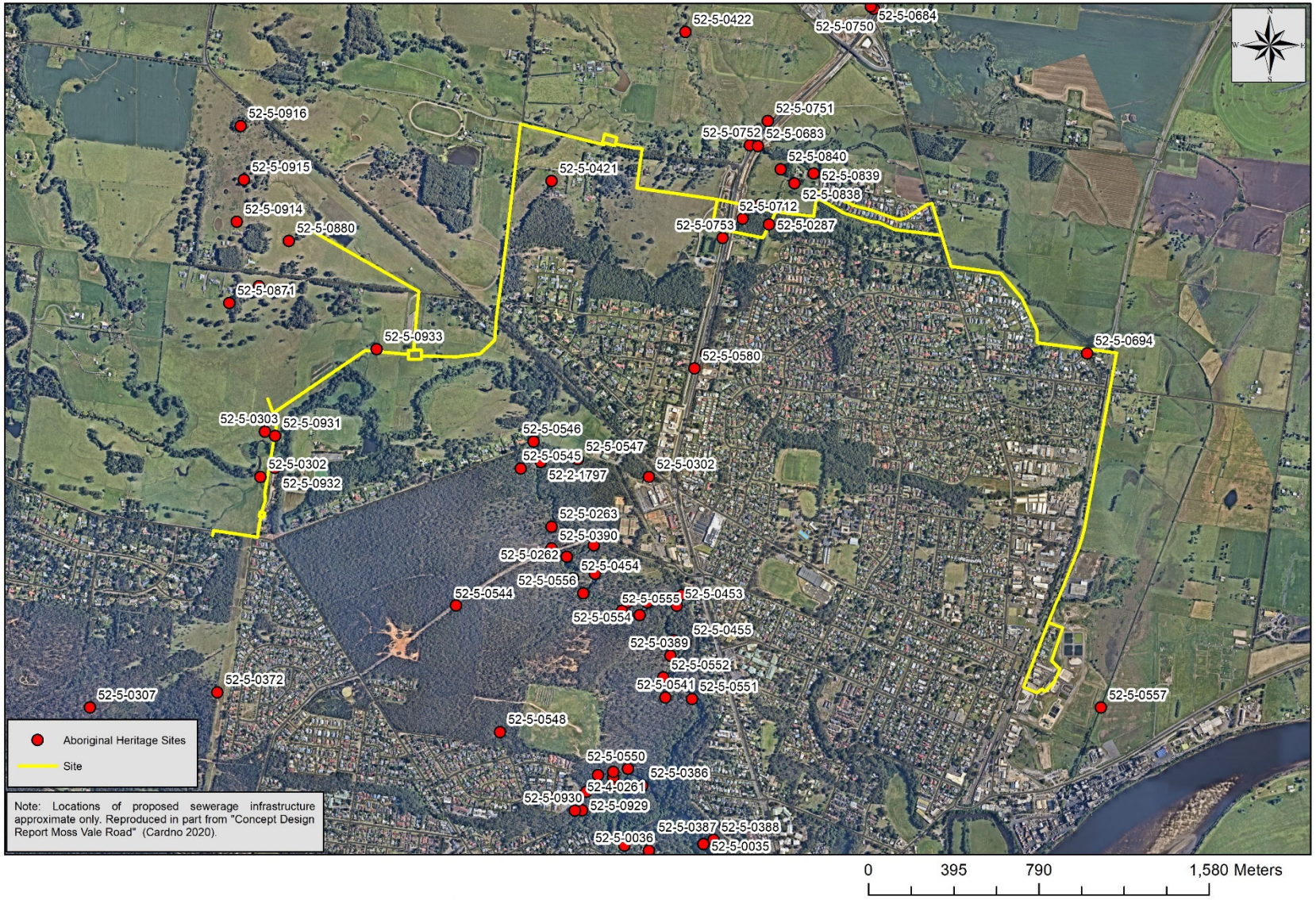
Areas surrounding and in close proximity to the site have been the subject of numerous Aboriginal heritage investigations, including those associated with development of the Princes Highway, the Eastern Gas Pipeline, the Moss Vale Urban Release Areas and the Far North Collector Road. A number of recorded Aboriginal heritage sites are known to occur in proximity to the site as a result of these studies.

Additionally, the site contains landscape features that are regarded as indicating a higher potential for Aboriginal objects, namely:

- Located within 200m of waters,

In accordance with the Due Diligence Guidelines (DECCW 2010), a search on the Aboriginal Heritage Information Management System (AHIMS) on 07 October 2020 indicated that there are at least 39 recorded Aboriginal sites or places, occurring within the locality of proposal (refer to AHIMS extensive report in Appendix C). These sites are mapped in Figure 8 and include records

Figure 8. Locations of recorded Aboriginal heritage sites in proximity to proposed works



that are not in close proximity to the site (e.g. within Bomaderry Creek Nature Reserve) and therefore do not require further consideration.

Table 3 presents the Aboriginal heritage records occurring in close proximity to the proposed works (within 200m) and requiring further assessment as to whether the current proposal poses risk of impact. Site descriptions were obtained from AHIMS site cards acquired in association with extensive search. Map locations from available site cards and reports are presented for relevant sites in Appendix D.

Table 3. Aboriginal heritage records in close proximity to the site

Site reference	Coordinates	Description	Risk of impact
52-5-0287	AGD84 E280360 N6142800	Artefact – open camp site - Abernethys Creek. Scattered artefacts recorded on north facing hill side adjacent to valley floor of minor tributary by K.Officer (NOCH) during investigations for proposed housing subdivision.	**Possible**. The coordinates place the site in close proximity to a rising main alignment. The site description from site card suggests the landscape has been modified since the 1994 record and makes the location difficult to determine. The report associated with the 1994 investigation is not available. Subsequent reports by NOCH (e.g. Navin Officer Heritage Consultants 2013) covering the area, refer to the site but do not add to the description or offer a location map to more clearly define the site location.
52-5-0302	AGD84 E278000 N6141630	Tapitallee (Bomaderry) Creek – low density subsurface artefact scatter between 7cm and 30cm deep, recorded on low creek terrace adjacent to permanent creek by M.Barber & D.Williams during investigations for fibre optic cable installation. Additional artefact recorded by S.Wickman between original site and Tapitallee Creek, during investigations for Eastern Gas Pipeline.	**Possible**. The coordinates and site description place the site at approx. 30m west of the proposed rising main alignment, running north from the New SPS21. The site description however, suggests vaguely that the site may be up to 200sq.m, potentially placing the site within the footprint of the proposed works.
52-5-0303	AGD84 E278020 N6141840	Tapitallee (Bomaderry) Creek – two subsurface artefacts 150m apart each at no greater than 10cm deep, recorded on low creek terrace adjacent to permanent creek by M.Barber & D.Williams during investigations for fibre optic cable installation. A single additional artefact at 11-20cm deep recorded by S.Huys between original site and Tapitallee Creek, during	**Possible**. The coordinates and site description place the site at approx. 47m west of the proposed rising main alignment, running north from the New SPS21. The site description however, suggests vaguely that the site extends for 150m, potentially placing the site within the footprint of the proposed works.

Site reference	Coordinates	Description	Risk of impact
		investigations for Eastern Gas Pipeline.	
52-5-0421	AGD84 E279350 N6143000	Artefact scatter recorded approximately 170 metres from Bells Lane along the easement by S.Wickman during investigations for the Eastern Gas Pipeline.	None. Sewer pipe alignment would be 170m from the record site.
52-5-0557	AGD84 E281896 N6140560	Canyon shelter – description places site in Bomaderry Creek gorge.	None. Heritage site does not occur in close proximity to the proposed works. Coordinates were incorrectly recorded.
52-5-0694	GDA94 E281938 N6142393	Artefact – Edwards Ave. A single artefact located beneath a tree on a small patch of exposure within one metre to the north of an east-west running property boundary fence in Bomaderry. Approximately 30 metres to the ENE of the northwestern end of Roseville Road; and 40 metres to the south of Abernethys Creek. J.Symons during investigations for the Sewer Pump Station works.	**Low**. The remains of the tree are visible, occurring on the southern side of the fence. The proposed rising main alignment would occur approx. 5m on the north side of the fence. The heritage site shall be located and identified with hi-visibility para-webbing or similar to avoid potential impact during works.
52-5-0712	GDA94 E280341 N6143016	PASA 52 – Identified during investigations into the Berry to Bomaderry Princes Hwy upgrade by A.Cressey (Navin Officer Heritage Consultancy). PASA extents both east and west of the current Princes highway alignment, adjacent to Abernethys creek, 200m south of Abernethys Lane likely having a low artefact incidence on this landform, indicated by adjacent site 52-5-0287. Excavations at PASA52 confirmed the presence of subsurface Aboriginal artefacts. These artefacts were located in two areas, now identified as Aboriginal sites G2B A61, as well as an extension of existing site Abernethy's Creek 1. Site G2B A61 had a low density of artefacts resulting in its	Potential Archaeological Sensitive Area (PASA). Refer to PAD “G2B A61” and PAD “Abernethys Creek” below.

Site reference	Coordinates	Description	Risk of impact
		archaeological significance being assessed as low - at the local level. No further works have been recommended for this site prior to construction impacts. Abernethy's Creek 1 was assessed to be of moderate local archaeological significance given the previous presence of surface artefacts at this site, as well as the subsurface artefact uncovered during these excavations. No further works have been recommended for this site prior to construction impacts, due to the fact that no artefacts were uncovered within the area of impact from the project.	
52-5-0753	GDA94 E280248 N6142928	PAD "G2B A61" – Identified during investigations into the Berry to Bomaderry Princes Hwy upgrade by A.Cressey (Navin Officer Heritage Consultancy). Archaeological significance of site assessed as low at local level due to low artefact density of subsurface archaeological deposits. A single artefact found at one location out of eight test pits.	**Low**. Potential Archaeological Deposit (PAD) within which, comprehensive test pitting was undertaken. Rising main alignment would pass approx. 37m to the north of the site, which appears to have been destroyed by the Princes Hwy upgrade under Permit 3791.
52-5-0754	GDA94 E280423 N6143083	PAD "Abernethys Creek" – Identified during investigations into the Berry to Bomaderry Princes Hwy upgrade by A.Cressey (Navin Officer Heritage Consultancy). Was considered moderate archaeological significance at local level, but of less research potential than other sites situated on similar landforms within the study area.	**Possible.** Potential Archaeological Deposit (PAD) within which, little test pitting has been undertaken. Site record 52-5-0287 occurs in this area.
52-5-0838	GDA94 E280581 N6143181	Artefacts. Two surface artefacts, no subsurface artefacts (Biosis 2016).	None. Heritage site occurs on northern side of Abernethys Creek at least 110 to 140m from proposed works.

Site reference	Coordinates	Description	Risk of impact
52-5-0839	GDA94 E280671 N6143226	Artefacts – subsurface artefact scatter recorded on C130 Princes Hwy across crest landform ~15m from tree-line in north-eastern paddock from house by J.Cole (Biosis) during investigation for residential subdivision.	None. Heritage site occurs on northern side of Abernethys Creek approx. 90m north of proposed works.
52-5-0840	GDA94 E280517 N6143246	Artefacts – subsurface artefact scatter recorded on C130 Princes Hwy across crest landform ~10m from tree-line in north-western paddock from house by J.Cole (Biosis) during investigation for residential subdivision.	None. Heritage site occurs on northern side of Abernethys Creek approx. 198m north of proposed works.
52-5-0931	GDA94 E278174 N6142011	Artefact – Bomaderry Creek. Low density, sub-surface artefact scatters at 10-30cm deep, recorded during archaeological investigations for the proposed FNCR by S. Feary (2019).	**Possible**. The proposed rising main running north from New SPS21, would pass in close proximity to the record (within 5m) which represents four test pits with low-density sub-surface artefact scatters at 10-30cm deep. At the time of works the artefacts would be covered by the Far North Collector Road (subject to approval of current AHIP application for Far North Collector Road) with the proposed rising main parallel to the western side of the road. The very close proximity however, creates a risk of impact.
52-5-0932	GDA94 E278172 N6141863	Artefact – Bomaderry Creek. Low density, sub-surface artefact scatters at 10-30cm deep, recorded during archaeological investigations for the proposed FNCR by S. Feary (2019).	**Possible (low likelihood)**. Rising main running north from New SPS21, at the time of works the artefact would be covered by the Far North Collector Road (subject to approval of current AHIP application for Far North Collector Road). The proposed rising main would run parallel to the western side of the road, at least 25m from the record and therefore be unlikely to impact the heritage site.
52-5-0933	GDA94 E278645 N6142413	Artefact – Paleochannel. Low density, sub-surface artefact scatters at 10-30cm deep, recorded during archaeological investigations for the proposed FNCR by S. Feary (2019).	**Possible**. The proposed rising main running connecting New SPS21 and MVRS SPS, would pass in close proximity to the record. At the time of works the artefacts would be covered by the Far North Collector Road (subject to approval of current AHIP application for Far North Collector Road) with the proposed rising

Site reference	Coordinates	Description	Risk of impact
			main parallel to the road. The very close proximity however, creates a risk of impact.
52-5-0880	GDA94 E278238 N6142914	Artefact (rotated chert core) within upper branches of tributary and potential archaeological deposit on landform between two tributaries. Artefact was recorded approx. 125m from the proposed alignment and PAD was entirely within Lot 1 DP 949932. Note that subsequent investigation (*Biosis 2019*) concluded that the PAD does not constitute a site.	**Low likelihood of impact with current proposal, but potential for impact with future connection.** Artefact is 125m from the proposed alignment and PAD is entirely within Lot 1 DP 949932. The rising main would not continue into Lot 1 DP 949932 as part of the current proposal, however, connection to the MVR South URA may result in impact to the PAD.

In consideration of the potential for Aboriginal heritage within the footprint of the proposed infrastructure works, consultant archaeologist Dr Sue Feary was engaged by Council to undertake an Aboriginal cultural heritage due diligence assessment (Feary 2020) and provide recommendations for mitigation.

Feary identified areas of archaeological potential with consideration of landscape position, proximity to water, landform and level of disturbance, assigning a rating of very low, low or medium potential for each survey unit assessed (refer to Table 4, Feary 2020). Most of the areas identified as having archaeological potential have been avoided through redesign of the infrastructure alignments.

The survey unit areas considered by Feary to have a medium potential for archaeological potential where conflict remains with the current design alignment includes:

- Survey Unit 13: Pressure main from SPS08 to Princes Hwy (low flat terraces associated with Abernethys Creek)
- Survey Unit 16: North Nowra Diversion (Bomaderry Creek / Tapitallee Creek terraces and flats in the vicinity of the future Far North Collector Road bridge)

In the vicinity of Survey Unit 13, impact to known and potentially occurring artefacts shall be avoided through design refinement and construction methodology (refer to Section 3.4.1).

In the vicinity of Survey Unit 16, site constraints and uncertainty regarding the extent of heritage items limit the ability to ensure avoidance of known and potentially occurring artefacts. It is considered that impact to Aboriginal artefacts in this area cannot be avoided and that an Aboriginal Heritage Impact Permit (AHIP) will be required.

An existing AHIP application and associated Aboriginal Cultural Heritage Assessment Report (ACHAR) by Sue Feary (2019), for impact to sites along the proposed Far North Collector Road alignment (including sites 52-5-0302, 52-5-0303, 52-5-0931, 52-5-0932) is currently being revised

to include potential impacts to these sites associated with the current sewerage infrastructure proposal.

3.4.1 Mitigation of impacts to known Aboriginal heritage sites and sensitive areas

Potential for impact to a number of Aboriginal heritage sites and sensitive areas as a result of the proposed sewage infrastructure works has been identified.

Recommended options for mitigation (from Feary 2020) include the following:

1. Redesign the proposal to ensure the locations of all previously recorded sites are not impacted, and proceed with caution. Works must cease if objects are encountered during development.

Note: The sites have no visible expression as there is no ground visibility and they are mostly subsurface artefacts which have since been removed. Avoidance will be based on grid coordinates with a 5 metre buffer or by underboring to a depth no less than 400 mm.

Justification for this option arises from the considerable amount of archaeological investigation in the north Nowra region that has demonstrated the presence of a very low density of stone artefacts across the landscape, most buried by post-European sediment deposition. Sites tend to be associated with present and prior drainage lines. Even intensive test pitting has revealed only very small amounts of archaeological material.

It could be argued that sufficient test pitting has been done and that any further test pitting would be unlikely to contribute any new information and therefore would not be in accordance with Section 3.1 of the OEH code of practice, viz.

> Archaeological test excavation will be necessary when it can be demonstrated ….that sub-surface Aboriginal objects with potential conservation value have a high probability of being present in an area, and the area cannot be substantially avoided by the proposed activity. The test excavations permitted by this Code are limited in their scope as described below. The first priority in test excavations, and recording Aboriginal objects during test excavations, must always be to avoid or minimise, as far practicable, the risk of harm to the objects under investigation.

2. As above but additionally, avoid areas specified in this report as having medium archaeological potential. This reduces the risk of encountering objects during construction. In this instance, avoidance includes the technique of underboring to a depth no less than 400 mm.

The basis for this option is that the development may impact subsurface artefacts, most likely within areas identified as having archaeological potential, given the known nature and extent of the archaeological evidence. The basis for not undertaking any additional investigation such as test pitting is that there has already been a considerable amount of test pitting across the same landforms affected by the proposed development, leading to a loss of the physical heritage. Without exception these have produced low numbers of artefacts, whose analysis has so far not changed the models of pre-contact Aboriginal occupation and use developed in 2007.

3. Undertake a test excavation program at some or all of the locations identified in Table 4 of this report, using the methodology outlined in Appendix 3 and either seek an AHIP or underbore any sites that are found.

Locations and numbers of test excavations should be refined by prior careful field checking of all locations. Landforms previously unsurveyed, such as those in the northwest of the study area should have higher priority as they may reveal new information. SU10, adjacent to Bomaderry Creek is also a priority due to the large numbers of sites found further downstream. Table 4 assigns priorities to areas of archaeological potential.

4. Combine Options 2 and 3 and conduct test excavations at high priority locations only. Remaining locations of archaeological potential could be underbored.

This is the preferred option of the consultant archaeologist as it maximizes return of useful information for test excavation effort and avoids damage to the remaining areas of archaeological potential.

Redesign of the proposal to avoid previously recorded sites and sensitive areas has been undertaken as far practical and achieves avoidance of most areas.

Recommended mitigation measures are presented for the remaining sites and areas to minimise risk of impact and ensure compliance with the *National Parks and Wildlife Act 1974.*

Sites 52-5-0287 and 52-5-0754

52-5-0287 (AGD84: E280360 N6142800) and 52-5-0754 (GDA94: E280423 N6143083) are both associated with Abernethys Creek, occurring east of the Princes Highway, following the depression in the landscape associated with Abernethys Creek, to the south of Emerald Drive. The area was identified as a Potential Archaeological Deposit and was confirmed by Feary (2020) as an area of archaeological potential.

Given the somewhat ambiguous nature of the records, precise identification to ensure avoidance of these sites is not possible.

Under-boring to a depth no less than 400 mm, is proposed through the area covered by the “Abernethys Creek” PAD (52-5-0754) to avoid impact to this area and ensure avoidance of site 52-5-0287 (refer to Figures 9 and 10). Under-boring is already proposed for the low flat terrace area associated with Abernethys Creek east of Meroo Rd where the alignment deviates away from existing disturbed and modified landforms. The area parallel to the southern side of Emerald Drive is disturbed and modified, in addition to forming part of the drainage line, which Feary (2020) notes would have no potential for containing Aboriginal sites. Under-boring shall involve monitoring of excavation for entry and exit pits where required, by Nowra Aboriginal Land Council Aboriginal Heritage Site Officers.

Figure 9. Location of "Abernethys Creek" PAD (from Navin Officer Heritage Consultants 2013)

Figure 10. Proposed under-boring area to avoid impact to Aboriginal sites associated with Abernethys Creek (PADs reproduced from Navin Officer Heritage Consultants 2013)

Site 52-5-0694

52-5-0694 (GDA94: E281938 N6142393) refers to a single artefact in the vicinity of SPS08 off Roseville Rd (near Edwards Avenue).

The remains of the tree where the artefact was located are visible, occurring on the southern side of the fence. The proposed rising main alignment would occur approx. 5m on the north side of the fence.

It is recommended that this heritage site shall be located and identified with hi-visibility para-webbing or similar to avoid potential impact during works.

Site 52-5-0753

52-5-0753 (GDA94: E280248 N6142928) refers to PAD "G2B A61" identified during investigations into the Berry to Bomaderry Princes Hwy (refer to Figure 10 above).

It is recommended that this heritage site shall be located and identified with hi-visibility para-webbing or similar to avoid potential impact during works.

Site 52-5-0880

52-5-0880 (GDA94: E278238 N6142914) refers to an artefact (rotated chert core) within upper branches of tributary and potential archaeological deposit on landform between two tributaries.

The site shall be located and identified with hi-visibility para-webbing or similar to avoid potential impact during works.

It should be noted that there is potential for impact with future connection to the MVR South URA within Lot 1 DP 949932. Refer to Figure D-8 in Appendix D, noting that subsequent investigation (Biosis 2019) concluded that the PAD does not constitute a site.

3.5 Non-indigenous heritage

No items of local heritage significance or any items on the State Heritage Register or listed in the Shoalhaven Local Environmental Plan occur in close proximity to the site such that the proposed works might impact them.

3.6 Flood liable land

Land within the site associated with Bomaderry Creek and the lower Shoalhaven River floodplain is mapped as being flood liable (refer to Figure 11).

Consultation with the Council's Floodplain Engineer team occurred during the design development phase.

With regard to the construction of subsurface sewer infrastructure, i.e. the rising and gravity mains, it is considered that the proposal will not change flood patterns or local flood behaviour, or lead to an increased risk associated with flooding.

With regard to the proposed sewer pump stations, two (New SPS21 and MVRN SPS) occur outside the mapped areas of flood liable land.

Rhelm (2018) mapped high hazard floodway associated with Abernethys Creek occurring in close proximity to the MVRN SPS site and a broad floodway (at 1% AEP) covering much of the unformed section of Abernethys Rd which would provide access from Bells Lane. Shoalwater has considered and accepts that access to the SPS during flood events may be restricted and notes that this would not affect operations during such times.

The proposed MVRS SPS occurs within mapped flood liable land. Consultation under Part 2, Division 1 of the Infrastructure SEPP is therefore required for this structure.

The project was referred to Council's Floodplain Officers for review on 19 October 2020. Responses received (D21/132554, D21/132547 and D21/136692) provided 1% AEP Flood levels for the SPS locations as shown in Table 4 and the recommendation that electrical switchboards are located with 500mm freeboard above the 1% AEP levels.

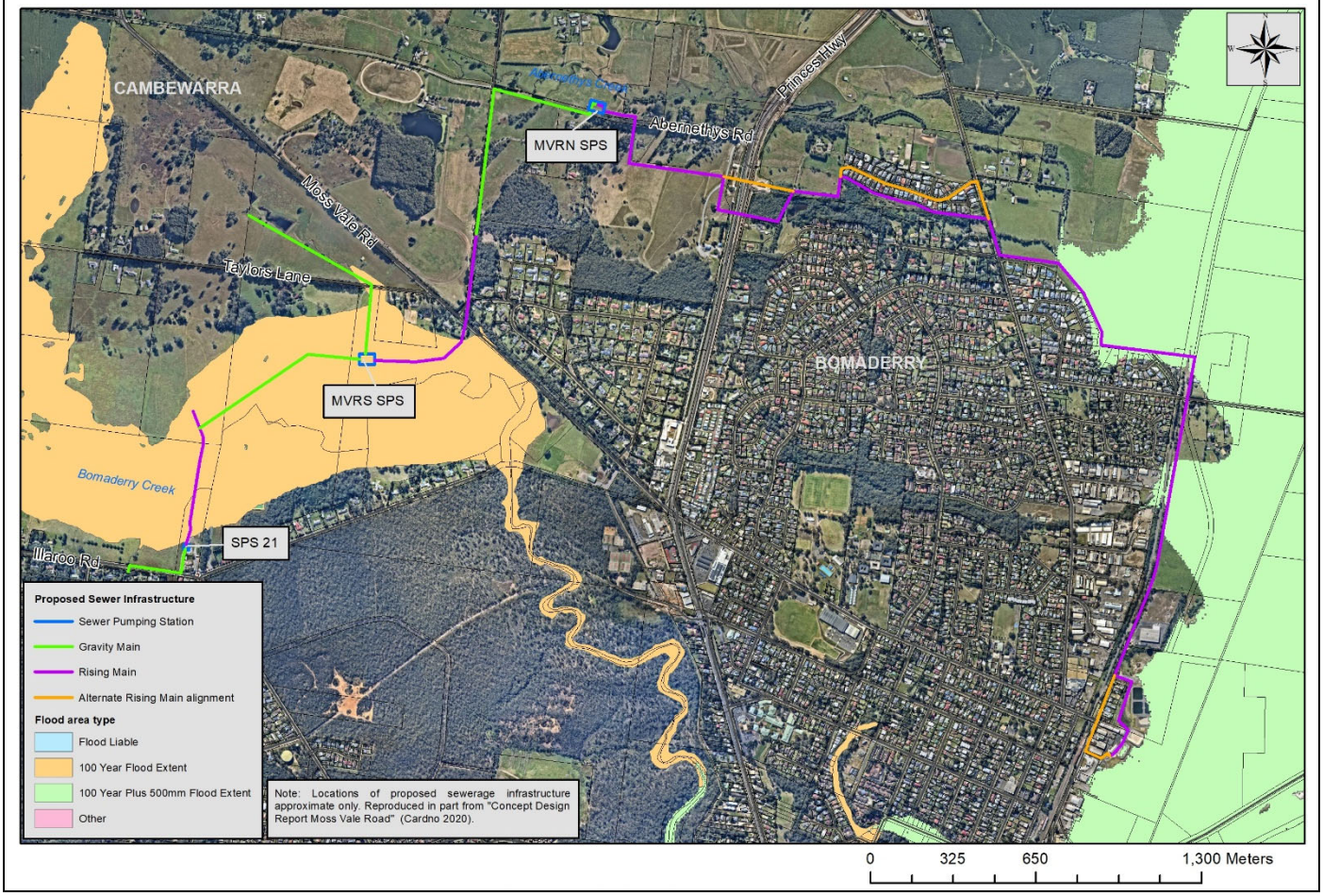
Table 4. Flood Planning Levels (FPL) and 1%AEP for proposed Sewer Pump Station (SPS) locations (Note that levels for MNRN SPS have been estimated, not modelled)

Sewer Pump Station	1%AEP	FPL
MVRN SPS (Lot 2 DP 1134376)	18.6m AHD (estimated)	19.1m AHD (estimated)
MVRS SPS (Lot 262 DP 794245)	33.5m AHD	35.0m AHD
New SPS21 (Lot 1 DP 848630)	38.6m AHD	39.1m AHD

General recommendations include:

- electrical switchboards are located with 500mm freeboard above the 1% AEP levels (i.e. above flood planning levels);
- bunding to the FPL to be installed around hazardous chemical storage areas and dosing plants;
- use of flood compatible materials below the FPL;
- structural soundness;
- reliable access in a 1% AEP event;
- hydraulic impact assessment.

Figure 11. Flood liable land in proximity to the site



Additional comments regarding MVRS SPS:

The current FNCR design provides a raised roadway with a 10% AEP flood immunity and minimum 300 mm of freeboard. The peak water surface elevations associated with the 1% AEP flood event are approximately 300 mm higher than the 10% elevations, so the design levels for the roadway effectively represent 1% AEP flood immunity without freeboard with the exception of the two overflow locations which are located to the west of the Taylors Lane connection road roundabout. Hence the proposed SPS near this roundabout should be able to be accessed during a 1% AEP flood event if required.

Tanvir has already provided 1% AEP event flood levels in the location of the proposed SPS sites. It is noted from the REF that all electrical cabinets are proposed to be provided at least 300mm above the 1% AEP event maximum flood level which is supported. It is noted that we typically adopt a 500mm freeboard above the 1% AEP event flood level as standard condition for which electrical installations shall be installed above, so you may want to adopt a higher freeboard in these locations, especially given that some afflux may occur due to the FNCR construction.

It is understood that the SPS near the FNCR / Taylors Lane connection road roundabout will be located on an approx. 60x40m site which is built up above flood levels. Based on the flood mapping in the attached memo, this location does not have high flow velocities, has a low flood hazard (depth x velocity) and no floodwater is expected to overtop the FNCR from the north in a 1% AEP event. Hence this location seems appropriate for the proposed SPS. The

significant size of the fill platform in this location will have some impact on floodwaters conveyed in this location, although this should hopefully be minor. It is recommended that the proposed fill extent in this location is included in the flood model to identify if there are any potential adverse impacts. This task would be relatively quick and easy and could be undertaken by the FNCR flood consultant as a small variation. Please let me know if you are happy to proceed with this and we can request a fee from the consultant to investigate this further.

Further consultation with Council's Floodplain Engineers shall occur during the detailed design phase for all proposed works in flood liable areas.

3.7 Riparian corridors

The site contains a number of riparian corridors associated with Bomaderry Creek and Abernethys Creek (refer to Figure 12).

The proposal would not involve removal of trees or significant vegetation from the banks of any creeks or elsewhere within the riparian corridors.

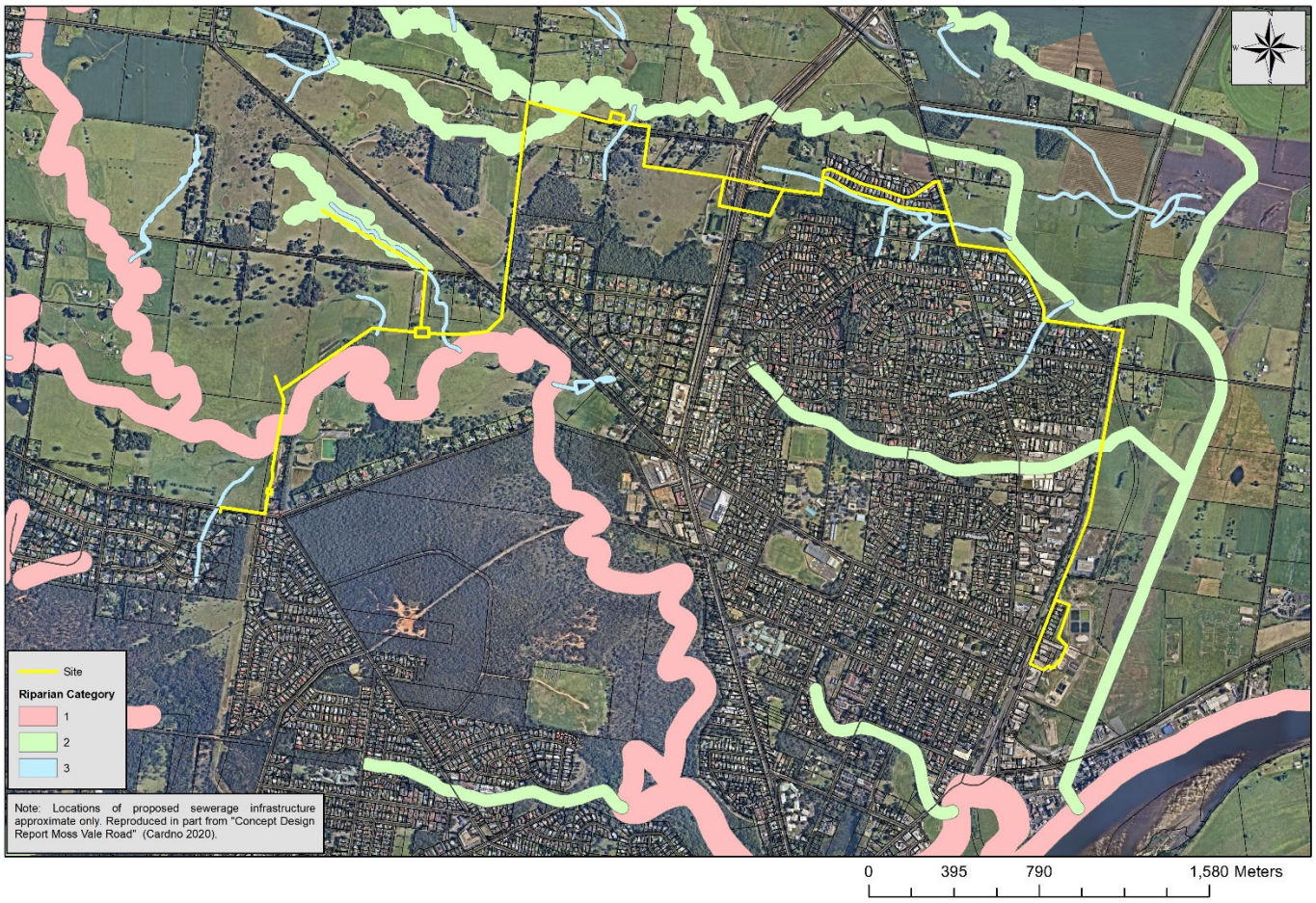
In most instances where the alignment of rising or gravity mains would intersect a waterway, under-boring would be utilised to avoid disturbance to the riparian corridor. The only exceptions to this are Bomaderry Creek north of New SPS21 where the rising main would be attached to the side of the Far North Collector bridge and Bells Lane where the watercourse associated with the Category 2 riparian corridor is poorly defined, open grassed swale within paddocks, and containing no treed vegetation.

The proposed Rising Main running north-west from Taylors Lane, providing future connection to MVR South URA would occur within a Category 2 riparian corridor containing scattered native and exotic trees. It is anticipated that all trees would be avoided. If construction of the Rising Main in this location requires trenching, sediment and erosion controls shall be implemented, works shall be scheduled to avoid moderate to heavy rain (i.e. exceeding 50mm in a 3-day period) and the excavation shall be filled and stabilised as the construction progresses with no more than a 50m section open at one time.

Works would therefore not compromise the integrity of creek banks, nor the function of any riparian corridor in providing habitat connectivity.

Erosion and sediment controls would be installed to manage potential erosion where works occur in the vicinity of creeks and watercourses.

Figure 12. Riparian corridors within and in proximity to the site



3.8 Key Fish Habitat

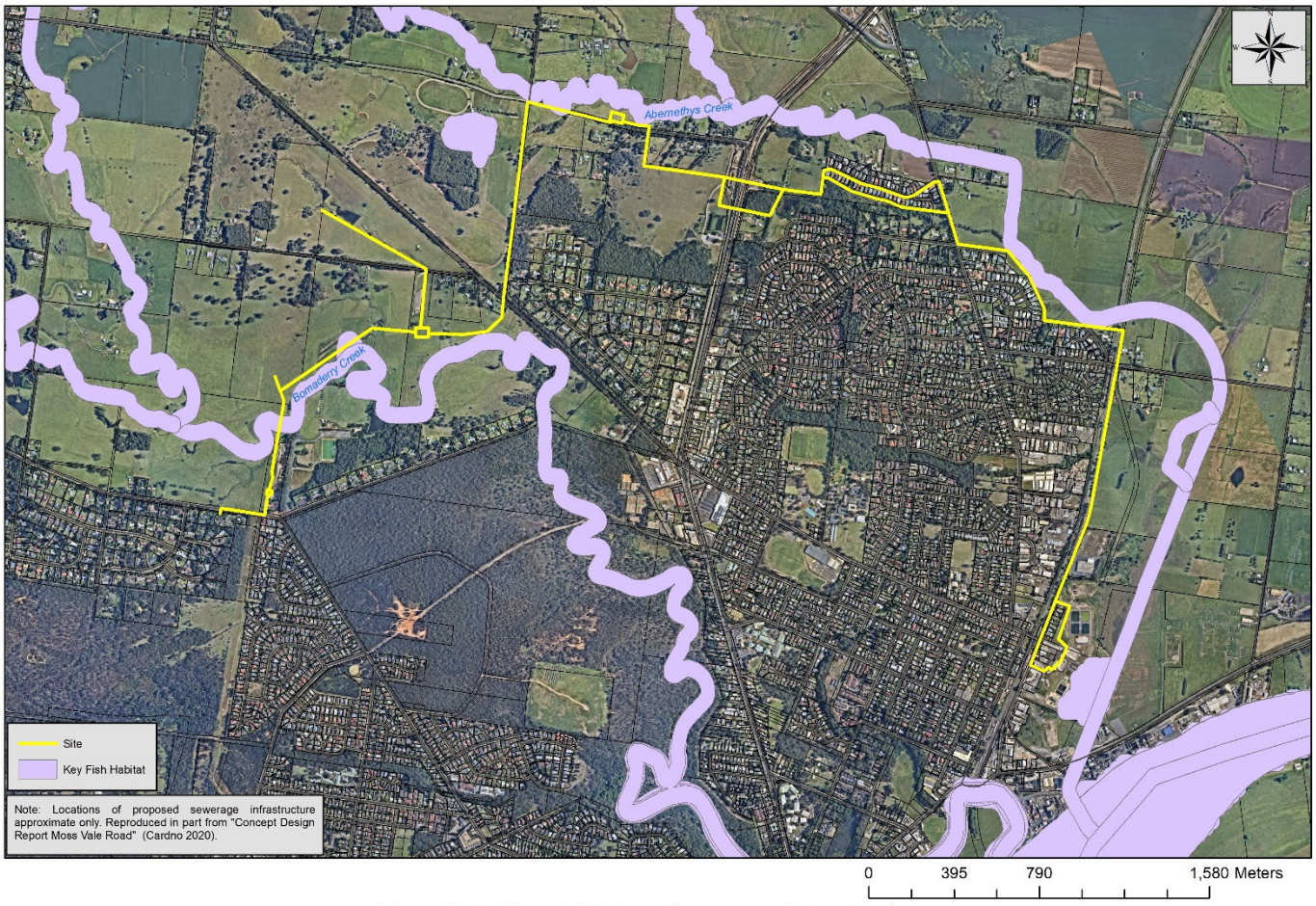
Key Fish Habitat, mapped for the purpose of the *Fisheries Management Act 1994* occurs within and in close proximity to the site, associated with Bomaderry Creek and Abernthys Creek as shown in Figure 13 below.

The footprint of the proposal would encroach into the mapped Key Fish Habitat in four locations: the Bomaderry Creek / Far North Collector Road crossing; a low lying watercourse associated with Bomaderry Creek along the Far North Collector Road alignment, west of proposed MVRS SPS; along the unformed section of Abernethys Rd, east of Bells Lane and adjacent to Abernethys Creek; and the north-eastern corner of the proposal in the vicinity of Appleberry Close, Roseville Rd and Abernethys Creek.

It is anticipated that in most cases, underboring can be employed to avoid excavation affecting Key Fish Habitat.

Where excavation within mapped Key Fish Habitat is required, a DPI Fisheries Permit will be required.

Figure 13. Key Fish Habitat mapped as occurring in proximity to the site



Moss Vale Road URAs - Sewerage Infrastructure

3.9 Acid Sulfate Soils

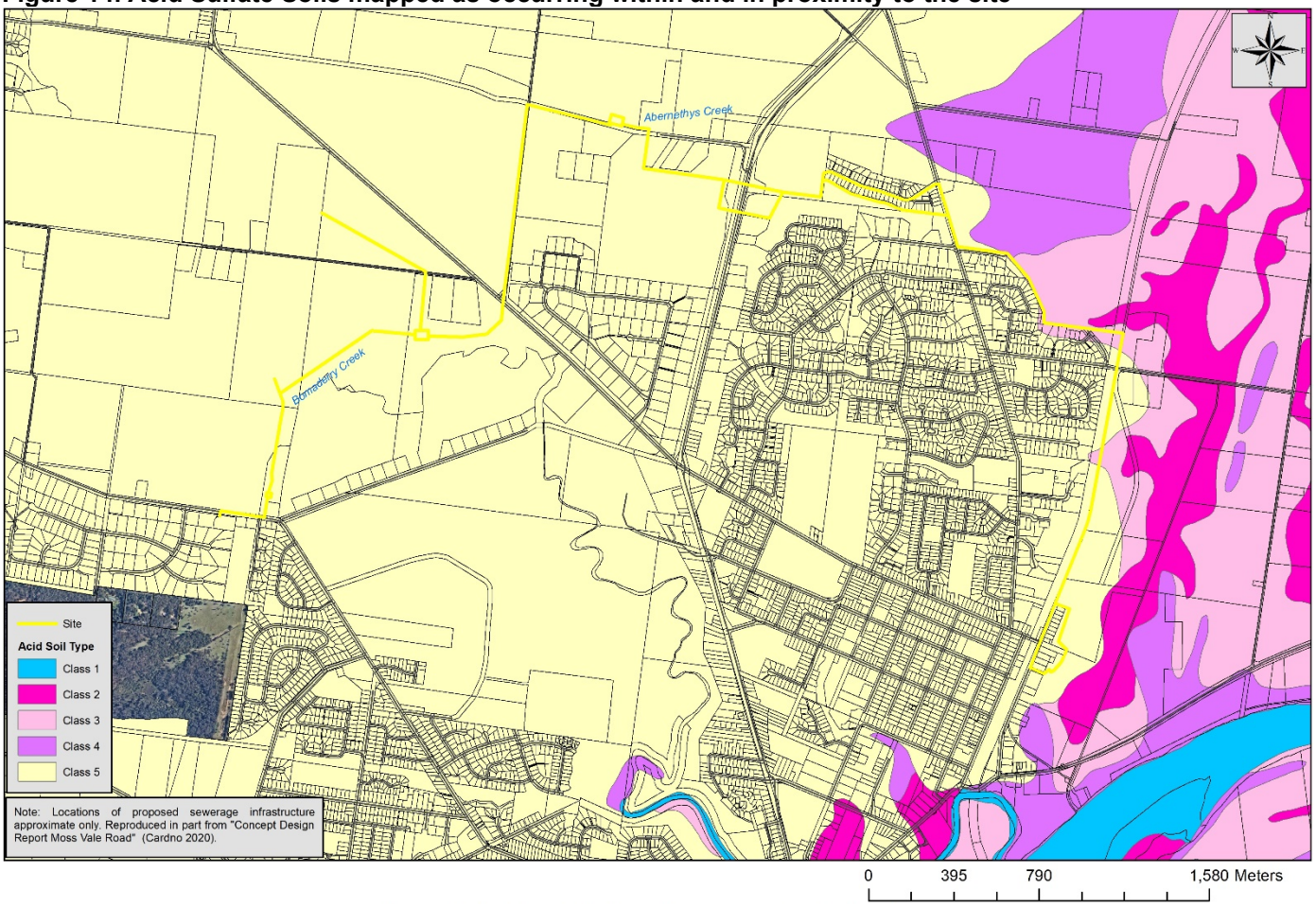
Most of the site is mapped as Class 5 Acid Sulfate Soils. On the eastern and north-eastern edges, between Meroo Rd and Railway St in the vicinity of Abernethys Creek, the rising main alignment would cross areas mapped as Class 4 and Class 3 Acid Sulfate Soils.

The *Shoalhaven Local Environment Plan 2014* indicates that a risk of A.S.S exposure exists for Class 4 A.S.S where works would occur more than 2m below the natural ground surface, or where works would involve lowering of the watertable more than 2m below the ground surface. A risk of A.S.S exposure exists for Class 3 A.S.S where works would occur more than 1m below the natural ground surface, or where works would involve lowering of the watertable more than 1m below the ground surface.

From Chainage 2400 to 3250 in Class 3 and Class 4 A.S.S., depth of excavation would range from 0.93 to 3.37m (frequently greater than 2m) and from Chainage 3700 to 3800 in Class 3 A.S.S, depth of excavation would be 1.35m. In these areas, sampling and analysis will be required to

determine the need for an Acid Sulfate Soil Management Plan and inform the plan if management and treatment of excavated soil is required.

Figure 14. Acid Sulfate Soils mapped as occurring within and in proximity to the site



3.10 EP&A Regulation – Clause 228 matters of consideration

Clause 228(2) of the *Environmental Planning and Assessment Regulation 2000* lists the factors to be taken into account when consideration is being given to the likely impact of an activity on the environment under Part 5 of the EP&A Act. The following assessment in Table 5 deals with each of the factors in relation to the proposed activity.

Table 5. Clause 228 Matters of consideration

Does the proposal:	Assessment	Reason
a) Have any environmental impact on a community?	Positive	The proposal is to construct sewer infrastructure to facilitate provision of sewage services to the Moss Vale Road urban release areas. The proposal has been designed to align with existing cleared and disturbed areas to every practical extent, to

		have minimal risk of impact to Aboriginal cultural heritage and sensitive environmental areas, requiring minimal vegetation clearing, and minimal disturbance to watercourses and riparian corridors. The proposed activity would not have any impact on other community services and infrastructure such as water, waste management, educational, medical or social services.
b) Cause any transformation of a locality?	Low adverse	The proposal would result in the construction of three sewer pump stations within land formerly of agricultural use. The location of these pump stations will be preceded by the development of Far North Collector Road and will be associated with the future development of the Moss Vale Road Urban Release Areas however. In this context, the impact on the locality of the current proposal will be negligible. The locality's current use would otherwise remain unchanged. The rising and gravity mains would be subsurface except where attached to the side of the Far North Collector – Bomaderry Creek bridge. Valves would be unobtrusive. Vegetation removal would be minimal and primarily in previously cleared and modified areas.
c) Have any environmental impact on the ecosystem of the locality?	Low adverse	The five-part test of significance (Section 3.2) concludes that the proposed activity would not have a significant impact upon endangered ecological communities. No hollow-bearing trees, threatened flora species, rocky outcrops, caves or water bodies would be removed or otherwise impacted. No food resources critical to the survival of a particular species would be removed. Aquatic ecosystems are not likely to be affected by the proposed activity and there is not likely to be any long-term or long-lasting impact through the input of sediment and nutrient into the ecosystem (refer to Section 3.1) Environmental safeguards and mitigation measures (Section 6) would be employed to minimise risk of impacts.
d) Cause a diminution of the aesthetic, recreational,	Low adverse	Impact to the recreational, scientific and environmental values of the site would be negligible.

scientific or other environmental quality or value of a locality?		Impact to the aesthetic values of the locality would be negligible for subsurface mains. The construction of the sewer pump stations may detract from the aesthetics of the current rural locality, but in the context of the development of the Far North Collector Road and Moss Vale URAs, this would be minor.
e) Have any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific, or social significance or other special value for present or future generations?	Low adverse	The site of the proposed activity has no significant aesthetic, architectural, cultural, historical or scientific values. As such, the proposed activity would have no significant impact on these items. No items in the vicinity of the work site which are listed on the State Heritage Register and the Shoalhaven Local environmental Plan would be impacted by the proposal. The site is not within an Aboriginal Place declared under the *National Parks and Wildlife Act 1974.* In accordance with the NSW Department of Environment, Climate Change and Water's Due Diligence Code of Practice, the proposed activity would either avoid potential harm to Aboriginal heritage sites, or where impossible to avoid, would be undertaken in accordance with an Aboriginal Heritage Impact Permit.
f) Have any impact on the habitat of protected fauna (within the meaning of the Biodiversity Conservation Act 2016)?	Low adverse	No important habitat would be removed or otherwise impacted as part of the proposal. Habitat corridors would not be severed. Barriers to fauna movement and new threats to fauna would not be introduced. Mitigation measures (Section 6) will reduce risks further.
g) Cause any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?	Low adverse	The five-part test of significance, provided in Section 3.2 above, concludes that the proposed activity would not have a significant impact upon threatened fauna. No potentially important habitat or food resources for locally occurring threatened species would be removed or otherwise impacted by the proposal. No hollow-bearing trees, threatened flora species, rocky outcrops, caves, crevices or water bodies would be

		removed or otherwise impacted. No food resources critical to the survival of a particular species would be removed.
h) Have any long-term effects on the environment?	Negligible	The proposed activity would not use hazardous substances or use or generate chemicals which may build up residues in the environment. SPS overflows would be managed in accordance with an EPA licence and would disperse any overflow to a grassed/vegetated swale to minimise wastewater impact to waterways. Minimal maintenance corridors (approx. 5m wide) would be retained long-term, but these are primarily in areas where vegetation growth is prevented (e.g. roadsides and existing cleared areas) and would not affect the potential for future significant habitat.
i) Cause any degradation of the quality of the environment?	Low-adverse	The environmental safeguards (Section 6) to be undertaken would minimise impacts and risks to the quality of the environment. No significant habitat would be removed or otherwise impacted. Works would be undertaken almost entirely through previously cleared and modified land. The proposal would not intentionally introduce noxious weeds, vermin, or feral animals into the area or contaminate the soil.
j) Cause any risk to the safety of the environment?	Negligible	The proposal would involve trenching across relatively flat land and under-boring to avoid impacts to waterways and riparian corridors. Excavation within the watercourse for creation of access to MVRN SPS would be in accordance with a Fisheries Permit and would involve sediment and erosion controls in accordance with the “Blue Book”.
k) Cause any reduction in the range of beneficial uses of the environment?	Negligible	The site and local environment will remain relatively unchanged. The footprint of the sewer pump stations in the context of the site and the locality is negligible.

l) Cause any pollution of the environment?	Low adverse	The proposal would involve a temporary and local generation of noise. However, this is not anticipated to negatively affect any sensitive receivers such as schools, childcare centres and hospitals. It is unlikely that the activity (including the environmental impact mitigation measures) would result in spillages, dust, odours, vibration or radiation. The proposal does not involve the use, storage or transportation of hazardous substances or the use or generation of chemicals which may build up residues in the environment. SPS overflows would be managed in accordance with an EPA licence and would disperse any overflow to a grassed/vegetated swale to minimise wastewater impact to waterways.
m) Have any environmental problems associated with the disposal of waste?	Low adverse	The project would facilitate provision of wastewater disposal and treatment services for the Moss Vale URAs. SPS overflows would be managed in accordance with an EPA licence.
n) Cause any increased demands on resources (natural or otherwise) which are, or are likely to become, in short supply?	Low adverse	The amount of resources that would be used are not considered significant and would not increase demands on current resources such that they would become in short supply.
o) Have any cumulative environmental effect with other existing or likely future activities?	Low adverse	The assessed low adverse or negligible impacts of the proposal are not likely to interact. The low adverse impacts to water quality as a result of this project may contribute to cumulative water quality degradation in Bomaderry Creek and Abernethys Creek, in conjunction with development of the Far North Collector Road and Moss Vale Urban Release Areas. Mitigation measures (Section 6) including utilisation shall be implemented to minimise the risk of cumulative environmental effects.

		Future development associated with the URAs will involve further vegetation clearing with associated environmental assessment. The current proposal would not affect any habitat corridor or reduce any significant vegetation.
p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions	Low adverse	The proposed activity would have no effect on coastal processes including those projected under climate change conditions. The site of the proposal is not located in an identified coastal hazard area.

4. PERMISSIBILITY

Section 4.1 (Development that does not need consent) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) states that:

> *"If an environmental planning instrument provides that specified development may be carried out without the need for development consent, a person may carry the development out, in accordance with the instrument, on land to which the provision applies."*

In this regard, clause 106(3B) of the NSW *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP) provides that:

> *Development for the purpose of sewage reticulation systems may be carried out without consent on any land in the prescribed circumstances.*

Where:
(1) Development is carried out in the ***prescribed circumstances*** *if the development—*
(a) is carried out by or on behalf of a public authority,

As the proposal does not require development consent, and as it constitutes an 'activity' for the purposes of Part 5 of the EP&A Act, being carried out by (or on behalf of) a public authority, environmental assessment under Part 5 of the EP&A Act is required. This REF provides this assessment.

A summary of other relevant legislation and permissibility is provided in Table 6 below.

Table 6. Summary of other relevant legislation and permissibility

NSW STATE LEGISLATION
***Environmental Planning and Assessment Act 1979* (EP&A Act)**
Permissible √ Not permissible ☐
Justification: The Infrastructure SEPP provides for the proposed works to be undertaken without development consent (refer above). In circumstances where development consent is not required, the environmental assessment provisions outlined in Part 5 of the Act are required to be complied with. This REF fulfils this requirement.
Shoalhaven Local Environmental Plan 2014 (SLEP)
Permissible √ Not permissible ☐
Justification:

Under the SLEP the proposed activity may have required development consent. The provisions of SEPP Infrastructure, however, prevail over the SLEP where there is an inconsistency by virtue of Section 3.28 of the EP&A Act. Consequently, development consent is not required.
State Environmental Planning Policy (Coastal Management) 2018
Permissible √ Not permissible ☐
Justification: The proposed activity would be undertaken within an area which is not mapped for the purpose of the SEPP.
State Environmental Planning Policy (Koala Habitat Protection) 2019
Permissible √ Not permissible ☐
Justification: Development control provisions of the SEPP apply only in relation to a development application (Part 2 of the SEPP). The proposal would not remove or otherwise impact habitat that Koalas are likely to rely on.
Wilderness Act 1987
Permissible √ Not permissible ☐
Justification: The proposed activity is not located within a wilderness area declared under this Act.
Protection of the Environment Operations Act 1997
Permissible under licence √ Not permissible ☐
Justification: The pollution of waters with prescribed matter (including excreta, manure or urine, or any waste from an on-site human waste storage facility or treatment device or any matter that contains faecal coliform or faecal streptococci, as per (f) of Schedule 5) is prohibited under S120 of the Act. Sewage treatment (including reticulation systems) also qualifies as a scheduled activity under S36, where the capacity exceeds 2,500 persons equivalent or 750KL per day, whichever is greater. The current proposal provides for 900 residential lots in Moss Vale Rd South URA and 2500 residential lots in Moss Vale Rd North URA, therefore exceeding the limit.

Operation of the system and regulation of water pollution must therefore be in accordance with an environment protection licence under Chapter 3 of the Act.

***National Parks and Wildlife Act 1974* (NP&W Act)**

Permissible √ Not permissible ☐

Justification:

- The proposed activity would not encroach into National Park estate.
- The Act provides the basis for the legal protection and management of Aboriginal sites in NSW. Under Sections 86 and 90 of the Act it is an offence to disturb an Aboriginal object or knowlingly destroy or damage, or cause the destruction or damage to, an Aboriginal object or place, except in accordance with a permit of consent under section 87 and 90 of the Act.
- **Known sites shall be avoided or if harm unavoidable, shall be in accordance with an approved AHIP**

Fisheries Management Act 1994

Permissible under Permit √ Not permissible ☐

Justification:

The proposed activity:

- would not affect declared aquatic reserves (Part 7, Division 2 of the Act);
- would involve dredging or reclamation (Part 7, Division 3). Excavation within Key Fish Habitat associated with Bomaderry Creek and Abernethys Lane will likely be required;
- would not involve blocking the passage of fish (s.219);
- would not impact mangroves and marine vegetation (Part 7, Division 4);
- would not involve disturbance to gravel beds where salmon or trout spawn (s.208 of the Act);
- does not involve the release of live fish (Part 7, Division 7);
- does not involve the construction of dams and weirs (s.218);
- would not result in the blocking of the passage of fish;
- would not impact declared threatened species of endangered ecological communities (Part 7A);
- does not constitute a declared key threatening process (Part 7A); and
- would not use explosives in a watercourse (Clauses 70 and 71 of the *Fisheries Management (General) Regulation 2019).*

A Fisheries Permit is therefore required for works within the watercourse associated with construction of access to MVRN SPS.

Heritage Act 1977

Permissible √ Not permissible ☐
Justification: • The proposed activity would not disturb an item of state heritage significance. • The Act also provides statutory protection to relics, archaeological deposits, artefacts or deposits. Section 139 to 146 of the Act require that excavation that is likely to contain, or is believed may contain, archaeological relics is undertaken in accordance with an excavation permit issued by the Heritage Council. The Act defines an archaeological relic as "*any deposit, artefact, object or material evidence that:* *a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement; or* b) *is of state and local heritage significance"* As the site has little to no archaeological potential, a permit is not required.
Biodiversity Conservation Act 2016
Permissible √ Not permissible ☐
Justification: • The proposed activity is unlikely to have a significant impact on species and communities listed in the schedules of the Act (refer to Section 3.2). • The proposed development is not within an area declared to be of "outstanding biodiversity value" as defined in the Act. • The design and mitigation measures (Section 6) would ensure that no *serious and irreversible impacts on biodiverstiy values* (as defined by the BC Act) occur at the site of the proposed activity. The proposed activity therefore is not deemed to be *likely to significantly affect threatened species* and an environmental impact statement (EIS) or a Biodiversity Development Assessment Report (BDAR) is not required. It is also a defence to a prosecution for an offence under Part 2 of the Act (harming animals, picking plants, damaging the habitat of threatened species or ecological communities *etc*) if the work was essential for the carrying out of an activity by a determining authority within the meaning of Part 5 of the Environmental Planning and Assessment Act 1979 after compliance with that Part. The activity will not remove vegetation that is listed under Schedule 1 Threatened Species, Schedule 2 Threatened ecological communities and Schedule 6 Protected Plants. Therefore the activity is considered permissible as this REF has been prepared and determined in accordance with the EP&A Act.

Water Management Act 2000
Permissible √ Not permissible ☐
Justification: • Local councils are exempt from s.91E(1) of the Act in relation to all controlled activites that they carry out in, on or under waterfront land (by virtue of clause 41 of the *Water Management (General) Regulation 2018.* • The proposal would not interfere with the aquifer and therefore an interference licence is not required (s.91F).
COMMONWEALTH LEGISLATION
Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EP&BC Act)
Permissible √ Not permissible ☐
Justification: The proposed activity would not be undertaken on Commonwealth land and no matters of National Environmental Significance are likely to be significantly impacted by the proposed activity (Section 3.3). The proposed activity is therefore not a controlled action and does not require commonwealth referral.
Commonwealth *Native Title Act 1993*
Permissible √ Not permissible ☐
Justification: All affected land comprises freehold land or road reserves for which Council is the authority (refer to Section 1.3). Native Title has therefore been extinguished as a Previous Exclusive Possession Act – Freehold Title (Section 23B). Consultation or approval from native title claimants is therefore not required.

5. CONSULTATION

5.1 Infrastructure SEPP

Clause 13 – Development with impacts on council-related infrastructure or services

In consideration of the consultation requirements specified under Clause 13 of the Infrastructure SEPP, the proponent, Shoalhaven Water, is the also the party responsible for considering the impact of the proposal on the capacity of the sewerage system. No impacts to stormwater management systems, traffic generation, water use, public places, nor excavation of footpaths or road surfaces would occur. Consultation under Section 13 is therefore not required.

Clause 14 – Development with impacts on local heritage

No impacts to any local heritage item would occur. Consultation under Clause 14 is therefore not required.

Clause 15 – Development with impacts on flood liable land

With regard to the construction of subsurface sewer infrastructure, i.e. the rising and gravity mains, it is considered that the proposal will not change flood patterns or local flood behaviour, or lead to an increased risk associated with flooding.

With regard to the proposed sewer pump stations, two (New SPS21 and MVRN SPS) occur outside the mapped areas of flood liable land.

Consultation with the Council's Floodplain Engineer team occurred during the design development phase.

The proposed MVRS SPS occurs within flood prone land. While it is considered that the proposal would not change flood patterns or local flood behaviour, or lead to an increased risk associated with flooding, consultation under clause 15(2) of the Infrastructure SEPP has been undertaken. The project was referred to Council's Floodplain Officers for review. Recommendations received (D21/132554, D21/132547 and D21/136692) have been considered and incorporated into the proposal. Refer to Section 3.6 for more information.

Clause 15AA – Consultation with State Emergency Service—development with impacts on flood liable land

The proposal does not constitute a relevant provision as listed in Clause 15AA(2). Consultation is therefore not required.

Clause 15A – Development with impacts on certain land within the coastal zone

The proposal would not occur within a coastal vulnerability area. Consultation is therefore not required.

Clause 16 – Consultation with public authorities other than councils

In consideration of the consultation requirements specified under Clause 16 of the Infrastructure SEPP, the proposed activity:

- would not be undertaken on adjacent to land reserved under the *National Parks and Wildlife Act 1974* or in Zone E1 or in equivalent zones
- would not be undertaken within or adjacent to a marine park or aquatic reserve declared under the *Marine Estate Management Act 2014*
- would not be undertaken in the foreshore area within the meaning of the *Sydney Harbour Foreshore Authority Act 1998*
- does not comprise a fixed or floating structure in or over navigable waters
- is not a development for the purposes of a health services facility, correctional centre or group home, or for residential purposes, in an area that is bush fire prone land.
- would not increase the amount of artificial light in the night sky and located on land within the dark sky region as identified on the dark sky region map
- would not be undertaken within Defence communications facility buffer (only relevant to the defence communications facility near Morundah)
- would not be undertaken on land in a mine subsidence district within the meaning of the *Mine Subsidence Compensation Act 1961*

The consultation requirements specified under Clause 16 of the Infrastructure SEPP therefore do not apply.

5.2 Community consultation

The proposal was publicly exhibited in November to December 2020. Table 7 (below) provides an overview of concerns raised and responses provided. Refer to D20/562981 for complete REF Concerns Register with Shoalwater Responses.

Following an April 2021 amendment to the REF, which incorporated design updates including vents and minor alignment changes, public exhibition was again undertaken 25 May 2021 and 15 June 2021. The amended document was exhibited on Council's website, with key stakeholders along the sections of the alignment which have been amended, notified by letter also (refer to D21/245760 for notification letter and mailout recipients). No stakeholder submissions were received for this exhibition.

Table 7. Summary of concerns with provided responses from public exhibition

Issue / concern	Response
From: Landowner The spectre of a concrete SPS,on a site 60mx 40m surrounded by a 1.8m fence with associated	Thanks for taking my call today to arrange a meeting to discuss the concerns raised regarding the location of a Sewer Pump Station in Bells Lane, Meroo Meadow. As you explained to me, you have made further enquires with

infrastructure causes me concern as it impacts severely on the amenity of my property. It is apparent that this proposal has been in the pipeline for some time. Are you willing to meet with me, explain the proposal in detail and respond to any questions i have?	your attendance to Council since the email was received and you are now satisfied, at this point that it being some 1 kilometre away from your property, there is no further requirement from Council to meet to discuss the matter raised. "
From: Moss Vale Road North Owners Group 1. The MVRNOG objects to the timeframe of 2024 for the construction of the MVRN SPS – it is proposed that DA's for this area will be being lodged in 2021 and the latest timeframe of 2022 would be considered as satisfactory for the land owners in this area; 2. It appears the SPS site and some of the other associated infrastructure has been designed without reference to the overall masterplan for the MVRN Indicative Layout Plan (ILP) that has been proposed by the MVRNOG and the ILP that has been adopted by Council; 3. We note in Appendix A to the REF (i.e. the Cardno Concept Design Report- Section 4.3), the location of the MVRS SPS and question whether a SPS in that location will cater for the B7 zoned land on Lot 4 DP268209 and the urban zoned land on Lot 1 DP258745 and Lot 261 DP794245 and other urban land in this vicinity. It would appear from some of the contours provided that this SPS will not cater for some of the adjacent urban land; 4. the comment is made that flood levels were not available at the time of preparing the concept plans. This is not the case. The MVRNOG funded a flood study across the entire MVRN site, which was completed by Rhelm and this information was provided to Council in 2019; 5. We note in Appendix A to the REF (i.e. the Cardno Concept Design Report- Section 5.2), the ADWF is 44.8L/s. No ET count is provided so we have no way of knowing if sufficient capacity is being provided in the system. We feel this should be part of the Concept Design Report; 6. We note in Appendix A to the REF (i.e. the Cardno Concept Design Report- Section 5.2), the comment is made that flood levels were not available at the time of preparing the concept plans. This is not the case. The MVRNOG funded a flood study across	1. Shoalhaven Water continues to progress this project as a priority project. As way of an update, Shoalhaven Water is currently in detailed design for the water lead in works, with Council targeting construction of the lead in water main mid-late 2021. Council has also just awarded contracts for Detailed Design services for the Wastewater Infrastructure, with design currently scheduled to concluded late 2021 to permit a construction period commencing early 2022 and concluding mid-late 2023. The REF will be updated accordingly to reflect the updated timeframes. 2. Shoalhaven Water did consider the MVRN Indicative Layout Plan (ILP) during the concept design development, however, notes that the original ILP location identified had several identified constraints that supported the relocation to the proposed site. The identified constraints included (no limited to): -Located within the riparian corridor (increased environmental impacts); -Reduced access (limitations for required service vehicles); -Excessive well depth (identified operational constraints). Shoalhaven Water understands that the Development Control Plan for the southern URA is currently under review, with the northern URA DCP yet to be finalised. Accordingly, the SPS was designed and located to minimise well depth, ensure appropriate access, with the MVRN SPS modelled to allow for the catchment nominated below as per the Concept Options Report prepared by Cardno. The catchment was based on available data at the time of the investigation. 3. The MVRS SPS was designed to cater for the development area nominated by the Council Planning Team. As flagged in point 2 above, the catchment is shown as per the Concept Options Report. Lot 4 DP268209, Lot 1 DP258745 and Lot 261 DP794245 all appear to be within the catchment area. Current MVRS SPS gravity inlet to SPS is shown at 29.87m (which was based on a preliminary gravity network to assist with the planning report). MVRS SPS is currently designed at 5m

the entire MVRN site, which was completed by Rhelm and this information was provided to Council in 2019;	deep, meaning there is capacity and room to increase the SPS depth during detailed design.
7. We note in Appendix A to the REF (i.e. the Cardno Concept Design Report- Section 5.3), the SPS site is indicated as being 350m west of Bells Lane/Abernethy's Lane intersection. This is incorrect and the site shown is more like 385m to 445m east of the Bells Lane/Abernethy's Lane intersection;	4. Your comment is acknowledged, however we note that the flood levels are impacted by the proposed Far North Collector Road being undertaken by Council, and the amended flood levels (considering the new road) are not currently available.
8. With respect to the proposed location of the MVRN SPS site, the proposed location is seriously questioned. The SPS site has been located in the middle of a large area of R1 zoned land and this will seriously sterilise a significant portion of this land which will need to be acquired by Shoalwater at market rates. It is our view that a more suitable site approximately 500m to the east of the Bells Lane/Abernethy's Lane intersection is preferred. It is on high ground and is outside (or at least on the fringe of) the R1 zoned land;	5. The ET calculations have been based on planning information provided by Council's project team, and detailed within the Appendix A Concept Options Report as follows: Moss Vale Road – Ultimate flows (Civil works) New MVRS SPS 2049 ETc 956 ETr 2806 ADWF (L/s) 23.4 PDWF (L/s) 47.2 PWWF (L/s) 131.4 SPS MVR-N 2049 ETc 2568 ETr 5374 ADWF (L/s) 44.8 PDWF (L/s) 84.3 PWWF (L/s) 259.7 Emergency storage is 8 hours at ETc ADWF
9. We note in Appendix A to the REF (i.e. the Cardno Concept Design Report- Section 5.4), the 60m x 40m site is shown in Appendix A. Following a detailed review of the SPS layout drawing C1013 Rev A, we seriously question the need for a 2400m2 site which has to be purchased at full market rates by Shoalwater. We also question the need for a 19m semi-trailer to be able to enter and exit the site without needing to do any reversing – this is over the top and warrants reconsideration. We are therefore of the view that the site could be designed far more efficiently to have a much smaller footprint which reduces the impact on the proposed urban release area, profitability of the landowner and cost base of Shoalwater;	6. Please refer to response 4 above.
10. We repeat the comments made earlier regarding the site location and are of the opinion that a far more suitable site with a smaller footprint can be found approximately 100m further to the north-east;	7. Noted.
11. We also note that the SPS site is in close proximity to the Jemena Gas Pipeline and HV transmission electrical lines and other works also cross these assets in a number of locations and this should be considered carefully in the detailed design;	8. The location of the SPS has been determined in consultation with Council's planners, environmental officers, Shoalhaven Water Operations, and the community; to best meet the needs of Council and Shoalhaven Water, for the safe future operation of the SPS. Gravity service, well depth, safe access and environmental potential impacts were the key considerations during the concept design phase. The proposed relocation of the SPS further east will increase access road required, impose a greater potential environmental impact, and delay the current project schedule with landowner consultation, detailed survey and geotechnical investigation works now completed for the nominated SPS locations and overall alignment. Furthermore, moving the SPS further east will also further increase the wet well depth past the 6-7m depth currently proposed, which imposes further operational limitations which was not desired by Shoalhaven Water.
12. We note in Appendix A to the REF (i.e. the Cardno Concept Design Report- Section 5.4), it is proposed to access the SPS site along Abernethy's Lane. This alignment is seriously questioned principally as the route would cross the southern tributary which in a 1% AEP flood event is	

approximately 175m wide (along the alignment of Abernethy's Lane). Consideration should be given to accessing the site from further to the south at the access points to 66A-66D Bells Lane using the existing access road where possible. This would negate the need for a significant culvert crossing in an area where no future road is proposed. Obviously, Shoalwater would need to be responsible for a share of the ongoing maintenance of this road and any damage caused during construction; 13. We have also reviewed the drawings in Appendix A of the Cardno report and provide the following comments which have not yet been made above: - Dwg C1000 – we note the MVRS Gravity main is proposed to cross the Jemena Gas Main and HV Transmission lines in two locations; - Dwg C1006 – we query the location of the MVRS RM and GM within the Bells Lane Road Reserve. The MVRN ILP proposed a major upgrade to Bells Lane and the proposed infrastructure should be designed to ensure that it does not conflict with future roadworks which would require its relocation and potential damage; - Dwg C1006 – we query the MVRS RM location where it crosses Moss Vale Rd. This intersection will have major upgrade as part of the FNC Rd project and will become a signalised intersection. The pipe crosses Moss Vale Rd at an oblique angle which should be reconsidered for the future maintenance issues that could arise; - Dwg C1007 – we query how the design of the MVRS GM will take into account the future road upgrade of Bells Lane particularly the two watercourse crossings in the vicinity of Abernethy's Creek and the southern tributary where there will be significant fill; - C1013 -we note the overflow pipework is shown as draining to Bomaderry Creek however the SPS is nowhere near any watercourse; - a flood study across the entire MVRN site, which was completed by Rhelm and this information was provided to Council in 2019; 14. Section 3.6 of the REF proper discusses flood liable land. IT is also noted that the <MVRNOG flood study has not been considered and there are significant watercourse crossings of the MVRN URA which need to be considered;With respect to the above matters we strongly urge Shoalwater to engage with	9. The size of the sites identified represent Shoalhaven Water's standard sizing requirements for all SPS sites, allowing for access and circulation of a 19m vehicle turning path and onsite emergency storages capacity. Furthermore, Shoalhaven Water requires onsite area for future landscaping and screening to assist with the general amenity of the area. 10. Proposed location is deemed not suitable as the wet well would be too deep at this location and this has been identified as a limitation for Shoalhaven Water. 11. Noted, Council to continue to engage with identified utility providers during detailed design and future construction phases of the works. 12. Please note that this is a sewer main and not a culvert. The design has been determined to connect into the future trunks sewer main serving the MVRN development. With regards to providing access to MVRN SPS by using access points to 66A-66D, Bells Lane using the existing access road, Council notes that this was investigated during the concept design however was not preferred due to restrictions on the required 19m truck. 13. Noted, Council to consider and incorporate as/where deemed appropriate during detailed design. Council further notes that the rising main alignment crossing all future road and intersection upgrades can be designed deeper to future proof the works as deemed necessary as part of future authority discussions and approvals. The gravity main alignment was also kept along Bells Ln to reduce impact on existing and future lots. 14. Acknowledged. To be referred to Council's Environmental Officer for review, consideration and incorporation within the final REF as deemed necessary.

the MVRNOG via its consultants APS to discuss these matters in more detail to avoid unnecessary costs now and in the future. The main concerns are timing and location of infrastructure and its impact on the future URA's.	
From: Sydney Trains Sydney Trains is formally seeking an extension of the time frame to enable sufficient reviews to be undertaken with our internal and cluster stakeholders for the proposed works. Sydney Trains will have particular attention to the works proposed immediately adjacent and within TAHE (Transport Asset Holding Entity – formally RailCorp) land. In addition, current initial reviews seek clarification for the following in association with the proposed works: 1. Does Council have any agreements for works to be undertaken in TAHE land; 2. Does Council have any existing easements or licences specifically with TAHE (previously RailCorp) for use of TAHE land (for any purpose); 3. Does Council have any existing excavation and construction methodologies which will apply to these works, specifically for work in TAHE land; 4. Has Council undertaken any Contamination Assessments on the land where the works are proposed (in particular land immediately adjacent to or within TAHE land); 5. Does Council have any existing pipes which are the subject of these proposed works, in TAHE land, or are these ground works and pipes new; 6. The document available on Council's website only refers to it as "Part 2: Sewer Infrastructure"; please advise what Part 1 related to. Sydney Trains has also been liaising RMS / TfNSW, whom also request an extension to the review time frame. They may have additional queries to the above, and your details have been passed on to them. If Sydney Trains received any particular queries, we may make these on behalf of the Transport cluster, or vice versa. Primary contact for RMS: Chris.Millet@transport.nsw.gov.au Contact for TfNSW: development@transport.nsw.gov.au	Yes, proposed approach is acceptable. Council does not intend on extending the official period in which the Document is on Public Exhibition, we take no objections to your request for an extended response period being no later than 17 December 2020, refer to email by Andrew Lissenden from TfNSW, see attached. Following reply in response to your raised concerns. 1. Does Council have any agreements for works to be undertaken in TAHE land; Yes. As per attached email to CI Australia [EMAIL to CI Australia Pty Ltd.pdf], Council has requested a copy of the agreement as we have been unable to locate this on our system, however as per attached invoice [Rent payment slip to CI Australia Pty Ltd.pdf] regularly (annually) make payment for all our infrastructure crossing railway properties, see attached schedule listing all services crossing railway properties [Shoalhaven Schedule of Agreements.pdf]. 2. Does Council have any existing easements or licences specifically with TAHE (previously RailCorp) for use of TAHE land (for any purpose); Yes, as detailed in item 1 above. 3. Does Council have any existing excavation and construction methodologies which will apply to these works, specifically for work in TAHE land; No. We do however not that the anticipated works will entail underboring of the new wastewater main within the exiting rail crossing easement – refer extracts below to assist (new magenta line represents the new 560mm main proposed). 4. Has Council undertaken any Contamination Assessments on the land where the works are proposed (in particular land immediately adjacent to or within TAHE land); No. See enclosed extract of draft REF mitigations with regards to soil and water. 5. Does Council have any existing pipes which are the subject of these proposed works, in TAHE land, or are these ground works and pipes new; Yes, the intended works will be ran within the existing easement railway crossing (currently have DN150 and DN300 services crossing). 6. The document available on Council's website only refers to it as "Part 2: Sewer Infrastructure"; please

	advise what Part 1 related to. Part 1 relates to Water Infrastructure, however this does not extend across any railway properties, see enclosed link FYI: https://shoalhaven.infocouncil.biz/Open/2020/10/SA_20201013_ATT_16088_EXCLUDED.HTM#PDF3_ATTACHMENT_45518_1
From: Sydney Trains 1. Prior to the commencement of any works adjacent to and/or within the Rail Corridor, TAHE (Transport Asset Holding Entity) land or rail related easements, consultation and approval is to be obtained from Sydney Trains to ensure there are no potential impacts to the rail corridor or infrastructure and that any works undertaken within the rail corridor are in accordance with any lease agreement(s). 2. All requests, consultation, provision of documentation associated with the proposed works are to be emailed to Illawarra_Interface@transport.nsw.gov.au 3. No work is permitted within the rail corridor, or any easements which benefit Sydney Trains/TAHE (Transport Asset Holding Entity), at any time, unless the prior approval of, or an Agreement with, Sydney Trains/TAHE (Transport Asset Holding Entity) has been obtained by Council. a. No works are permitted to be undertaken in the rail corridor outside the area as defined by the existing lease unless otherwise agreed to. 4. During all stages of the works, extreme care should be taken to prevent any form of pollution or contamination from entering the rail corridor (TAHE land). 5. During and as a result of the works, drainage is not to be directed, disposed or discharged into the rail corridor.	1. Noted, consultation will be undertaken during detailed design development and submitted for approval from Sydney Trains. 2. Noted. 3. Noted. 4. Noted. 5. Noted.
From: Transport for NSW 1. TfNSW records show that Lot 602 DP 1223625 and Lot 435 DP 1210528 have been acquired by TfNSW for the Berry to Bomaderry Princes Highway upgrade (refer to Attachment 1). These lots are proposed to be declared a controlled access road/public road (i.e. become part of the Princes Highway road reserve) sometime after the completion of the upgrade which at this time is scheduled for 2022.	1. Noted. 2. Noted. 3. Noted, contacts nominated will be consulted.

2. Lot 602 DP 1223625 and Lot 435 DP 1210528 is land that is designated road on the deposited plans. Council's records, based on Table 1 in the REF, indicate that TfNSW owns the land but also indicate that Council may not be aware that the land is designated road. The creation of a services easements on land designated road reserve is not generally required. 3. Prior to the commencement of any works on Lot 602 DP 1223625 and Lot 435 DP 1210528, or within/under the existing Princes Highway road reserve discussions shall be had with TfNSW Property Unit as well as the Berry to Bomaderry - Princes Highway upgrade project team. Contact details are provided below: a. Property Unit: Ivo Pacitto (Senior Property Officer) Ph: 4221 2495 Email: Ivo.Pacitto@transport.nsw.gov.au b. Berry to Bomaderry – Princes Highway Upgrade: Jason Llyod (Project manager/Engineer) – Ph: 8874 6834 or 0418 299 379 Email: Jason.Lloyd2@transport.nsw.gov.au; or Shaun Walsh (Project Contract Manager) – Ph: 4221 2504 or 0407 463 105 Email: Shaun.WALSH@transport.nsw.gov.au. 4. Prior to the commencement of works within/under the Moss Vale Road reserve and the Princes Highway road reserve TfNSW will need to provide approval (i.e. Section 138 consent under the Roads Act 1993). The detailed design plans submitted for approval shall demonstrate compliance with the following: c. a) The work will need to be by under boring or tunnelling. No trenching is allowed. d. b) Standard depth requirements of min 1.5 m below road level would apply: and e. c) Sleeving of the pipe under the road formation would be required to eliminate the need to excavate the road in the future should a maintenance problem occur. To obtain the required approval contact shall be made with TfNSW Southern Asset Section via the email SRO_PublicUtilities@rms.nsw.gov.au 5. Prior to the commencement of works that impact a classified road reserve and/or TfNSW owned land Council will need to consider and address any environmental impacts of the proposed works in accordance with applicable legislation. This includes	4. Noted, consultation will be undertaken during detailed design development and submitted for approval. 5. Noted.

consideration and mitigation of issues including, but not limited to, traffic/road safety, flora/fauna, noise, heritage, contamination, impact upon the community, etc.	
From: Landowner As Abernethys Creek runs through our property, directly downstream from the overflow area of the associated SPS, we read the document in relation to our concerns about this. In the event of an ""SPS overflow"", are you aware of when they occur? Are there any records of overflow events made publicly available? Can we be notified of an ""SPS overfow event"" so that we can monitor the impact on Abernethys Creek, and our property for ourselves?"	1. Yes, if an overflow event occurs, Shoalhaven Water are notified through our telemetry system; we then report the incident to the Environment Protection Authority (EPA) as a condition of our licence. For your reference, Council notes that the project has adopted the NSW Public Works standard for overflow, i.e. design to 1in5 years rainfall event with onsite provision for eight (8) hours of emergency storage. 2. Not at the time of the event itself. The EPA has indicated that they would be able to confirm whether an overflow incident has been reported or not (via their hotline 131555) should the public wish to enquire. Council does however prepare as part of our annual National Performance Reporting, a report on all Overflow events, which is submitted to the NSW Department of Planning, Industry and Environment. The NSW Department of Planning, Industry and Environment then compile their own report and publicly release. 3. Notifications to the public are generally only undertaken in the case of major overflow occurrences. Council's environmental services team will attend site to implement the appropriate control measures and inform affected residents direct impacted.
From: Landowner > We readily acknowledge the need for the substation and related wastewater lines running through the development zone. >Our particular environmental concern is the current proposed positioning of the substation as it relates to the substrata in which the substation is to be located, thereby raising additional environmental hazard management issues. > When test bores were being done on the proposed location ,we were told by the staff engaged that there significant flows of fresh running water not far below the surface.	1. Noted. We understand reference to substation in the response refers to the associated Sewer Pumping Station (SPS). 2. The SPS was designed and located in consultation with Council's environmental officers, operations team and designers, to minimise well depth, ensure appropriate servicing access is provided and to ensure that the Moss Vale road Northern (MVRN) SPS allowed for the full catchment identified as part of Council's Concept Options Report. Furthermore, the location of the SPS has been determined in consultation with Council's planners, environmental officers, Shoalhaven Water Operations, and the community; to best meet the needs of Council and Shoalhaven Water,

> Our concern is that there will be unintended consequences should the substation be located in the spot currently proposed. > First,laying the underground holding tanks may not be straightforward. > Second,and potentially more significantly,when substantial rainfall occurs,the disruption to the existing natural underground water course may create new localised flooding/ boggy ground in adjacent areas. > We understand the likelihood of accidental waste water spillages / excess waste flows occurring can occur but ,in normal weather circumstances , we assume this would not be an issue.However, there is a reasonably significant distance between the substation and Abernathys Creek watercourse and overflows could progressively despoil nearby land. > Our query also relates to whether high rainfall could create greater than expected waste control flow concerns. > We are not consulting engineers or environmental experts but we do question why the actual proposed positioning of the substation be located in what we understand would be in the middle of significant underwater flows and on land zoned residential. > From a risk management mitigation perspective further bore testing should be undertaken in the proximate vicinity. > And in particular,to relocate the substation around 50 m south would position the within the adjacent council-owned land just south of the proposed substation location.Indeed, the unformed part of Abernathys Lane council-owned land further east has high and what would appear dry ground and would be closer to riparian land better suited to absorb a greater volume of excess waste water runoff. > The reasons for making this latter suggestion are of course ,in part prompted by personal commercial considerations: > (1)to minimise the disruption to our current thoroughbred horse stud > operations; (2)to minimise potential value loss from land acquired by > Council; (3)to minimise the time and associated legal and related > costs to Council and we the owners in negotiating the acquisition of the land by Council;and just as	for the safe future operation of the SPS. Gravity service, well depth, safe access and environmental potential impacts were the key considerations during the concept design phase. Proposed changes to the identified site would likely increase access road requirements, impose greater potential environmental impact, and delay the current project schedule with landowner consultation, detailed survey and geotechnical investigation works now completed for the nominated SPS locations and overall alignment. Furthermore, moving the SPS from the preferred location will also likely further increase the wet well depth past the 6-7m depth currently proposed, which imposes further operational limitations which was not desired by Shoalhaven Water. 3. Noted, however the presence of significant flows is not unexpected due to the general topography of the site (SPS typically located at low points to allow catchment flows to gravitate to the SPS). With regards to potential environmental impacts, the environmental officers and designers concluded that based on the proposed size of the infrastructure, it would have a minimal/negligible impact on groundwater movement. 4. Please refer to response 2 above. Essentially the Review of Environmental Factors investigation and reporting have considered potential impacts and helped inform the design team to identify an acceptable site which mitigates against all potential environmental impacts, whilst maintains optimum operational performance. 5. The project has been able to mitigate such risk by undertaking geotechnical investigations of the proposed site. Based on the conducted geotechnical investigations, Council's designers concluded that the works as propose are feasible and do not impose any unacceptable risks to Council, the community or the project. 6. Based on the investigations undertaken, Council does not consider the proposed works to impose any unacceptable risks to Council, the community or the project. The impacts to potential groundwater movements has been considered as part of the investigation works and it has been concluded that based on the proposed size of the infrastructure, it would have a minimal/negligible impact on groundwater movement. Additionally, as the ground water table is relatively close to the invert level of the wet well, disturbance of the water table is considered extremely unlikely and the project does not anticipated more ground level flooding associated with the proposed works.

importantly; (4)the opportunity to minimise the potential for nearby future house owners to be concerned about water management / waste water flowing through or near their properties,with concomitant home value reduction/ family health concerns. > Even with no water control issues,it would seem likely nearby blocks of land will lose some value because of visual and potential waste control concerns.	7. Council notes that the project has adopted NSW Public Works standard for overflow, i.e. design to 1in5 years rainfall event with onsite provision for eight (8) hours of emergency storage. Furthermore it is a legislated requirement (enforceable licence condition) that Council must report any/all overflow events to Environment Protection Authority (EPA); with Council then required to comply with all EPA requirements. 8. Please refer to response 7 above. Essentially, any rainfall event in excess of the design rainfall event and onsite emergency storage provisions has the potential to lead to a reportable overflow event. This is a typical of all wastewater networks across the country. To mitigate against the risk of overflow event, all new (and progressively most existing) SPS are provided with 8hr emergency storages. The intention of this is that the emergency storage provides additional capacity for the SPS to store excessive flows (typically during the higher intensity periods of a storm event) when the risk of overflows events are greatest. When the storm passes and flows once again typically reduces, the emergency storage flows captured during the event slowly gravitate back to the SPS and back to normal operation (thus significantly reducing the potential for any uncontrolled overflow event). Fortunately, the proposed infrastructure for this project is predominately new mains and SPSs, which would significantly reduce the risk of unauthorised infiltration flows, which often impact existing networks (i.e. illegal stormwater connections to the sewer mains). 9. Please refer to responses 2, 3 & 4 above. 10. A significant geotechnical investigations program has now been completed as part of the initial works for this project. The investigations support the proposed works (do not identify any unacceptable risks). The need for any further geotechnical investigation testing will be assessed as Council proceeds through the detailed design phases of the project. 11. Please refer to responses 2, 3 and 4 above. Placement of the SPS within the Council owned road reserve was previously investigated however deemed not suitable as this location would require a significantly deeper wet well (beyond that accepted by SW Operations) and presented limitations with regards to safe access for the 19m service vehicle. 12. Council acknowledges and notes your queries with regards to this project, As stated above, the location of the SPS and all wastewater infrastructure proposed to service the Moss Vale Road Urban Release Area has been determined following an intensive consultation

	process with Council's planners, environmental officers, Shoalhaven Water Operations, and the community; to best meet the needs of the proposed URA, Council and specifically Shoalhaven Water; ultimately for the safe future operation of the SPS and future residents. Where possible, Council's initial approach was to investigate Council owned lands for the proposed works. We were fortunately to identify a Council owned site in the southern URA for the proposed MVRS SPS, however unfortunately the Council owned lands to the north revealed significant limitations which ruled them out. Please note as part of the intended works, Council will look to implement a landscaping treatment to the SPS sites to help alleviate any perceived or actual aesthetic concerns. With regards to ongoing land matter discussions, we look forward to continuing to progress on our existing relationship through Council's identified Property Officer(s). We hope this helps to clarify your concerns, please feel free to contact for any further information."

6. ENVIRONMENTAL SAFEGUARDS AND MEASURES TO MINIMISE IMPACTS

General

1. Easements through private land shall be established where required and authorisation for work within NSW Roads and Maritime Services land and Railcorp NSW (Sydney Trains) land shall be acquired prior to commencement of works within these areas. Under-boring (micro tunnel or horizontal directional drilling (HDD)) where required must comply with relevant authority approvals.
2. Notification via mail to any properties whose access shall be affected by works shall be undertaken prior to commencement of works.
3. The operation of the sewerage system, including the management of SPS overflows shall be in accordance with an EPA issued environmental protection licence.
4. Amenity screen plantings shall be established and maintained around Sewer Pump Stations following construction, in accordance with site specific landscape plans. Plantings shall be of suitable native species (e.g. Callistemon, Melaleuca, Syzygium species – cultivars acceptable) with a suitable growth height for screening purposes, with consideration to minimising maintenance requirement.
5. An asset form must be trimmed to file 44574E on commissioning of each facility within the proposed activity in accordance with POL15/8 Asset Accounting Policy section 3.1.4 and POL16/79 Asset Management Policy section 3.3. Asset forms are available are webpage http://sccintranet/AssetsWorks/TechnicalServices/AssetStrategy/AssetForms.aspx

Works in flood-liable land

6. Continued consultation with Council's Floodplain Engineers shall occur during the detailed design phase for all proposed works in flood liable areas.
7. Electrical installation for SPSs should comply with the National Construction Code *Construction of buildings in flood hazard areas* (ABCB 2012).
8. Electrical switchboards shall be located with 500mm freeboard above the 1% AEP levels (i.e. above flood planning levels). Refer to levels in Table 4, p61.
9. For SPSs proposed in floodways, an appropriate consulting engineer's report shall be commissioned to:
    a. demonstrate that the proposed structure could withstand forces of floodwaters including debris and buoyancy forces up to a 1% AEP flooding scenario.
    b. demonstrate that the development would not increase flood hazard or flood damage to other properties or adversely affect flood behaviour for a 5% AEP up to the Probable Maximum Flood (PMF) scenario.

10. Building materials used for SPSs below the Flood Planning Level (FPL) must be of materials compatible with immersion in accordance with Schedule 4 of Shoalhaven Development Control Plan (SDCP – Chapter G9) and the NSW Flood Plain Development Manual 2005.
11. Bunding to the FPL to be installed around hazardous chemical storage areas and dosing plants;

Soil and water

12. From Chainage 2400m to 3250m (mapped as Class 3 and Class 4 Acid Sulfate Soils), sampling and analysis shall be undertaken to determine the need for an Acid Sulfate Soil Management Plan and inform the plan if management and treatment of excavated soil is required.
13. A Fisheries Permit shall be obtained for the construction of the access track to MVRN SPS. Works involving excavation within the watercourse crossing the unformed section of Abernethys Lane between Bells Lane and the site of MVRN SPS are not permitted without an approved Fisheries Permit.
14. Under-boring (micro tunnel or horizontal directional drilling (HDD)) shall be applied where the crossing of creeks and watercourses (in addition to roads and the railway line) is required to every practical extent, to minimise disturbance to these areas.
15. Erosion and sediment controls in accordance with the 'Blue Book' (Landcom 2004) shall be installed and maintained to prevent the entry of sediment into waterways i.e. water diversion, minimising disturbance, erosion control and rapid re-establishment. Erosion and sediment controls shall be maintained in good working order for the duration of the works and subsequently until the site has been stabilised and the risk of erosion is minimal.
16. Construction of the Rising Main running north-west from Taylors Lane, providing future connection to MVR South URA (Category 2 riparian corridor) shall be underbored if possible, but if construction requires trenching, sediment and erosion controls shall be implemented, works shall be scheduled to avoid moderate to heavy rain (i.e. exceeding 50mm in a 3-day period) and the excavation shall be filled and stabilised as the construction progresses with no more than a 50m section open at one time.
17. A dewatering plan shall be developed and implemented for each SPS site in the event that excavation for installation of wet wells encounters the water table associated with Bomaderry or Abernethys Creek and/or coincides with significant rain events. Pooled water shall be discharged via low velocity pump into a bund constructed of a geofabric wrapped straw-bales and situated at least 20 metres from the creek in a grassy vegetated area such that the filtered water would enter the creek downstream of the works. The geofrabric shall be replaced as required and disposed of in a licenced waste facility.
18. Sewer Pump Station overflows shall include trash grates and discharge to grassed / vegetated swales from a point as close to the SPS as possible.

Flora and Fauna protection

19. The watercourse containing Illawarra Lowlands Grassy Woodland EEC between the site of proposed MVRS SPS and Moss Vale Rd, along the future Far North Collector Rd alignment (in the vicinity of photo-point P1 – refer also to Photo 1), shall be under-bored to minimise impacts to vegetation and the waterway. If it is not possible to under-bore this location, the construction corridor must be reduced to no more than 5m and all native trees and shrubs retained to every practical extent.
20. Native vegetation removal and pruning shall be undertaken only to the extent required to construct and maintain the proposed sewer infrastructure.
21. Pruning of trees where required is to be undertaken in accordance with AS 4373-1996 "Pruning of Amenity Trees".
22. Impact to the structural root zones of trees to be retained shall be avoided to every practical extent.
23. In the event that any wildlife be significantly disturbed or injured during works, Council's Environmental Officers are to be contacted on 4429 3405, or if unavailable, Wildlife Rescue – South Coast should be contacted on 0418 427 214, to rescue and relocate the animal(s).

Aboriginal heritage

24. Under-boring to a depth no less than 400 mm, shall be undertaken through the area covered by the "Abernethys Creek" PAD (52-5-0754) to avoid impact to this area and ensure avoidance of site 52-5-0287 (refer to Figures 9 and 10). Under-boring shall involve monitoring of excavation for entry and exit pits where required, by Nowra Aboriginal Land Council Aboriginal Heritage Site Officers.
25. Amendment of the current AHIP application for harm to sites 52-5-0932, 52-5-0931, and 52-5-0933 associated with the Far North Collector Road shall be sought to also allow for harm to sites as a result of the current sewer infrastructure proposal.

    Alternatively, under-boring through the area in the vicinity of site 52-5-0931, to a depth no less than 400mm could be undertaken to ensure no impact to the site.
26. Location and identification of sites 52-5-0694 (GDA94: E281938 N6142393), 52-5-0753 (GDA94: E280248 N6142928) and 52-5-0880 (GDA94: E278238 N6142914) with hi-visibility para-webbing or similar shall be undertaken prior to works in these areas to avoid potential impact to these sites.
27. Consideration shall be given in the current design regarding the potential for impact to Aboriginal Heritage site 52-5-0880 associated with future connection to the MVR South URA within Lot 1 DP 949932.
28. Staff working at the site will be instructed to stop work immediately on identification of any suspected Aboriginal heritage artefact. If any objects are found, NSW Department of Planning, Industry and Environment (ph:131 555) shall be contacted.

Sydney Trains authority and Transport for NSW

29. Prior to the commencement of any works adjacent to and/or within the Rail Corridor, TAHE (Transport Asset Holding Entity) land or rail related easements, consultation and approval is to be obtained from Sydney Trains to ensure there are no potential impacts to the rail corridor or infrastructure and that any works undertaken within the rail corridor are in accordance with any lease agreement(s).
30. All requests, consultation, provision of documentation associated with the proposed works are to be emailed to Illawarra_Interface@transport.nsw.gov.au
31. No work is permitted within the rail corridor, or any easements which benefit Sydney Trains/TAHE (Transport Asset Holding Entity), at any time, unless the prior approval of, or an Agreement with, Sydney Trains/TAHE (Transport Asset Holding Entity) has been obtained by Council.
32. No works are permitted to be undertaken in the rail corridor outside the area as defined by the existing lease unless otherwise agreed to.
33. During all stages of the works, extreme care should be taken to prevent any form of pollution or contamination from entering the rail corridor (TAHE land).
34. During and as a result of the works, drainage is not to be directed, disposed or discharged into the rail corridor.
35. Lot 602 DP 1223625 and Lot 435 DP 1210528 is land that is designated road on the deposited plans. Council's records, based on Table 1 in the REF, indicate that TfNSW owns the land but also indicate that Council may not be aware that the land is designated road. The creation of a services easements on land designated road reserve is not generally required.
36. Prior to the commencement of any works on Lot 602 DP 1223625 and Lot 435 DP 1210528, or within/under the existing Princes Highway road reserve discussions shall be had with TfNSW Property Unit as well as the Berry to Bomaderry - Princes Highway upgrade project team. Contact details are provided below:

    a. Property Unit: Ivo Pacitto (Senior Property Officer) Ph: 4221 2495 Email: Ivo.Pacitto@transport.nsw.gov.au

    b. Berry to Bomaderry – Princes Highway Upgrade: Jason Llyod (Project manager/Engineer) – Ph: 8874 6834 or 0418 299 379 Email: Jason.Lloyd2@transport.nsw.gov.au; or Shaun Walsh (Project Contract Manager) – Ph: 4221 2504 or 0407 463 105 Email: Shaun.WALSH@transport.nsw.gov.au.
37. Prior to the commencement of works within/under the Moss Vale Road reserve and the Princes Highway road reserve TfNSW will need to provide approval (i.e. Section 138 consent under the Roads Act 1993). The detailed design plans submitted for approval shall demonstrate compliance with the following:

    a) The work will need to be by under boring or tunnelling. No trenching is allowed.

b) Standard depth requirements of min 1.5 m below road level would apply: and

c) Sleeving of the pipe under the road formation would be required to eliminate the need to excavate the road in the future should a maintenance problem occur.

38. To obtain the required approval contact shall be made with TfNSW Southern Asset Section via the email SRO_PublicUtilities@rms.nsw.gov.au

39. Prior to the commencement of works that impact a classified road reserve and/or TfNSW owned land Council will need to consider and address any environmental impacts of the proposed works in accordance with applicable legislation. This includes consideration and mitigation of issues including, but not limited to, traffic/road safety, flora/fauna, noise, heritage, contamination, impact upon the community, etc.

7. SIGNIFICANCE EVALUATION & CONCLUSION

This Review of Environmental Factors has assessed the likely environmental impacts, in the context of Part 5 of the Environmental Planning and Assessment Act 1979, of a proposal by Shoalhaven City Council for the construction of sewer infrastructure to service the Moss Vale Rd URAs.

Shoalhaven City Council has considered the potential environmental effects of the proposal and the effectiveness and feasibility of measures for reducing or preventing detrimental effects. It is determined that:

1. The proposed safeguards and mitigation measures identified in the report (Section 6) shall be adopted and implemented.
2. It is unlikely that there will be any significant environmental impact as a result of the proposed work and an Environmental Impact Statement is not required for the proposed works.
3. The proposed activity is not likely to significantly affect threatened species, populations or ecological communities, or their habitats and a Species Impact Statement / BDAR is not required.
4. No additional statutory approvals, licences, permits and external government consultations are required.

REF approved by COUNCIL STRATEGY & ASSETS COMMITTEE 19 January 2021 - Item SA21.11
RESOLVED (Clr Proudfoot / Clr White) MIN21.21

That Council, after consideration of the Review of Environmental Factors (REF) for the Proposed Moss Vale Road URAs Part 2: Moss Vale Road Wastewater Infrastructure project at Cambewarra, dated December 2020:

1. Determine that it is unlikely that there will be any significant environmental impact as a result of the proposed works and an Environmental Impact Statement is therefore not required for the proposed activity.
2. Adopt and implement the proposed mitigation measures and controls outlined in the REF.

AMMENDED REF approved by:

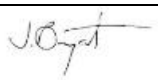
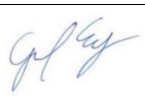
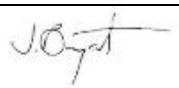
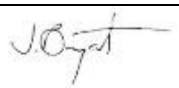
Robert Horner

Executive Manager

Shoalhaven Water

Shoalhaven City Council Date: 25 June 2021

Document Review:

	Name	Signature	Date
Author:	Jeff Bryant		19/10/2020
Reviewed by:	Geoff Young		27/10/2020
Revised:	Jeff Bryant		23/12/2020
Revised:	Jeff Bryant		08/04/2021
Revised:	Jeff Bryant		30/04/2021
Revised:	Jeff Bryant		25/06/2021

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APPENDIX A – Design report with layout plans

"Concept Design Report Moss Vale Road"

Consultant report including layout plans with longitudinal sections by Cardno Pty Ltd

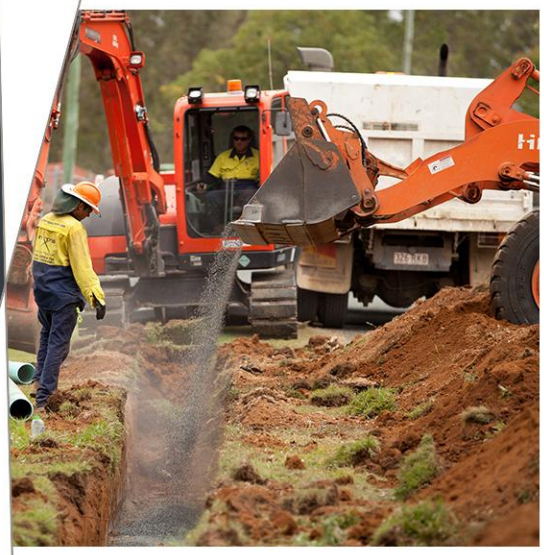
Council reference D20/450654

Council reference D20/450654

Concept Design Report

Moss Vale Road

8202019701



Prepared for

Shoalhaven Water

21 October 2020

Cardno

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1 Introduction

1.1 Background

The Moss Vale Road Urban Release Area (URA) is large scale development area to the north of the Shoalhaven River, within the Shoalhaven City Council Local Government Area. This area was identified in the early 2000's, and has been included as part of the Illawarra Shoalhaven Regional Plan.

The area is currently a patchwork of property ownership, which has been characterised in two general zones based on the Moss Vale Road alignment. These zones are Moss Vale Road North (MVRN) and Moss Vale Road South (MVRS).

Moss Vale Road South is the most advanced in the approval process, with development application approval recently provided by Council. The area is projected to have a residential yield of 900 lots, combined with an originally proposed educational and commercial precinct zoned for the eastern margin of the area, which would extend off the existing Princes Highway establishments. It should be noted that Council communication with the NSW department of education have indicated that they do not intend to develop a school on this site. Council are considering potential rezoning options for this proposed educational precinct.

Moss Vale Road North is currently moving through the planning proposal process for land rezoning. The development program for the northern area was several years behind the southern development, but as a result of approval fast-tracking, this lag is reducing and it is expected that the two development areas will be constructed at a similar timing.

The MVRN area has a residential yield of 2,500 lots, with a small business park/ commercial precinct proposed to complement the southern area commercial precinct.

Shoalhaven Water completed a water and wastewater servicing strategy in 2020, that identified key the water and wastewater infrastructure required to service the Moss Vale Road URA. The preferred servicing strategies identified:

- Drinking Water - The expansion of the Cambewarra WSZ (Option 1)
- Wastewater - A Northern Terminal Sewer Pumping Station (Option 2)

1.2 Site Location

The project is located within Nowra, as per Figure 1-1.

Figure 1-1 Site Location

2 Design Criteria

2.1 Design Standards

The following standards have been adopted for this project:

- WSA 02-2014 Gravity Sewerage Code of Australia Version 3.1
- WSA 04-2005 Sewage Pumping Station Code of Australia Version 2.1
- WSA 03-2011 Water Supply Code of Australia Version 3.1

3 Initial Investigations

3.1 Options Assessment

An overview of the option assessment process for the water and wastewater strategy is provided in the following sections.

Drinking Water

The investigation looked at two (2) key strategies for the drinking water supply:

1. Expansion of the Cambewarra WSZ
2. Dedicated Moss Vale Road URA WSZ

Each option was developed based on guidance provided by Shoalhaven Water during the preliminary options workshop and Shoalhaven Water's design standards. Shoalhaven Water requested that as part of

the new URA supply option, the lower pressure areas of Bomaderry be rezoned to improve performance. This increases peak day demand by 10 L/s and storage requirements by approximately 0.5 ML.

The design standards used to size and configure each option are in the table below.

Item	Criteria	Requirements
Supply Pressure	Minimum Pressure - PDD	≥15 m (Minimum) ≥30 m (desirable)
	Maximum Pressure - ADD	60 m (desirable) 90 m (maximum)
Reservoir Storage	Operating Storage	Up to 1/3 PDD
	Reserve Storage	Minimum of 1/3 PDD
Headloss	≤ DN150	< 5 m/km
	≥ DN200	< 3 m/km
Maximum velocity	Transfer mains	≤ 4 m/s
	Reticulation mains	≤ 2 m/s
	Optimal	0.8 m/s to 1.4 m/s
Fire Flow Enquires	Commercial	20 L/s @ 150kPa (95%ile PDD)
	Residential	10 L/s @ 150 kPa (95%ile PDD)

Three (3) options were assessed against 2041 peak day demands using Shoalhaven Water's hydraulic model. The options assessed were:

Option 1 - expansion of the Cambewarra WSZ

Option 2 – A dedicated Moss Vale Road URA WSZ (supplied from Illaroo Road)

Option 3 - A dedicated Moss Vale Road URA WSZ (supplied from Moss Vale Road)

At the options workshop on the 5 March 2020, each option was presented and discussed in detail. The workshop was held with key internal Shoalhaven Water stakeholders to identify the risks and opportunities associated with each option. This was considered critical as the preliminary financial assessment did not provide a clear preferred solution.

Based on a risk and opportunity assessment undertaken in the options workshop, Option 1 – expansion of the Cambewarra WSZ was identified as the preferred option.

The key components of this option include:

- Interim connection to the URA via a new DN375 along Main road to the development off-takes
- 2024 upgrade of Illaroo Road WPS
- 2024 install new dedicated supply main for Hockeys Lane to the existing Cambewarra Reservoir.! Existing DN250 DICL main from Illaroo Road to Hockeys Lane to be utilised as a supply main only
- 2024 upsize Illaroo Road DN100 reticulation main to a DN150 to support firefighting flows
- 2024-2029 install new DN375 distribution main from Cambewarra Reservoir to connect into the! DN375 at Main Road
- 2029 – New 3.5 ML reservoir at Cambewarra reservoir site
- 2029 – Extend URA distribution main to Bomaderry WSZ. Low level area to be rezoned to the! Cambewarra WSZ.
-

This option has been used as the basis for the concept design of the water infrastructure requirements.

Wastewater

There is currently no capacity within the existing wastewater network to support the projected additional interim flows from the Moss Vale Road URA. Thus, a new independent wastewater scheme discharging to the Bomaderry WWTP is needed.

To improve the performance of the existing sewer network, Shoalhaven Water requested that the new wastewater scheme incorporate flows from:

- Cambewarra's SPS23
- The North Nowra diversion flows
- Decommissioning of SPS26

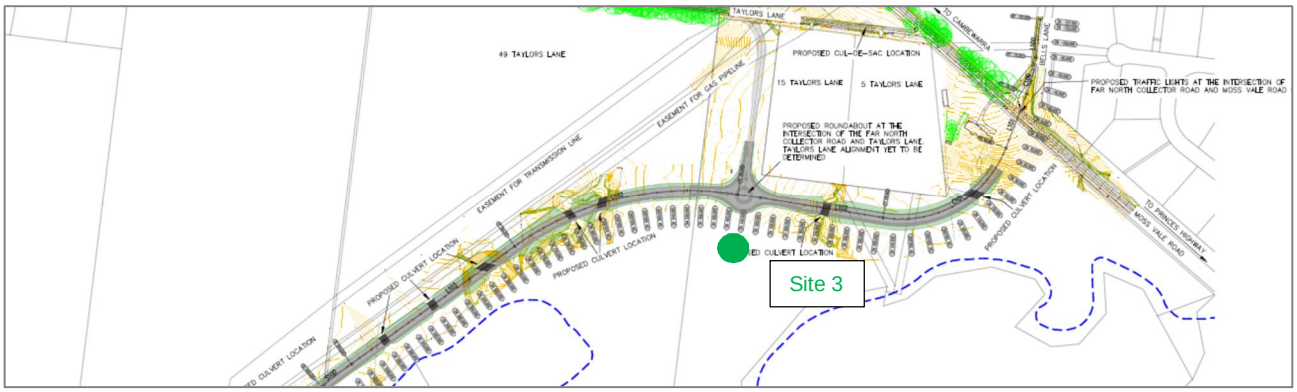
The design standards used to size and configure each option are in the table below.

Item	Criteria	Requirements
SPS	Capacity	Design flows (PWWF)
	Operational volume	< 10 starts per hour at ADWF
	Emergency Storage	8 hours ADWF
Rising main	Velocity	Minimum - 0.7 m/s Desired - 1.5 m/s Maximum – 3.5 m/s
	Detention times	4 hours

In addition to the performance standards, Shoalhaven Water also specified that sewer pumping station depths were not to exceed 8 m. This is due to specialist operational and maintenance requirements needed for stations deeper than this, which Shoalhaven Water does not possess.

The North Nowra sewer diversion also formed part of the investigation. This will be achieved via a new SPS to be constructed to the east of the Far North Collector Road. This new SPS will receive flows from the North Nowra area, discharging to the gravity network upstream of the new MVRS SPS. The new SPS is referred to as the New SPS21, as the existing SPS21 will be decommissioned as part of this diversion works.

The preferred location of the MVRS SPS is at the roundabout that connects the Far North Collector Road to Taylors Lane. The SPS at this site has a depth of 6 m, and provides the safest point of access and egress for future operation of the station.



Due to the maximum depth requirements of pumping stations, it is not feasible to decommission SPS26.

Three (3) key wastewater options were investigated based on the outcomes of the preliminary options workshop. These options were:

- **Option 1** - All URA flows discharged to Bomaderry WWTP via a terminal sewer pumping station in the Moss Vale Road South URA. The rising main alignment would be via Cambewarra Road or West Birriley Street
- **Option 2 -** All URA flows discharged to Bomaderry WWTP via a terminal sewer pumping station in the Moss Vale Road North URA. The rising main would loop around the northern border of Bomaderry, receiving injected flows from SPS08.

- **Option 3 -** Separate system serving the Southern URA and another system serving the Northern URA.

The options workshop reviewed the risks and opportunities associated with each option, with Option 2 being identified as the preferred wastewater option. This was primarily due to the risks associated with Option 1's rising main alignment through central Bomaderry and across the South Coast railway line in close proximity to the Bomaderry train station.

Option 2 poses significantly less construction risk, as the majority of the trenching would be undertaken within open space and within Council reserves. There are sections that will require easements to be established on private lands, and it is recommended that this engagement commence as soon as practical.

Option 2 also provides Shoalhaven Water with the opportunity to upgrade an existing deficient rising main from SPS08 to the WWTP.

The key components of this option include:

- 2022 - Construction of the New MVRS SPS. Access to be provide from the Far North Collector/Taylors Lane Roundabout. Level to be built up to exceed flood occurrence requirements
- 2022 - Installation of 1.3 km of rising main from MVRS to MVRN SPS site. Potential to inject into the!terminal rising main, allowing MVRN SPS to be staged, but should be further reviewed in Concept!Design, when development timings are better understood.
- 2022 - Installation of 2.7 km of DN525 rising main to SPS08. Dual DN375 mains could potentially be! installed to provide better interim performance and minimise retention times.
- 2022 – installation of 1.6 km of DN675 main from SPS08 to the Bomaderry WWTP
- 2022 – Divert North Nowra flows via a DN300 gravity line that utilises the Far North Collector Bridge! across Bomaderry creek.
- 2024 – Construction of the New MVRN SPS
- 2024 – Connection of Cambewarra rising main (SPS23) into the MVRN gravity system.
-

3.2 Survey and Services Location

The concept design has been undertaken based on Lidar, Council GIS and DBYD enquiries. The concept design has been used to direct detailed survey and asset location fields works, which are being undertaken in parallel to the finalisation of the concept design.

3.3 Geotechnical Investigations

Geotechnical investigations are being undertaken in parallel to the Concept design works. The findings of these field investigations will be available for the detailed design of this concept.

3.4 Environmental Assessment

Shoalhaven City Council has undertaken the environmental assessment for each component on the concept design. A summary of the outcomes from this assessment is detailed in Table 3-1. For full details of the assessment, refer to *Review of Environmental Factors (REF) Shoalwater Infrastructure – Moss Vale Rd URAs Part 2: Sewer Infrastructure* (October 2020).

The REF report is provided in Appendix B.

Table 3-1 REF Recommendations for each Sewer Pump Station Site

Environmental Safeguards and Measures to Mitigate Impacts	MVR - S	MVR - N	SPS21
General	▪ Easements through private land to be established as required ▪ Authorisation for works within NSW Roads and Maritime Services and Railcorp (Sydney Trains) land to be obtained prior to commencement of works ▪ Under-boring, where required, to comply with relevant authority requirements ▪ Properties affected by the works shall be notified via mail, prior to commencement of works.	▪ Easements through private land to be established as required ▪ Authorisation for works within NSW Roads and Maritime Services and Railcorp (Sydney Trains) land to be obtained prior to commencement of works ▪ Under-boring, where required, to comply with relevant authority requirements ▪ Properties affected by the works shall be notified via mail, prior to commencement of works.	▪ Easements through private land to be established as required ▪ Authorisation for works within NSW Roads and Maritime Services and Railcorp (Sydney Trains) land to be obtained prior to commencement of works ▪ Under-boring, where required, to comply with relevant authority requirements ▪ Properties affected by the works shall be notified via mail, prior to commencement of works.
Soil and Water	▪ Crossing of any creeks, watercourses, roads and railway lines shall be under-bored where practical. ▪ Erosion and sediment controls shall be in accordance with the "Blue Book" (Landcom 2004). ▪ A dewatering plan shall be developed and implemented, in accordance with the requirements of the REF, in the event that the water table is encountered during the construction of the wet well. ▪ SPS Overflow Structure shall include trash grates, and discharge to a grassed or vegetated swale, as close to the SPS as possible.	▪ CH2400 – CH3250 of the rising main has been mapped as Class 3 and Class 4 Acid Sulfate Soils. Sampling and analysis to be undertaken, to determine if an Acid Sulfate Management Plan is required. ▪ A Fisheries Permit shall be obtained prior to construction of the MVR-N SPS access road. No excavation within the watercourse crossing the unformed section of Abernethys Land shall be undertaken without an approved Fisheries Permit. ▪ Crossing of any creeks, watercourses, roads and railway lines shall be under-bored where practical.	▪ Crossing of any creeks, watercourses, roads and railway lines shall be under-bored where practical. ▪ Erosion and sediment controls shall be in accordance with the "Blue Book" (Landcom 2004). ▪ A dewatering plan shall be developed and implemented, in accordance with the requirements of the REF, in the event that the water table is encountered during the construction of the wet well. ▪ SPS Overflow Structure shall include trash grates, and discharge to a grassed or vegetated swale, as close to the SPS as possible.

Environmental Safeguards and Measures to Mitigate Impacts	MVR - S	MVR - N	SPS21
		▪ Erosion and sediment controls shall be in accordance with the "Blue Book" (Landcom 2004). ▪ A dewatering plan shall be developed and implemented, in accordance with the requirements of the REF, in the event that the water table is encountered during the construction of the wet well. ▪ SPS Overflow Structure shall include trash grates, and discharge to a grassed or vegetated swale, as close to the SPS as possible.	
Flora and Fauna	▪ The watercourse between MVR-S SPS and Moss Vale Road, containing Illawarra Lowlands Grassy Woodland EEC, shall be under-bored in accordance with the requirements of the REF. ▪ Removal or pruning of any native vegetation shall only be undertaken as required to construct and maintain the proposed sewer infrastructure. ▪ Impact to the Structural Root Zone of trees to be retained, is to be avoided where possible. ▪ Pruning of trees, where required, shall be undertaken in accordance with AS 4373-1996.	▪ Removal or pruning of any native vegetation shall only be undertaken as required to construct and maintain the proposed sewer infrastructure. ▪ Impact to the Structural Root Zone of trees to be retained, is to be avoided where possible. ▪ Pruning of trees, where required, shall be undertaken in accordance with AS 4373-1996.	▪ Removal or pruning of any native vegetation shall only be undertaken as required to construct and maintain the proposed sewer infrastructure. ▪ Impact to the Structural Root Zone of trees to be retained, is to be avoided where possible. ▪ Pruning of trees, where required, shall be undertaken in accordance with AS 4373-1996.
Aboriginal Heritage	▪ Sites 52-5-0694 and 52-5-0753 (refer to REF for details) to be located and identified prior to commencement of works, to ensure no impact to these sites. ▪ Works are to stop immediately if any suspected Aboriginal heritage artefacts are identified.	▪ The area covered by the "Abernethys Creek" Pad (refer to REF for details) shall be under-bored at a depth no less than 400mm, in accordance with the requirements of the REF. ▪ Works are to stop immediately if any suspected Aboriginal heritage artefacts are identified.	▪ Any works proposed within the vicinity of site 52-5-0931 (refer to REF for details) shall be under-bored to a depth no less than 400mm, unless the current AHIP application to harm is updated. ▪ Works are to stop immediately if any suspected Aboriginal heritage artefacts are identified.

4 MVR-S SPS

4.1 Background

Two new SPS's are required to service the proposed Moss Vale Road URA. The MVR-S SPS is located in Lot 262 DP DP794245, along the proposed Far North Collector and will be approximately 480m west of the Moss Vale Road. The SPS site will be approximately 60 x 40m. The SPS will discharge to a future gravity main along the Far North Collector Road and into Bells Lane that will drain to MVR-N SPS.

4.2 Design Parameters and Assumptions

The design parameters for the new MVRS SPS include the following.

Table 4-1 MVR-S SPS Design Parameters

Parameter	Value
ADWF	23.4 L/s
PDWF (Ultimate Flow 2049	47.2 L/s
PWWF	131.4 L/s
Emergency Storage Requirements	41.35 kL (8 hours of gravity ADWF – assuming U/S SPS would be shutdown)

Flood levels were not available at the time of preparing the concept plans. During the preparation of the SPS concept designs it was assumed the top of the wet well would be level with the existing ground level.

4.3 Site Location

MVR-S SPS will be located along the proposed Far North Collector and will be approximately 480m west of the Moss Vale Road

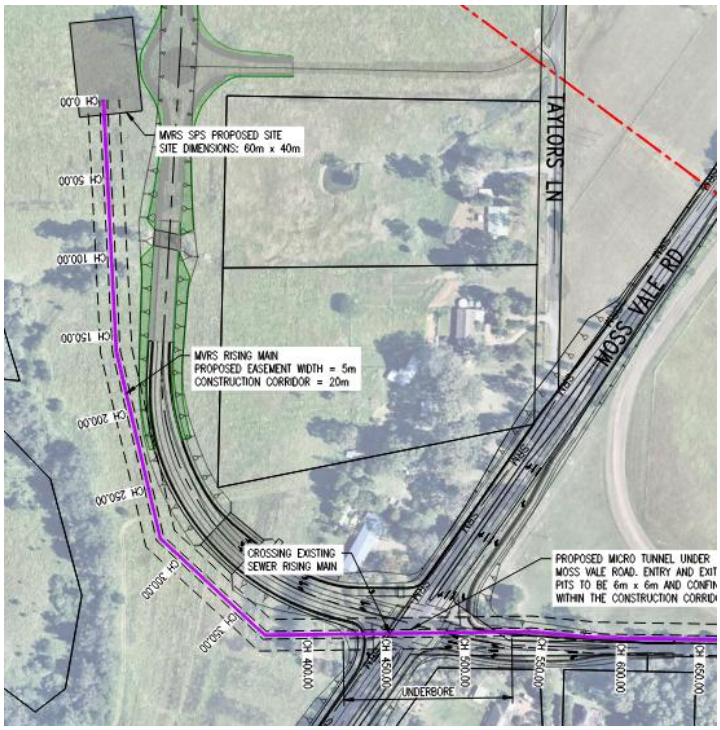


Figure 4-1 MVR-S SPS location

Site location plans are provided in Appendix A.

4.4 Site Layout

Access to the site will be from the Far North Collector. Temporary access is available from Taylors Lane until the future road is constructed. The site has been designed to allow a 19m truck to enter the site, turn around within the site boundary and exit.

The site will consist of the following features:

- An all-weather access track
- 1.8m high fence around the site
- Concrete wet well, concrete valve pit and concrete flow meter chamber
- Underground concrete emergency storage tank, with an overflow discharge to the local creek
- 2 x 10kL Chemical dosing tanks to be provided within a concrete bunded area
- Electrical cabinet, 300mm above the flood level with Electrical supply from Moss Vale Road
- Emergency generator
- Potable Water Supply from Moss Vale Road

Layout plans are provided in Appendix A.

4.5 Wet Well

The proposed wet well design parameters are detailed below.

Table 4-2 MVR-S SPS Wet Well Design Levels and Dimensions

Parameter	Value
Wet Well Cover Level	33.13 m
Gravity Sewer Inlet Level	29.87 m*
Wet Well Internal Diameter	3.5m
Wet Well Material	Reinforced Concrete
Proposed Pump Starts per Hour	5.8
Operational Volume	14.43 m^3
Total Well Depth	5 m
Top Water Level	30.13 m
Bottom Water Level	28.63 m
Wet Well Invert Level	28.13 m

* this is an assumed invert level and is to be confirmed once the gravity network is designed

Concept design plans are provided in Appendix A.

4.6 Valve Pit

The valve chamber is to be a separate concrete structure to the wet well. The valve chamber is to be a cast in-situ reinforced concrete pit.

Concept design plans are provided in Appendix A.

4.7 Flowmeter Pit

The flowmeter chamber is to be a separate concrete structure to the valve pit. The flowmeter chamber is to be a cast in-situ reinforced concrete pit.

Concept design plans are provided in Appendix A.

4.8 Electrical, Control and Telemetry

Shoalhaven Water have requested that the electrical switchboard is to be located 300mm above the 100-year flood level.

It is anticipated that power will be supplied to the site from Moss Vale Road.

4.9 Emergency Storage

The emergency storage has been sized designed for 8 hrs of flow at ADWF. The emergency storage required is 41.35kL. The emergency storage volume is to be confirmed during the detailed design as the storage within the gravity network has been assumed as no designs were available at the time the hydraulic assessment was prepared. Assumptions and design parameters used to determine the emergency storage is as follows:

Table 4-3 MVR-S SPS Emergency Storage Calculations

Parameter	Value
Total Storage Required	164.2 kL
Storage available in SPS	43.3 kL
Estimated length of gravity main used as storage	500 m
Estimated size of gravity main	450 mm
Storage available in gravity system	79.52 kL
Emergency Storage Required	41.35 kL

4.10 Rising Main

The rising main concept design was prepared using available GIS Council data and LIDAR survey. The concept design horizontal and vertical alignment will need to be updated during the detailed design phase once survey and geotechnical investigations are complete.

4.10.1 Pipe Size and Material

The rising main from MVR-S to the MVR-N has been sized as an OD450 SDR13.6 PE100 pressure main. The discharge pipework will be DN250 S.S.

The main has been sized based on the following parameters.

Table 4-4 MVR-S SPS Rising Main Design Parameters

Parameter	Value
Design Flow	131.4 L/s
Proposed Internal Diameter of Discharge Pipework	250 mm
Velocity achieved (target velocity >2m/s and < 4m/s)	2.7 m/s

Proposed Internal Diameter of Rising Main	382 mm
Velocity achieved (target velocity<3m/s and > 0.9m/s, target = 1.5 m/s)	1.1 m/s
Slime Control Velocity (target > 0.6 m/s)	1.07 m/s

4.10.2 Pipe Pressure Rating

Currently the main is proposed to be a pressure rating PN12.5, however this is to be confirmed via a surge analysis to be undertaken during detailed design.

4.10.3 Alignment

The MVR-S to MRV-N rising main alignment was selected to utilise existing Council land and existing easements where possible to reduce the impact on private land. A 20 m wide construction corridor has been provided with a 5m wide easement for the rising main.

The rising main will traverse through the following lots and roads.

- Lot 262 DP DP794245
- Crossing Moss Vale Road
- Along Bells Lane, within the road reserve
- Along Abernathy's Lane road reserve

4.10.4 Air Release Valves

Air release valves are to be provided at each high point along the alignment. Odour scrubbers may be required at certain air valve. The exact location of the air valves is to be determined during the detailed design.

4.10.5 Scour Valves

Scour valves are to be located at the low points, in consultation with Shoalhaven Water. The exact location of the scour valves is to be determined during the detailed design.

4.10.6 Connections

The MVR-S rising main will connect to the future gravity main along Bells Lane and gravity drain to MVR-N SPS.

4.10.7 Construction Methodology

The rising main is to be constructed by a combination of open trench and under bores. The under bores are required to cross existing waterways and roads The under bores are to comply with the relevant authority approvals.

5 MVR-N SPS

5.1 Background

Two new SPS's are required to service the proposed Moss Vale Road Subdivision. The MVR-N SPS is located in Lot 2 DP1134376, along Abernethys Lane, approximately 350m west of the Bells Lane and Abernethys Lane intersection. The SPS will be approximately 60 x 40m. The SPS will discharge to the STP along an OD560 PE rising main that is approximately 4,850m long.

5.2 Design Parameters and Assumptions

The design parameters for the new MVR-N include the following:

Table 5-1 MVR-N SPS Design Parameters

Parameter	Value
ADWF	44.8 L/s
PDWF (Ultimate Flow 2049	84.3 L/s
PWWF	259.7 L/s
Emergency Storage Requirements	289.52 kL (8 hours of gravity ADWF – assuming U/S SPS would be shutdown)

Flood levels were not available at the time of preparing the concept plans. During the preparation of the SPS concept designs it was assumed the top of the wet well would be level with the existing ground level.

The rising main from MVR-N to the STP will intersect the existing SPS-8. The flows from SPS-8 to the STP will now be through the new rising main, with the existing rising main from SPS-8 to the STP to be made redundant.

The design parameters for SPS-8 are as follows.

Table 5-2 SPS-8 Design Parameters

Parameter	Value
ADWF	26.7 L/s
PDWF (Ultimate Flow 2049	53.3 L/s
PWWF	80 L/s

5.3 Site Location

MVR-N SPS will be located along Abernethys Lane, approximately 350m west of the Bells Lane and Abernethys Lane intersection.

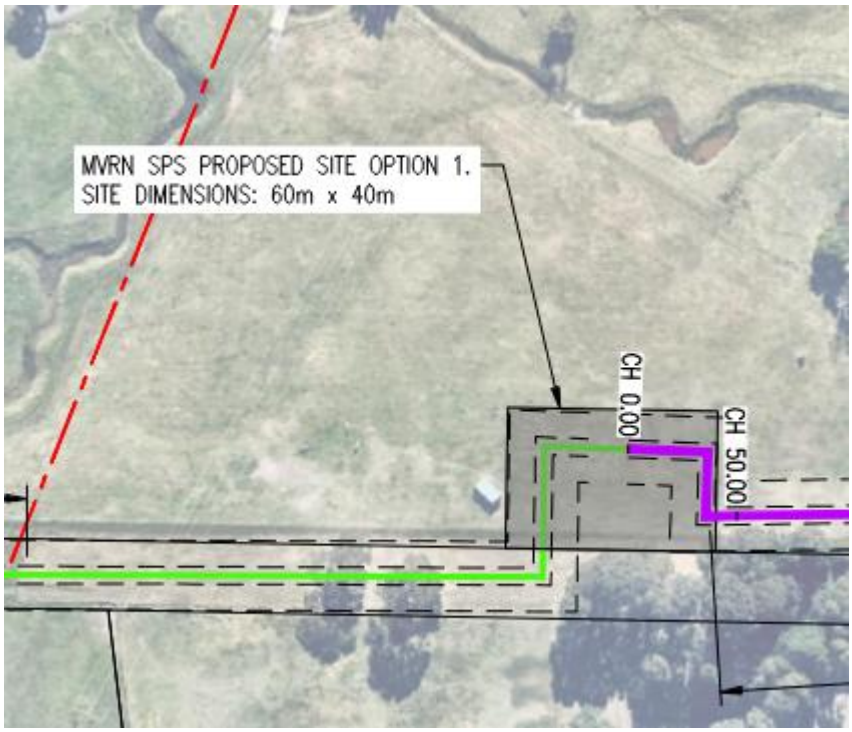


Figure 5-1 MVR-N SPS location

The SPS site will front the paper subdivision road that is yet to be constructed. Temporary all weather access track is to be provided from the intersection of Bells Lane and Abernethys Lane the SPS site.

Site location plans are provided in Appendix A.

5.4 Site Layout

Access to the site will be from the Bells Lane and Abernethys Lane intersection. The site has been designed to allow a 19m truck to enter the site, turn around within the site boundary and exit back onto Abernethys Lane.

The site will consist of the following features:

- An all-weather access track from the intersection of Bells Lane and Abernethys Lane to the SPS site along the road reserve.
- 1.8m high fence around the site
- Concrete wet well, concrete valve pit and concrete flow meter chamber
- Underground concrete emergency storage tank, with an overflow discharge to the local creek
- 2 x 10kL Chemical dosing tanks to be provided within a concrete bunded area
- Electrical cabinet, 300mm above the flood level with Electrical supply from Bells Lane
- Emergency generator
- Potable Water Supply from Bells Lane

Layout plans are provided in Appendix A.

5.5 Wet Well

The proposed wet well design parameters are detailed below.

Table 5-3 MVR-N SPS Wet Well Design Levels and Dimensions

Parameter	Value
Wet Well Cover Level	21.7 m
Gravity Sewer Inlet Level	18.7 m*
Wet Well Internal Diameter	4.5 m
Wet Well Material	Reinforced Concrete
Proposed Pump Starts per Hour	6.8
Operational Volume	23.86 m^3
Total Well Depth	6 m
Top Water Level	17.7 m
Bottom Water Level	16.2 m
Wet Well Invert Level	15.7 m

* this is an assumed invert level and is to be confirmed once the gravity network is designed

Concept design plans are provided in Appendix A.

5.6 Valve Pit

The valve chamber is to be a separate concrete structure to the wet well. The valve chamber is to be a cast in-situ reinforced concrete pit.

Concept design plans are provided in Appendix A.

5.7 Flowmeter Pit

The flowmeter chamber is to be a separate concrete structure to the valve pit. The flowmeter chamber is to be a cast in-situ reinforced concrete pit.

Concept design plans are provided in Appendix A.

5.8 Electrical, Control and Telemetry

Shoalhaven Water have requested that the electrical switchboard is to be located 300mm above the 100-year flood level.

It is anticipated that power will be supplied to the site from Bells Lane.

5.9 Emergency Storage

The emergency storage has been sized designed for 8 hrs of flow at ADWF. The emergency storage required is 289kL. The emergency storage volume is to be confirmed during the detailed design as the storage within the gravity network has been assumed as no designs were available at the time the hydraulic assessment was prepared. Assumptions and design parameters used to determine the emergency storage is as follows:

Table 5-4 MVR-N SPS Emergency Storage Calculations

Parameter	Value
Total Storage Required	518.4 kL
Storage available in SPS	87.47 kL
Estimated length of gravity main used as storage	500 m
Estimated size of gravity main	600 mm
Storage available in gravity system	141.37 kL
Emergency Storage Required	289.52 kL

5.10 Rising Main

The rising main concept design was prepared using available GIS Council data and LIDAR survey. The concept design horizontal and vertical alignment will need to be updated during the detailed design phase once survey and geotechnical investigations are complete.

5.10.1 Pipe Size and Material

The rising main from MVR-N to the STP has been sized as an OD560 SDR13.6 PE100 pressure main. The discharge pipework will be DN375 S.S.

The main has been sized based on the following parameters.

Table 5-5 MVR-N SPS Rising Main Design Parameters

Parameter	Value
Design Flow	259.7 L/s
Proposed Internal Diameter of Discharge Pipework	375 mm
Velocity achieved (target velocity >2m/s and < 4m/s)	2.4 m/s
Proposed Internal Diameter of Rising Main	455 mm
Velocity achieved (target velocity<3m/s and > 0.9m/s, target = 1.5 m/s)	1.6 m/s
Slime Control Velocity (target > 0.6 m/s)	1.10 m/s

5.10.2 Pipe Pressure Rating

Currently the main is proposed to be a pressure rating PN16, however this is to be confirmed via a surge analysis to be undertaken during detailed design.

5.10.3 Alignment

The MVR-N to STP rising main alignment was selected to utilise existing Council land and existing easements where possible to reduce the impact on private land. A 20 m wide construction corridor has been provided with a 5m wide easement for the rising main.

Alternative routes to the alignment have been shown on the concept design drawings. These alternative alignments are to be further investigated during the detailed design phase once survey and geotechnical investigations are complete.

The rising main will traverse through the following lots and roads.

- Lot 2 DP1134376
- Lot 1 DP1134376
- Abernethys Lane (paper road – Local Road)
- Lot 601 DP1223625
- Lot 602 DP1123625
- Princes Hwy (TfNSW Road)
- Lot 415 DP1210528
- Lot 502 DP1121372
- Meroo Road (Local Road)
- Lot 202 DP1180659
- Lot 1 DP1164576
- Lot 13 DP708513
- Rail Corridor
- Lot 1 DP620360

The alignment through Lot 202 DP1180659 and Lot 1 DP620360 is to stay within the existing sewer easements. The existing easement width is to be reviewed once the alignment is complete to ensure the existing easements are wide enough for the existing asset and the proposed OD560 rising main

The proposed rising main is to intersect SPS-8 in Lot 1 DP1164576. The new rising main is to connect to the existing rising main from SPS-8 to allow flows from SPS-8 to be diverted to the new rising main and leaving the existing rising main from SPS-8 to the STP redundant. The connection details and assessment of existing SPS-8 condition is to be completed during the detailed design phase.

5.10.4 Air Release Valves

Air release valves are to be provided at each high point along the alignment. Odour scrubbers may be required at certain air valve. The exact location of the air valves is to be determined during the detailed design.

5.10.5 Scour Valves

Scour valves are to be located at the low points, in consultation with Shoalhaven Water. The exact location of the scour valves is to be determined during the detailed design.

5.10.6 Barometric Loop

The MVR-N rising main will require a barometric loop within the treatment plant site. The barometric loop is to be located as close to the inlet works as possible to reduce the visual impacts from the local residents along Railway Street.

5.10.7 Connections

The MVR-N rising main is to connect to the inlet works at the STP via a barometric loop. There is an existing connection point at the STP inlet works for this rising main. Connection location is located on the northern face of the inlet works.

The MVR-N rising main is to intersect the SPS-8 rising main to provide a new route to the STP. The connection details are to be further investigated as part of the detailed design.

5.10.8 Construction Methodology

The rising main is to be constructed by a combination of open trench and under bores. The under bores are required to cross existing waterways, roads and rail lines. The under bores are to comply with the relevant authority approvals.

6 SPS21

6.1 Background

Currently SPS21 is located on Illaroo Road, in Lot 22 DP262851, which is approximately 100 m^2 in area. The existing SPS consists of a 2.4m diameter wet well, 3m in depth, and no emergency storage tank. There is not sufficient room on the existing lot to add an emergency storage tanks, therefore, this design involves diverting flows from the inlet MH to SPS21 (MH 21A/1), and constructing a new sewer pump station, including provision for emergency storage. The proposed site for the new SPS is on Lot 1 DP848630, adjacent to the proposed Far North Collector Road, near the intersection with Illaroo Road.

6.2 Design Parameters and Assumptions

The design parameters for the new SPS21 include the following:

Table 6-1 SPS21 Design Parameters

Parameter	Value
ADWF (Ultimate Flow 2049)	10.1 L/s
PDWF (Ultimate Flow 2049)	22.7 L/s
PWWF (Ultimate Flow 2049)	74.5 L/s
Emergency Storage Requirements	123 kL (8 hours of gravity ADWF – assuming U/S SPS would be shutdown)

6.3 Site Location

The proposed site is the blue shaded area in Figure 6-1.

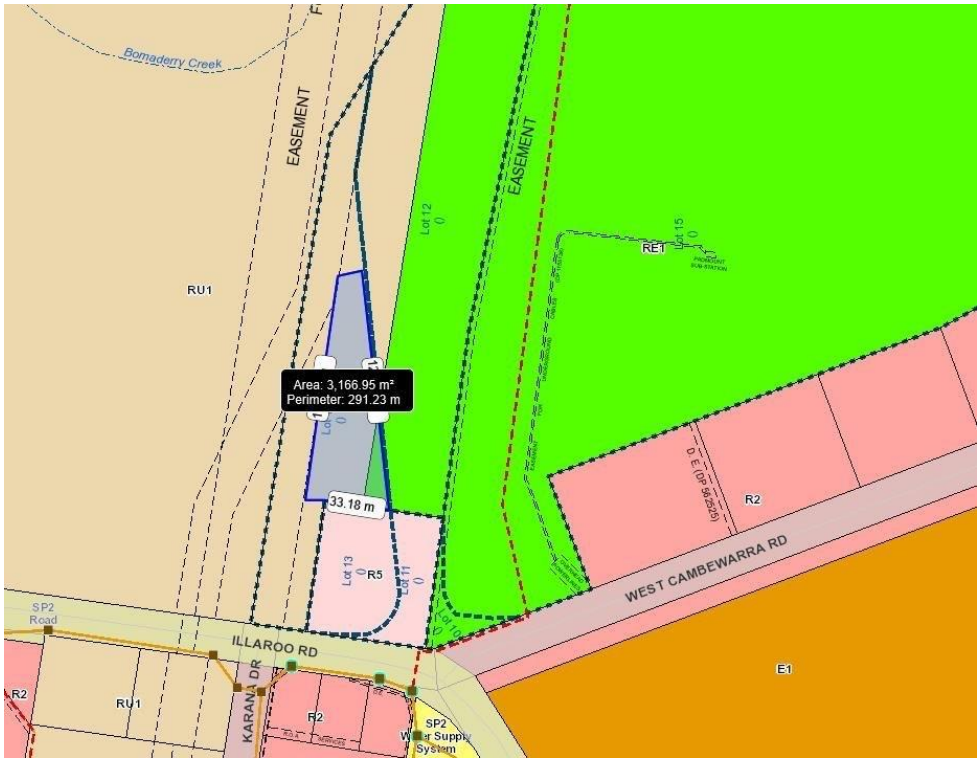


Figure 6-1 Proposed Site Location

6.4 Site Layout

Access to the site is from Illaroo Road, with the site designed to allow a 19m truck to enter the site, turn around within the site boundary and exit back onto Illaroo road.

The site will consist of the following features:

- All weather access track into the site from Illaroo Road
- Concrete slab adjacent to the wet well
- 1.8m high fence around the site
- Concrete wet well, concrete valve pit and concrete flow meter chamber
- Underground concrete emergency storage tank, with an overflow discharge to Bomaderry Creek
- Electrical cabinet, with Electrical supply from Illaroo Road
- Emergency generator
- Potable Water Supply from Illaroo Road

6.5 Wet Well

The proposed wet well design parameters are detailed in Table 6-2 below.

Table 6-2 Wet Well Design Levels and Dimensions

Parameter	
Wet Well Cover Level	36.88m
Gravity Sewer Inlet Level	33.98m
Wet Well Internal Diameter	3.5m
Wet Well Material	Reinforced Concrete
Proposed Pump Starts per Hour	3.8
Operational Volume	9.62 m^3
Total Well Depth	5m
Top Water Level	33.38
Bottom Water Level	32.38
Wet Well Invert Level	31.88

6.6 Valve Pit

The valve pit is proposed to be a reinforced concrete pit, separate to the wet well. A separate Flow Meter chamber is proposed.

6.7 Electrical Requirements

Shoalhaven Water have requested that the electrical switchboard is to be located 300mm above the 100-year flood level.

It is anticipated that power will be supplied to the site from Illaroo Road.

6.8 Emergency Storage

The wet well will provide approximately 40 kL emergency storage, whilst it is estimated that the gravity network will provide approximately 20 kL storage, therefore, an additional 63 kL storage is required.

Therefore, a 6.5m diameter concrete tank, at 2.35m depth, providing 65 kL storage would be suitable for this site.

6.9 Existing Sewer Pump Station

It is anticipated that the following works will be required at the existing sewer pumping station:

- Decommission existing sewer pumping station
- Modify existing inlet MH, to divert flows to new gravity line

6.10 Gravity Main

6.10.1 Pipe Sizing and Material

The gravity main is designed to convey the ultimate PWWF, of 74.5 L/s, to the new SPS21. The proposed pipe for the gravity main is DN300 uPVC SN8.

6.10.2 Alignment

The proposed alignment for the gravity main is as follows:

- Connect into existing MH 21A/1 within the existing SPS site
- Road Crossing of Illaroo Road
- Alignment located within the Illaroo Road verge on the northern side, including a crossing of the high pressure Eastern Gas Pipeline
- Alignment to head north to the inlet MH of the new SPS located to the west of the proposed Far North Collector Road

6.10.3 Construction Methodology

The gravity main is anticipated to be installed via open trench construction, other than the crossing of Illaroo Road, which is proposed to be installed via a trenchless methodology, to be determined during detailed design.

The construction methodology of the crossing of the high pressure Eastern Gas Pipeline is to be determined subject to potholing of the main, and consultation with the utility owner.

6.11 Rising Main

6.11.1 Pipe Size and Material

Shoalhaven Water requested the rising main to be polyethylene. The main has been sized based on the following parameters.

Table 6-3 Rising Main Design Parameters

Parameter	Value
Design Flow	74.5 L/s
Proposed Internal Diameter of Discharge Pipework	200mm
Velocity achieved (target velocity >2m/s and < 4m/s)	2.4 m/s
Proposed Internal Diameter of Rising Main	246.3mm
Velocity achieved (target velocity<3m/s and > 0.9m/s, target = 1.5 m/s)	1.6 m/s
Slime Control Velocity (target > 0.6 m/s)	1.02 m/s

Therefore, the proposed pipework is as follows:

- Discharge Pipework = DN200 SS
- Rising Main Pipework = OD280 PE100 PN10

6.11.2 Pipe Pressure Rating

Currently the main is proposed to be a pressure rating PN10, however this is to be confirmed via a surge analysis to be undertaken during detailed design.

6.11.3 Alignment

The proposed rising main alignment is as follows:

- CH0 – CH78: North of SPS within SPS site and the Far North Collector Road
- CH78 – CH234: Along the western side of the Far North Collector Road, within the verge, south of Bomaderry Creek
- CH234 – CH344: Rising main to be attached to the proposed bridge crossing of Bomaderry Creek, on the western side of the bridge
- CH344 - CH412: Along the western side of the Far North Collector Road, within the verge, north of Bomaderry Creek
- CH412 – CH555: Heading north-west within a proposed easement, connecting into the existing gravity sewer system north of Bomaderry Creek.

6.11.4 Air Release Valves

An air release valves are to be located at the high points, which are to be determined during detailed design.

6.11.5 Scour Valves

Scour valves are to be located at the low points, in consultation with Shoalhaven Water, to be determined during detailed design.

6.11.6 Connections

The rising main will connect into the proposed DN200 SS discharge pipework from the proposed SPS, and discharge to the existing maintenance structure within the gravity sewer network north of Bomaderry Creek.

6.11.7 Construction Methodology

The rising main will be installed via open trench construction, other than along the bridge crossing, which either will be installed within the bridge structure, or attached the side of the structure, to be determined during detailed design.

APPENDIX A

DRAWINGS

PROPOSED MICRO TUNNEL UNDER CREEK. ENTRY AND EXIST PITS TO BE 6m x 6m AND CONFINED WITHIN THE CONSTRUCTION CORRIDOR

MVRN SPS PROPOSED SITE OPTION 1
SITE DIMENSIONS 60m x 40m

MVRN RISING MAIN
PROPOSED EASEMENT WIDTH = 5m
CONSTRUCTION CORRIDOR = 20m

ALTERNATIVE MVRN RISING MAIN ALIGNMENT TO BE INVESTIGATED DURING DETAILED DESIGN

ALTERNATIVE MVRN RISING MAIN ALIGNMENT TO BE INVESTIGATED DURING DETAILED DESIGN

MVRS GRAVITY MAIN

BELLS LANE. PROPOSED WORKS TO BE WITHIN ROAD RESERVE TO REDUCE IMPACT ON PRIVATE PROPERTY

PROPOSED MICRO TUNNEL UNDER CREEK. ENTRY AND EXIST PITS TO BE 6m x 6m AND CONFINED WITHIN THE CONSTRUCTION CORRIDOR

MVRN RISING MAIN FOLLOWING EXISTING EASEMENTS

PROPOSED HDD UNDER BORE CONFINED WITHIN THE CONSTRUCTION CORRIDOR

PROPOSED MICRO TUNNEL UNDER MOSS VALE ROAD. ENTRY AND EXIST PITS TO BE 6m x 6m AND CONFINED WITHIN THE CONSTRUCTION CORRIDOR

MAJOR TfNSW ROAD CROSSING. EITHER HDD OR MICRO TUNNEL. ENTRY AND EXIT PITS TO BE 6m x 6m AND CONFINED WITHIN THE CONSTRUCTION CORRIDOR

MVRN RISING MAIN
PROPOSED EASEMENT WIDTH = 5m
CONSTRUCTION CORRIDOR = 20m

EXISTING SPS 8

MVRS RISING MAIN
PROPOSED EASEMENT WIDTH = 5m
CONSTRUCTION CORRIDOR = 20m

MVRS SPS PROPOSED SITE
SITE DIMENSIONS 60m x 40m

MVRN RISING MAIN
PROPOSED EASEMENT WIDTH = 5m
CONSTRUCTION CORRIDOR = 20m

PROPOSED HDD UNDER BORE CONFINED WITHIN THE CONSTRUCTION CORRIDOR

MVRN RISING MAIN
PROPOSED EASEMENT WIDTH = 5m
CONSTRUCTION CORRIDOR = 20m

EXISTING EASEMENT BETWEEN SPS 8 & WWTP

ALTERNATE ROUTE INTO STP ALONG RAILWAY STREET

BAROMETRIC LOOP – APPROX 20m HIGH TO BE LOCATED WITHIN STP SITE

ALTERNATE LOCATION FOR BAROMETRIC LOOP FOR RAILWAY ST ENTRY – APPROX. 20m HIGH TO BE LOCATED WITHIN STP SITE

GRAVITY MAIN FROM BAROMETRIC LOOP TO INLET WORKS TO CLOSELY FOLLOW EXISTING DN450 GRAVITY MAIN

CONNECTION INTO INLET WORKS VIA EXISTING CONNECTION POINT AT BOMADERRY STP

SHEET C1001
SHEET C1002
SHEET C1003
SHEET C1004
SHEET C1005

UNDERBORE
UNDERBORE TRAIN TRACK

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MOSS VALE SEWER GRAVITY MAIN INVESTIGATION

SEWER PUMPING STATION
& RISING MAIN
OVERVIEW PLAN

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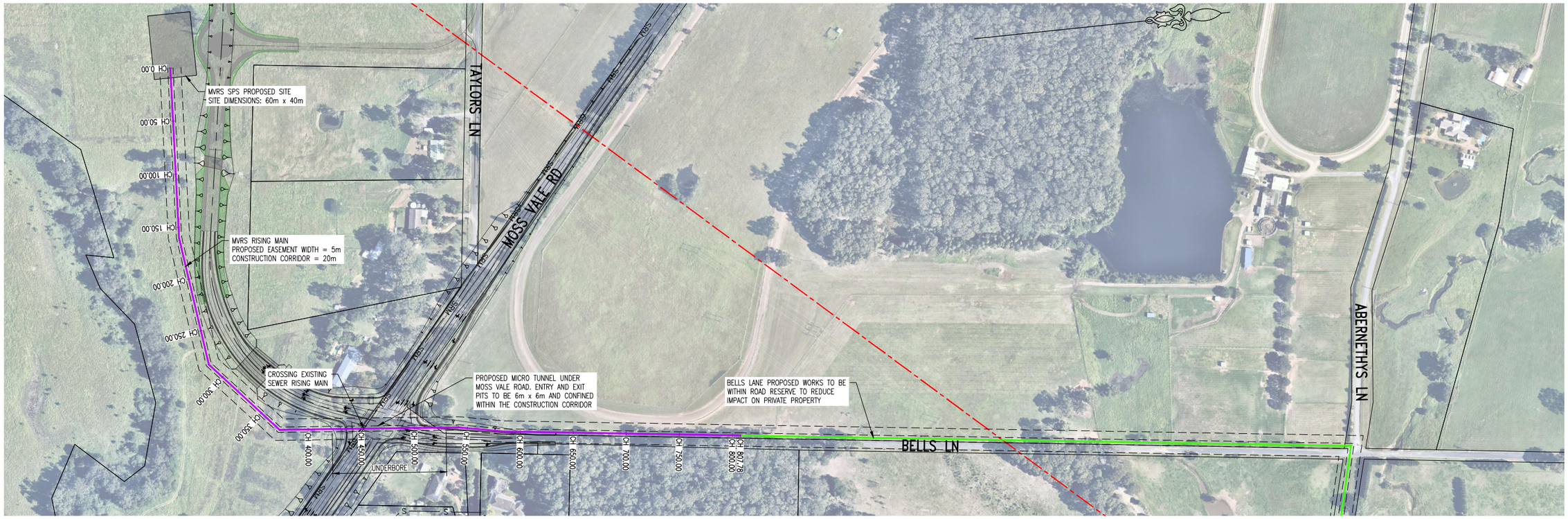

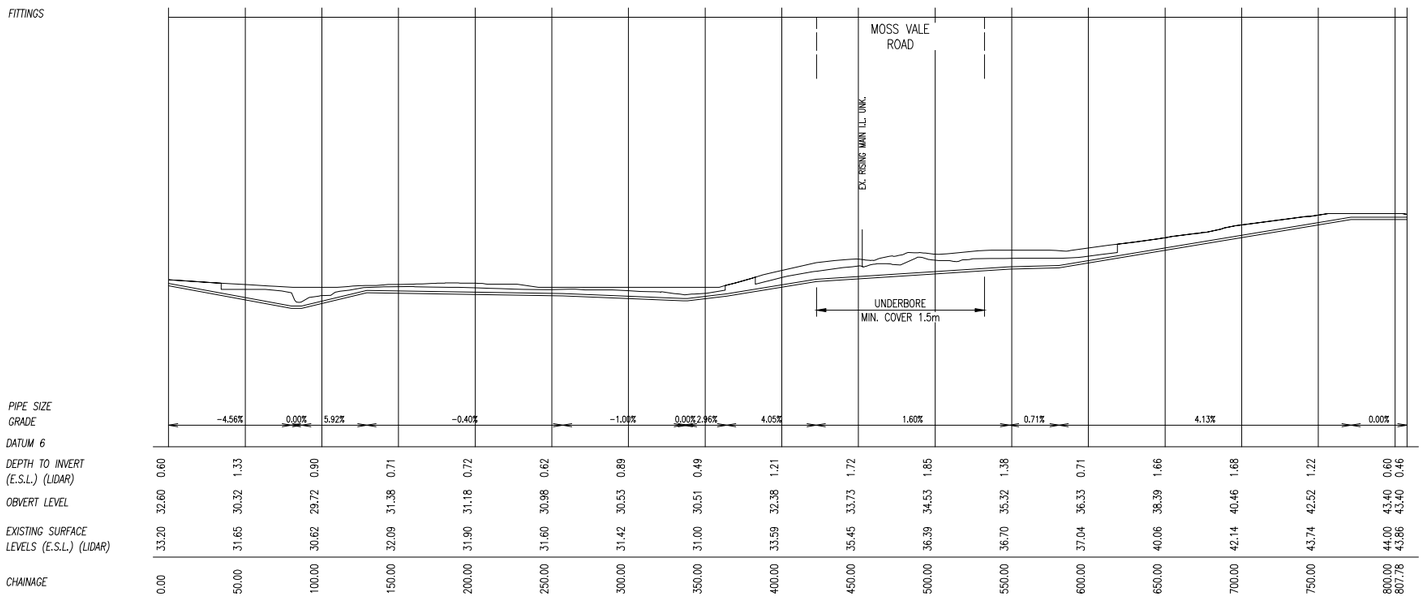

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MOSS VALE SEWER GRAVITY MAIN INVESTIGATION

SEWER PUMPING STATION
& RISING MAIN
SHEET 2

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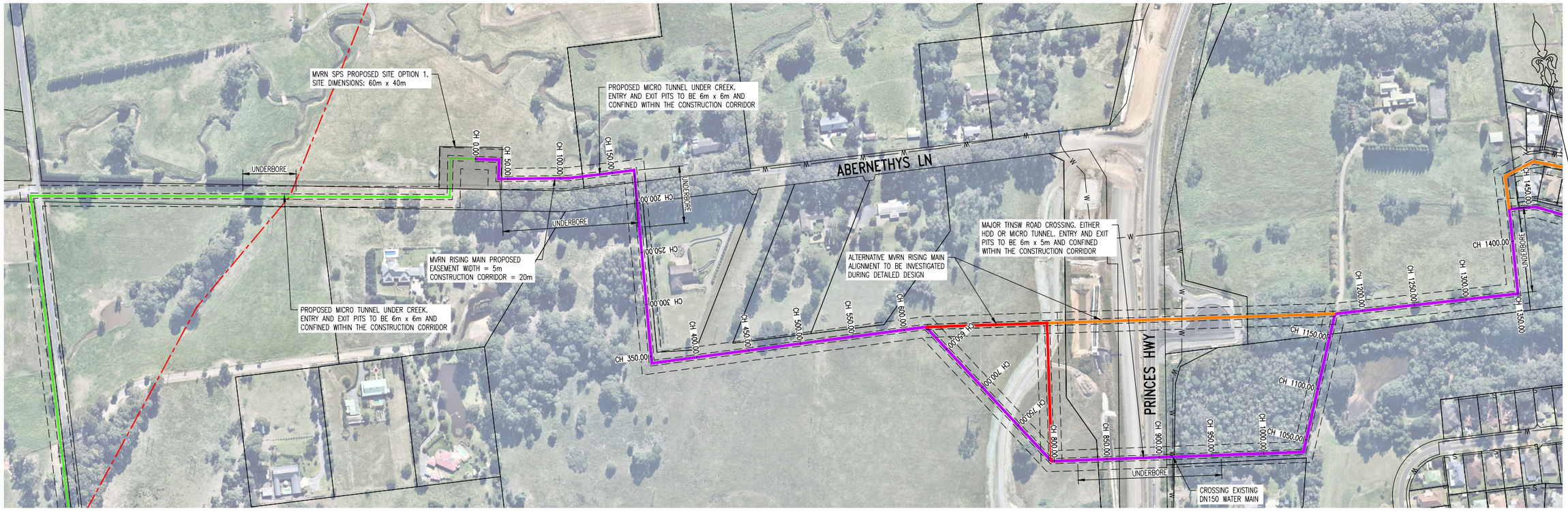

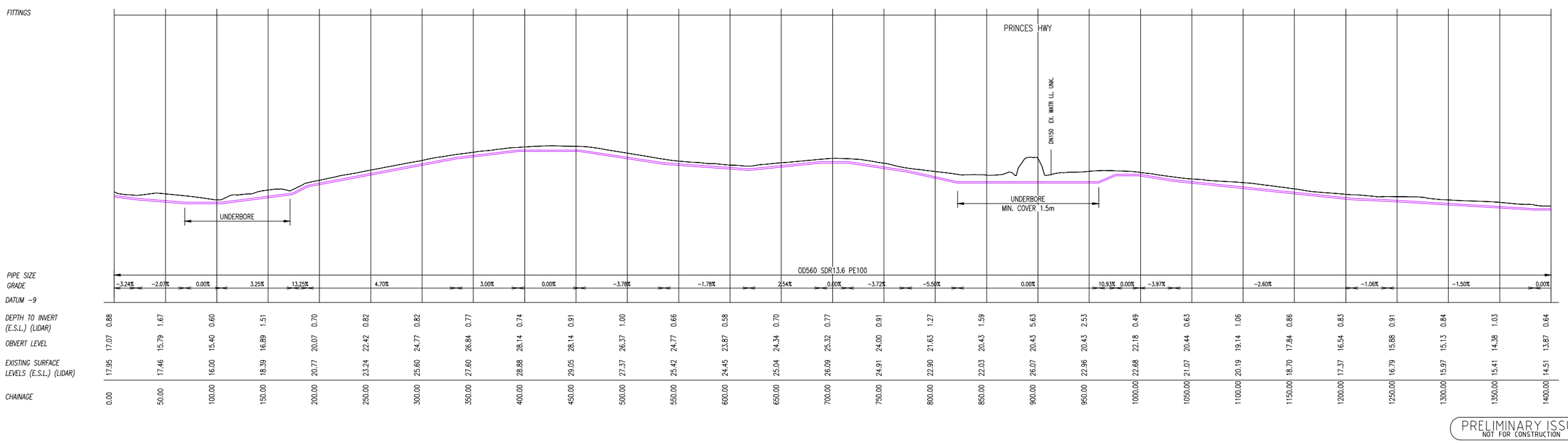

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MOSS VALE SEWER GRAVITY MAIN INVESTIGATION

SEWER PUMPING STATION
& RISING MAIN
SHEET 3

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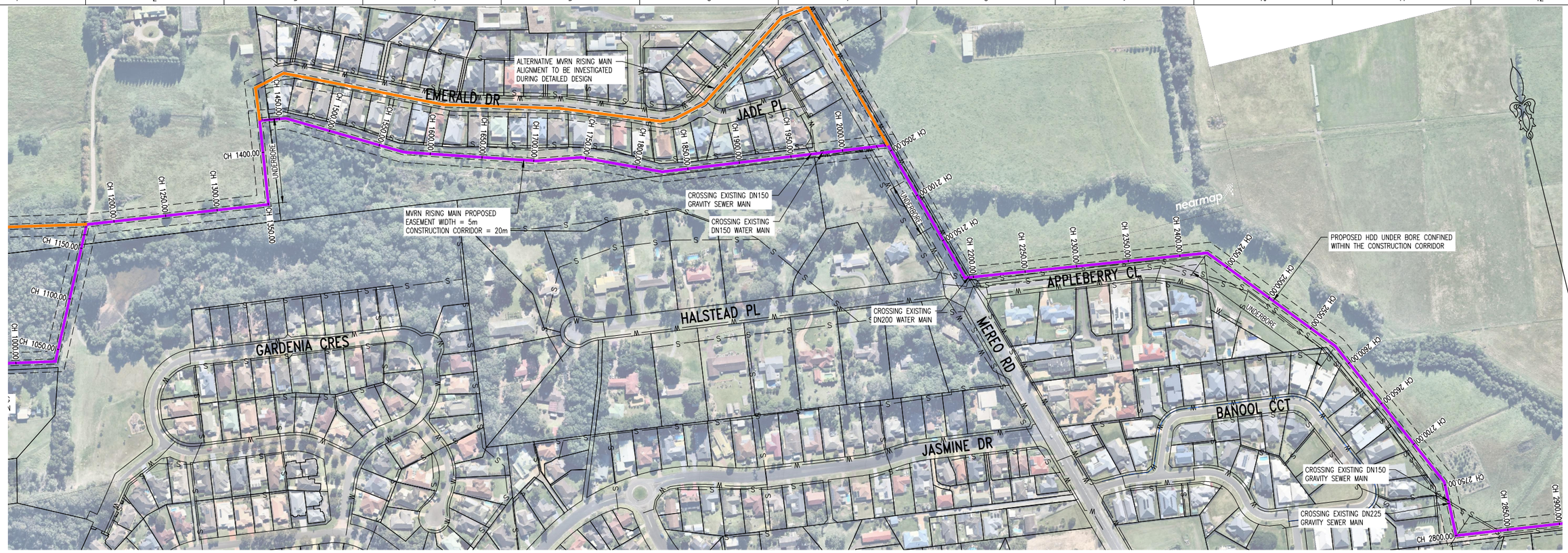

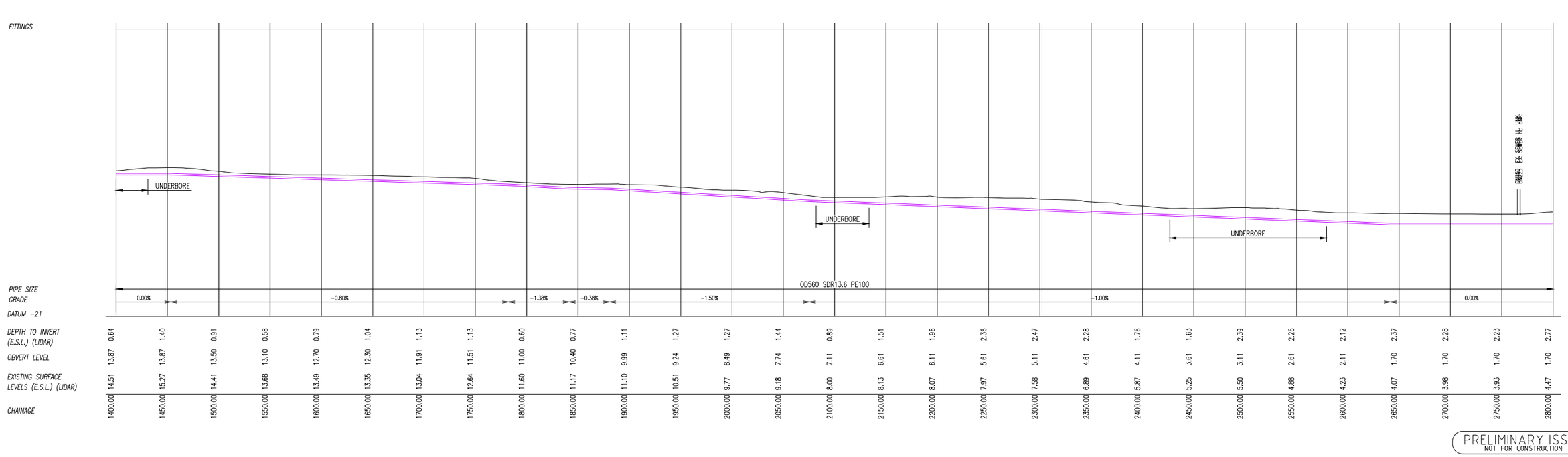

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SEWER PUMPING STATION
& RISING MAIN
SHEET 4

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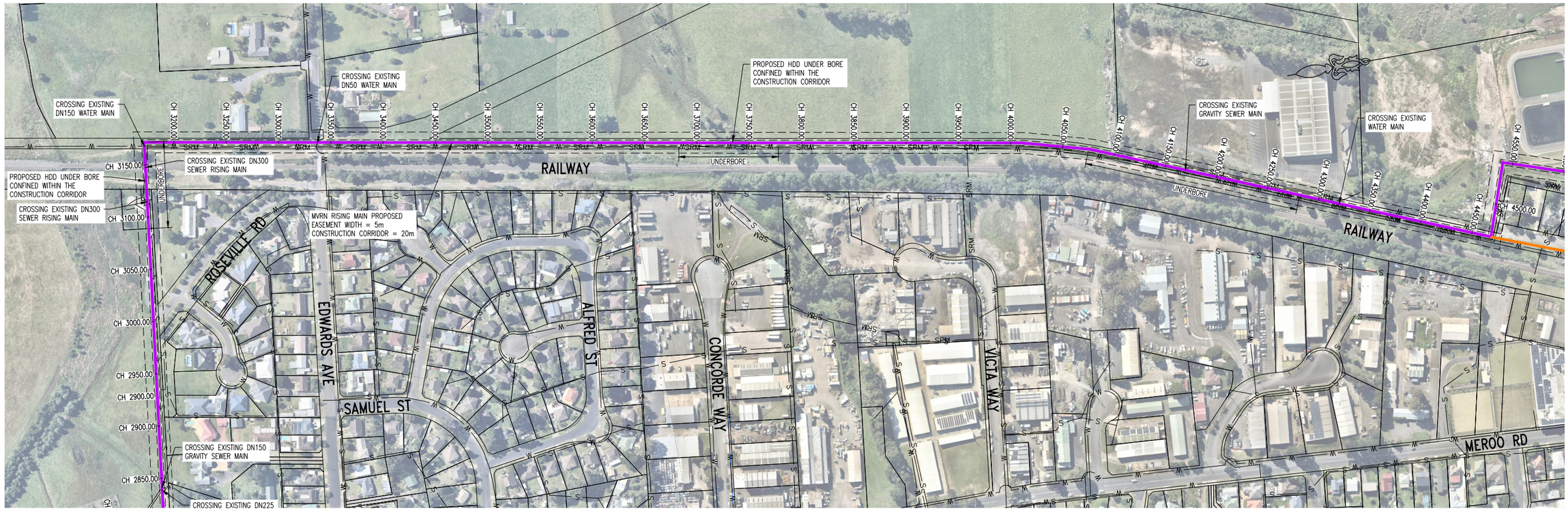

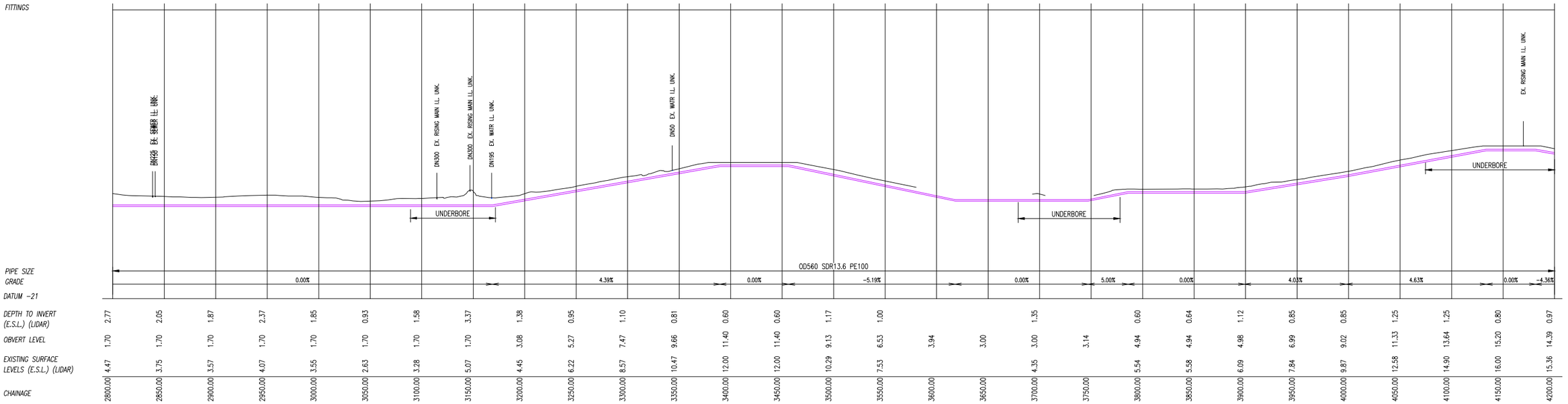

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MOSS VALE SEWER GRAVITY MAIN INVESTIGATION

SEWER PUMPING STATION
& RISING MAIN
SHEET 5

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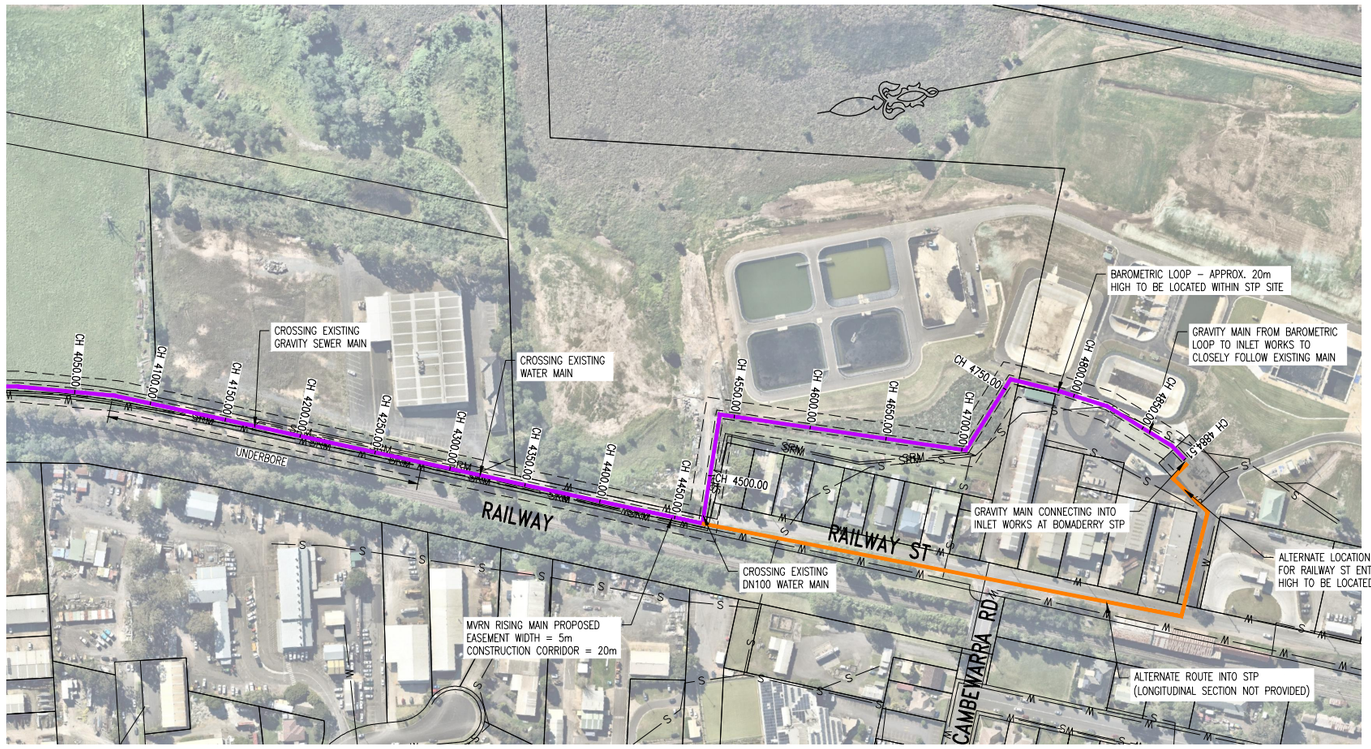

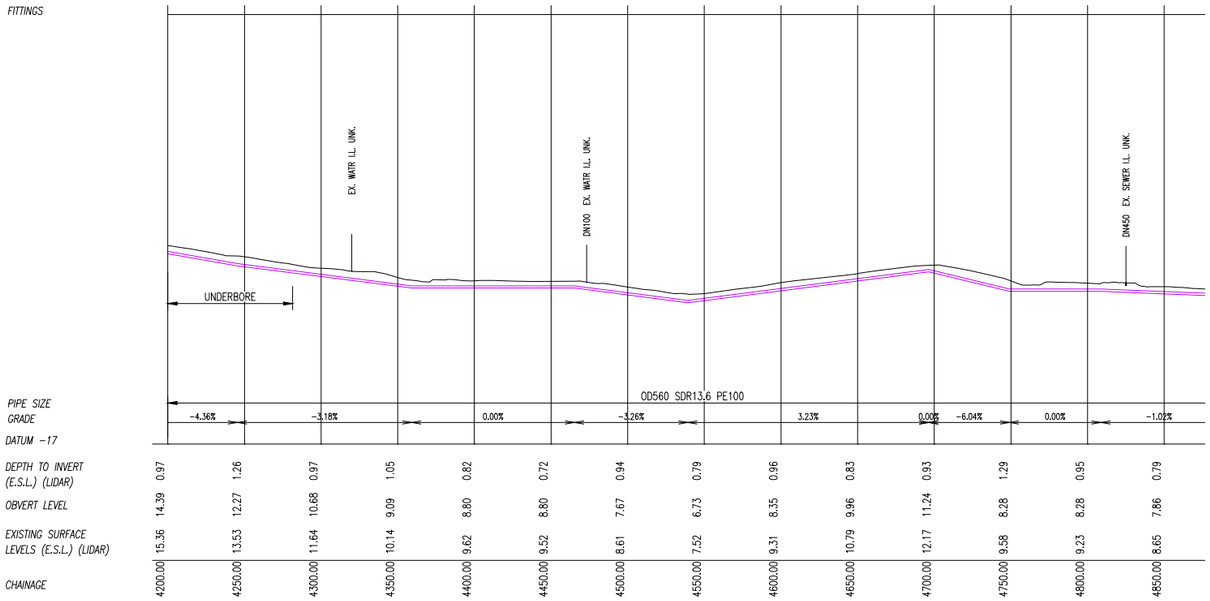

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SEWER PUMPING STATION
& RISING MAIN
SHEET 6

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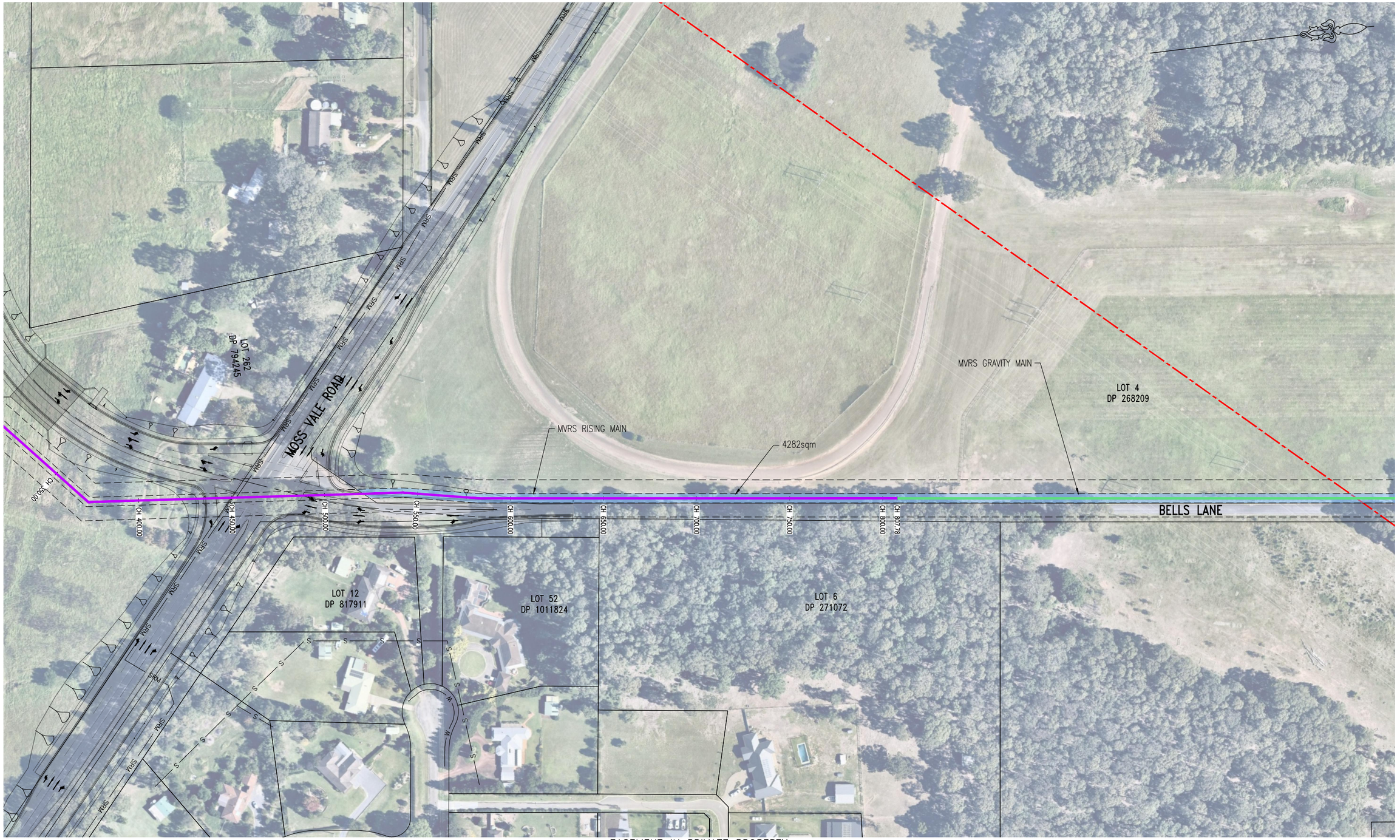

EASEMENT IN PRIVATE PROPERTY

SCALE 1:1000

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SEWER PUMPING STATION
& RISING MAIN
SHEET 7

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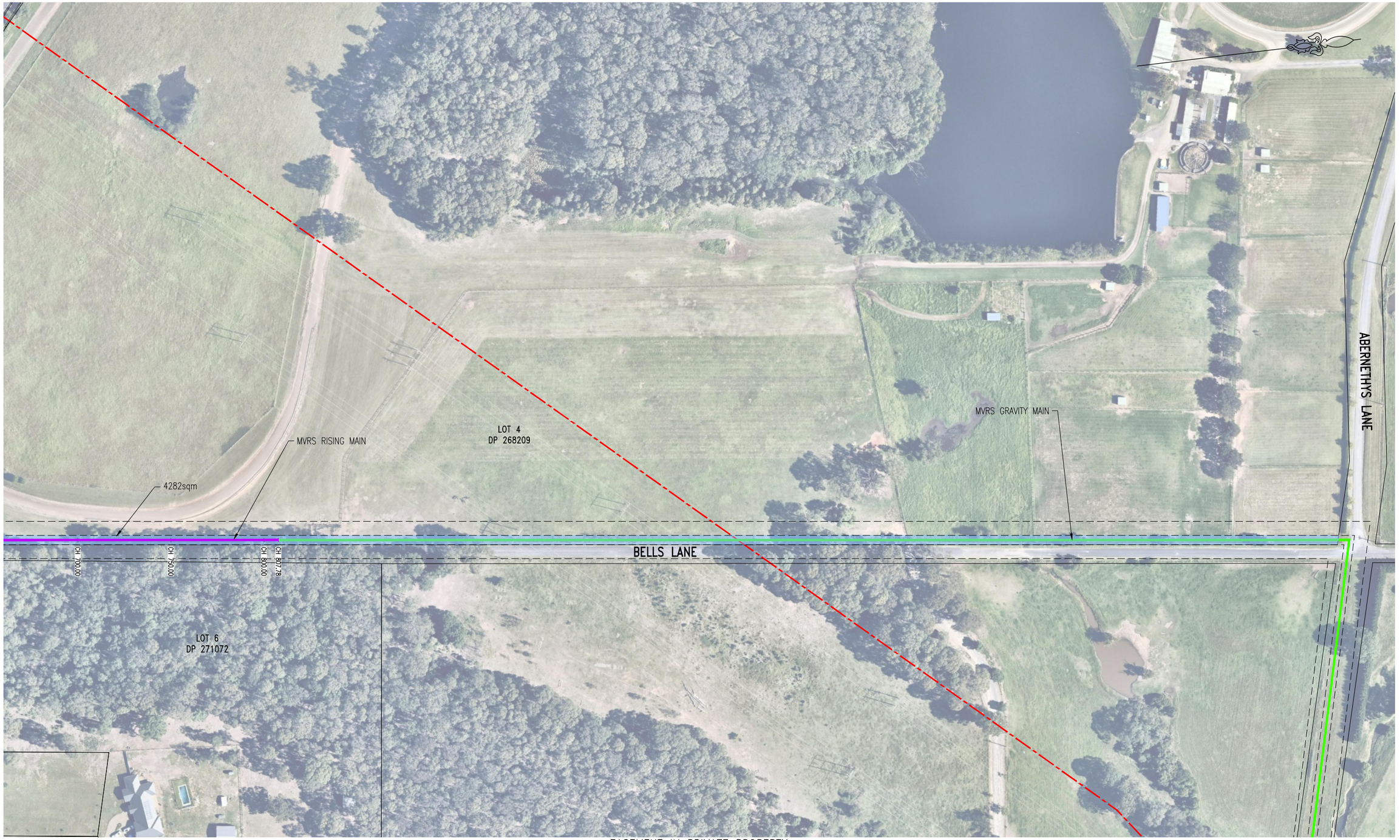

EASEMENT IN PRIVATE PROPERTY

SCALE 1:1000

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TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION

SEWER PUMPING STATION
& RISING MAIN
SHEET 8

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
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EASEMENT IN PRIVATE PROPERTY

SCALE 1:1000

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TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION

SEWER PUMPING STATION
& RISING MAIN
SHEET 9

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100 mm on original

Plotted: 26/10/20 - 13:17 CAD File: C:\Users\lachlan.moore\AppData\Local\Temp\AcPublish_18464\C1000_MASTER.dwg

EASEMENT IN PRIVATE PROPERTY

SCALE 1:1000

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	LBM	26/10/20

CONSULTANT DETAILS:
CARDNO

Shoalhaven Council's Water Utility
WATER
City Administrative Centre
PO Box 42, Nowra, NSW 2541
Ph 02 4429 3111
www.shoalwater.nsw.gov.au

SURVEYED:	DATE:	COMPANY:	
DESIGNED: LM	DATE: 26/10/20	COMPANY: CARDNO	
DRAWN: LM	DATE: 26/10/20	COMPANY: CARDNO	
CHECKED:	DATE:	COMPANY:	
APPROVED:	DATE:	COMPANY:	

SIZE: A1 | SCALE FACTOR: 1:6000 | CO-ORDINATE SYSTEM: MGA Zone 56 | HEIGHT DATUM: AHD

TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION

SEWER PUMPING STATION
& RISING MAIN
SHEET 10

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
	8202010301	C1009	1	A

100 mm on original

Plotted: 26/10/20 - 13:17 CAD File: C:\Users\lachlan.moore\AppData\Local\Temp\AcPublish_18464\C1000_MASTER.dwg

EASEMENT IN PRIVATE PROPERTY

SCALE 1:1000

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	LBM	26/10/20

CONSULTANT DETAILS:
CARDNO

SIZE: A1 | SCALE FACTOR: 1:6000 | CO-ORDINATE SYSTEM: MGA Zone 56 | HEIGHT DATUM: AHD

Shoalhaven Council's Water Utility
WATER
City Administrative Centre
PO Box 42, Nowra, NSW 2541
Ph 02 4429 3111
www.shoalwater.nsw.gov.au

SURVEYED:	DATE:	COMPANY:	
DESIGNED: LM	DATE: 26/10/20	COMPANY: CARDNO	
DRAWN: LM	DATE: 26/10/20	COMPANY: CARDNO	
CHECKED:	DATE:	COMPANY:	
APPROVED:	DATE:	COMPANY:	

TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION

SEWER PUMPING STATION
& RISING MAIN
SHEET 11

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
	8202010301	C1010	1	A

EASEMENT IN PRIVATE PROPERTY

SCALE 1:1000

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	LBM	26/10/20

CONSULTANT DETAILS:
CARDNO

Shoalhaven Council's Water Utility
WATER
City Administrative Centre
PO Box 42, Nowra, NSW 2541
Ph 02 4429 3111
www.shoalwater.nsw.gov.au

SURVEYED:	DATE:	COMPANY:	
DESIGNED:	LM	DATE: 26/10/20	COMPANY: CARDNO
DRAWN:	LM	DATE: 26/10/20	COMPANY: CARDNO
CHECKED:		DATE:	COMPANY:
APPROVED:		DATE:	COMPANY:

SIZE: A1 | SCALE FACTOR: 1:6000 | CO-ORDINATE SYSTEM: MGA Zone 56 | HEIGHT DATUM: AHD

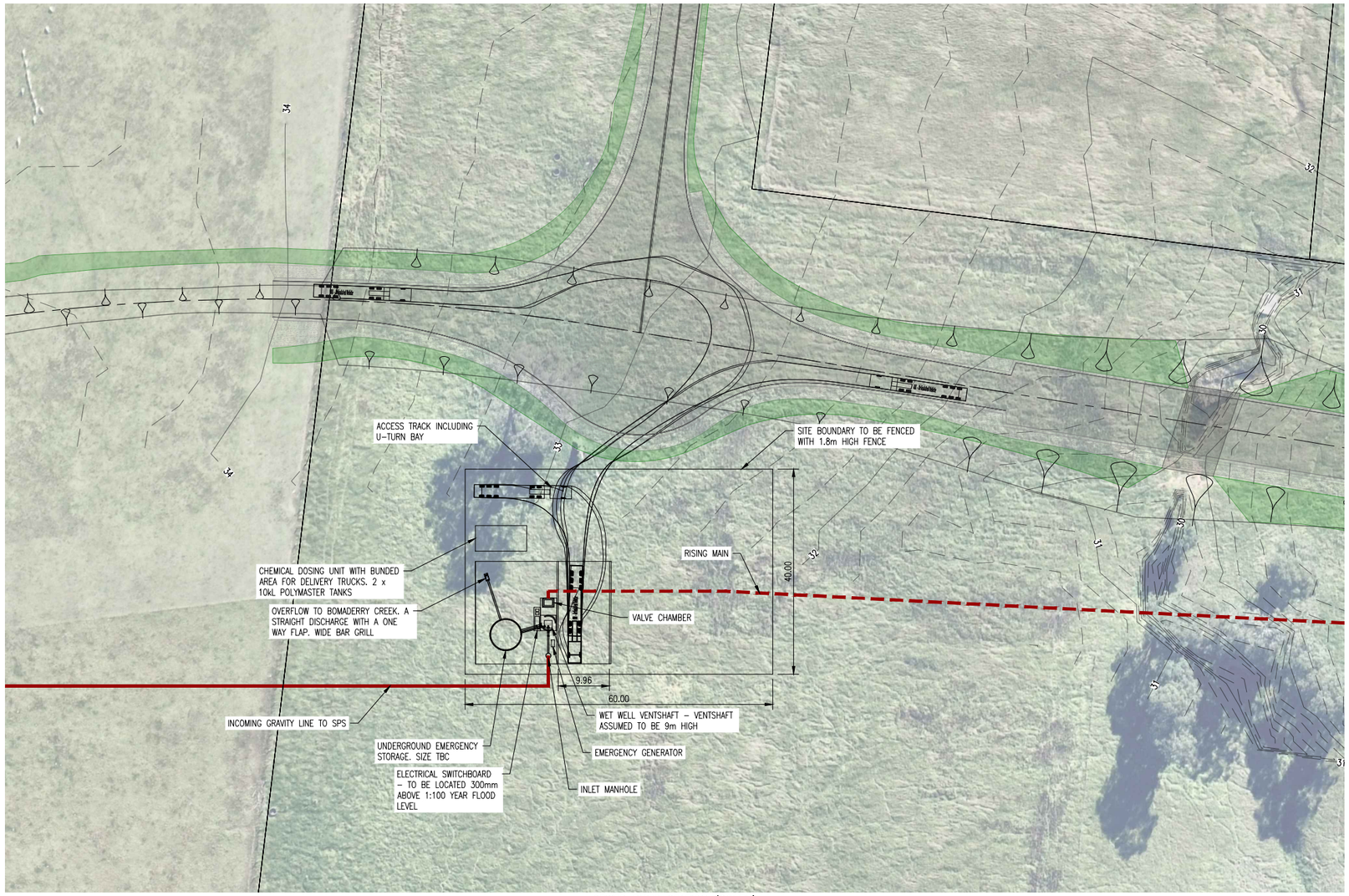
TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION

SEWER PUMPING STATION
& RISING MAIN
SHEET 12

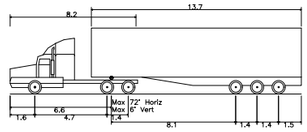
CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
	8202010301	C1011	1	A

100 mm on original

Plotted: 26/10/20 - 13:17 CAD File: C:\Users\lachlan.moore\AppData\Local\Temp\AcPublish_18464\C1000_MASTER.dwg



SEWER PUMP STATION (SOUTH)
SCALE 1:500



AV - Articulated Vehicle	
Overall Length	19.000m
Overall Width	2.500m
Overall Body Height	4.301m
Min Body Ground Clearance	0.418m
Track Width	2.500m
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	12.500m

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	LBM	27/10/20

CONSULTANT DETAILS:

0 10 20 30 40 50 METRES

SIZE: A1 | SCALE FACTOR: N.T.S. | CO-ORDINATE SYSTEM: MGA Zone 56 | HEIGHT DATUM: AHD

Shoalhaven Council's Water Utility
WATER
City Administrative Centre
PO Box 42, Nowra, NSW 2541
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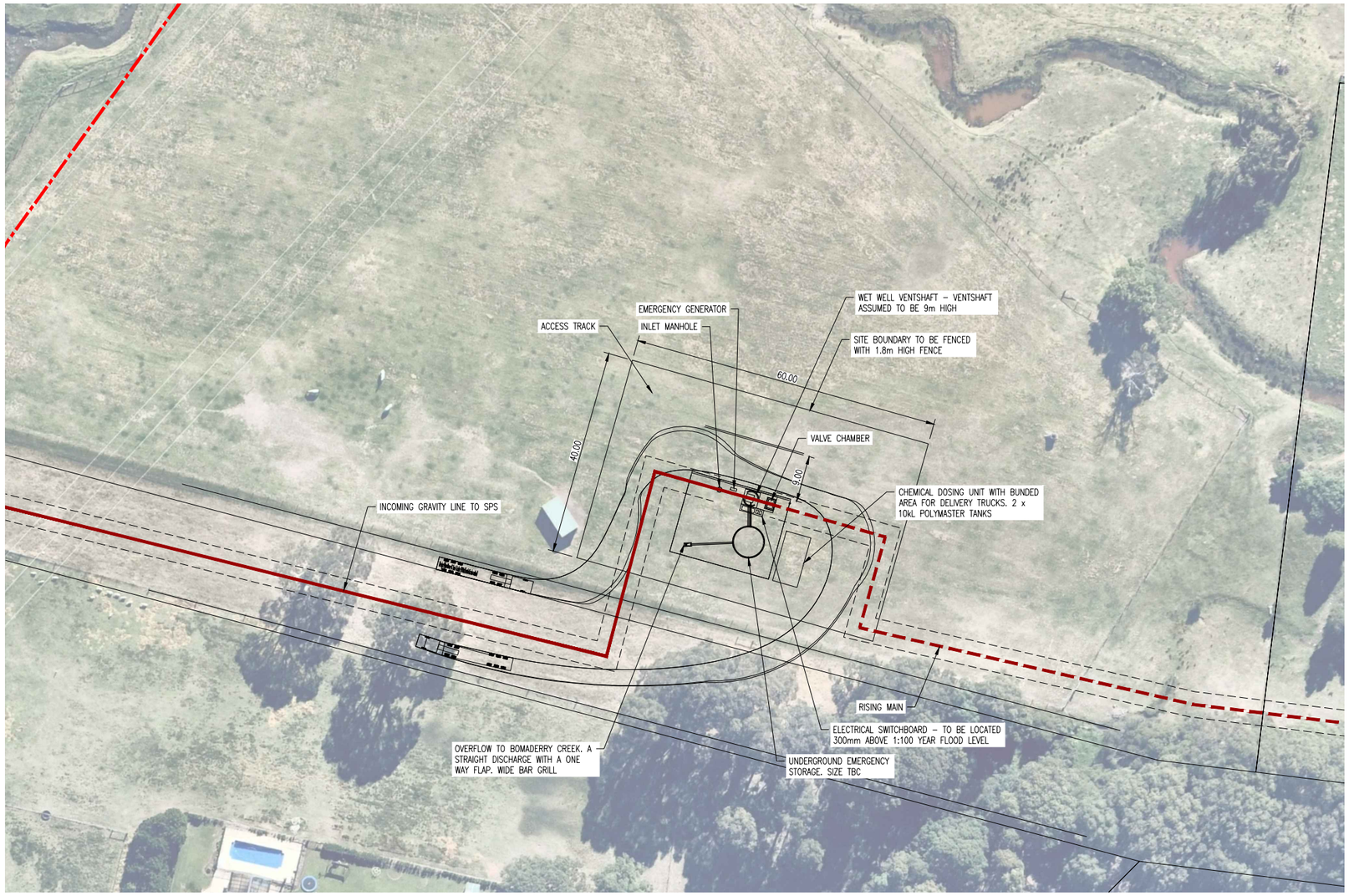
		DATE:	COMPANY:
SURVEYED:			
DESIGNED:	LM	04/06/20	CARDNO
DRAWN:	LM	27/10/20	CARDNO
CHECKED:			
APPROVED:			

TITLE:
MOSS VALE SEWER PUMP STATION
MOSS VALE ROAD SOUTH
19.0m ARTICULATED VEHICLE

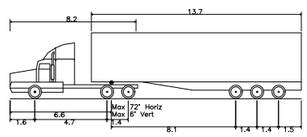
CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
	8202010301	C1012	1	A

100 mm on original

Plotted: 27/10/20 - 10:40 CAD File: C:\Users\lachlan.moore\AppData\Local\Temp\AcPublish_13632\C1012_MASTER.dwg



SEWER PUMP STATION (NORTH)
SCALE 1:500



AV – Articulated Vehicle

Overall Length	19.000m
Overall Width	2.500m
Overall Body Height	4.301m
Min Body Ground Clearance	0.418m
Track Width	2.500m
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	12.500m

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	LBM	27/10/20

CONSULTANT DETAILS:

0 10 20 30 40 50 METRES

SIZE: A1 | SCALE FACTOR: N.T.S. | CO-ORDINATE SYSTEM: MGA Zone 56 | HEIGHT DATUM: AHD

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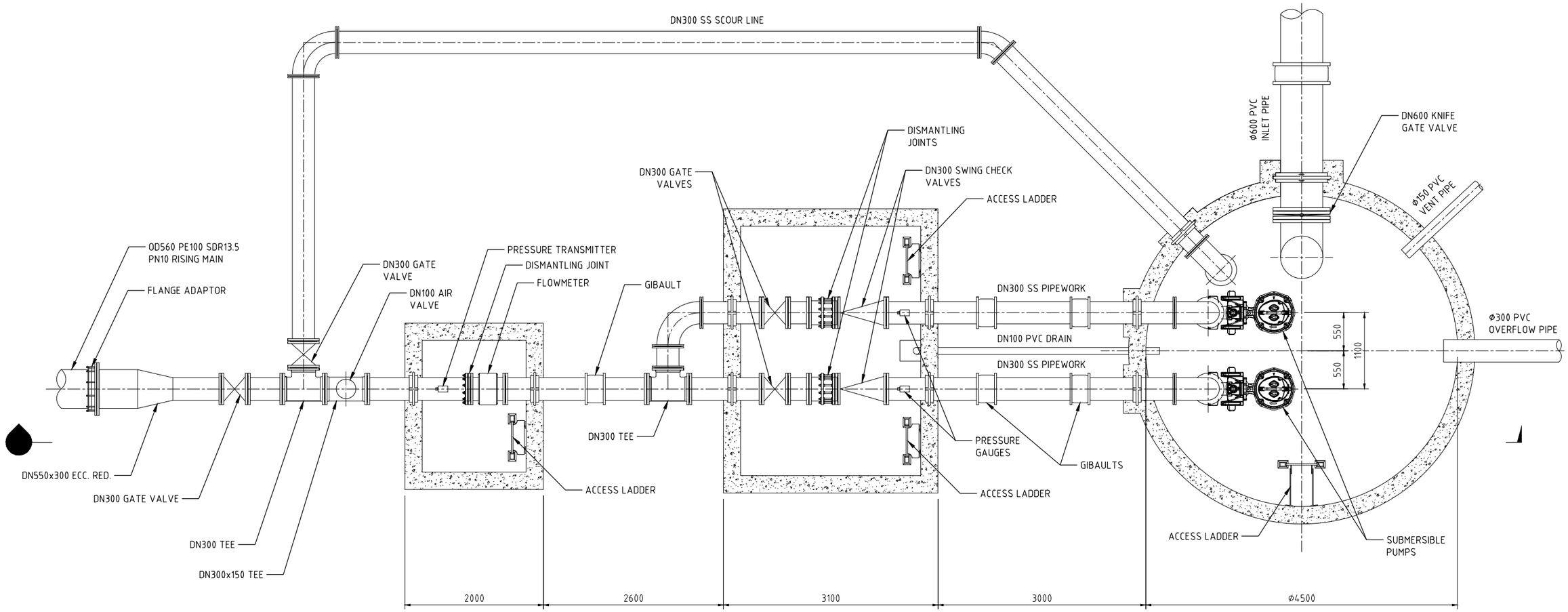
SURVEYED:	DATE:	COMPANY:	
DESIGNED:	LM	04/06/20	CARDNO
DRAWN:	LM	27/10/20	CARDNO
CHECKED:	DATE:	COMPANY:	
APPROVED:	DATE:	COMPANY:	

TITLE:
MOSS VALE SEWER PUMP STATION
MOSS VALE ROAD NORTH
19.0m ARTICULATED VEHICLE

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
	8202010301	C1013	1	A

100 mm on original

Plotted: 27/10/20 - 10:40 CAD File: C:\Users\lachlan.moore\AppData\Local\Temp\AcPublish_13632\C1012_MASTER.dwg



PLAN
SCALE 1:30

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	JQ	27/10/20

CONSULTANT DETAILS:
CARDNO

1:30 0 1500 3000mm

SIZE: A1 | SCALE FACTOR: AS SHOWN | CO-ORDINATE SYSTEM: MGA Zone 56 | HEIGHT DATUM: AHD

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SURVEYED:	DATE:	COMPANY:	
DESIGNED: LM	DATE: 27/10/20	COMPANY: CARDNO	
DRAWN: JQ	DATE: 27/10/20	COMPANY: CARDNO	
CHECKED: JA	DATE: 27/10/20	COMPANY: CARDNO	
APPROVED:	DATE:	COMPANY:	

TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION

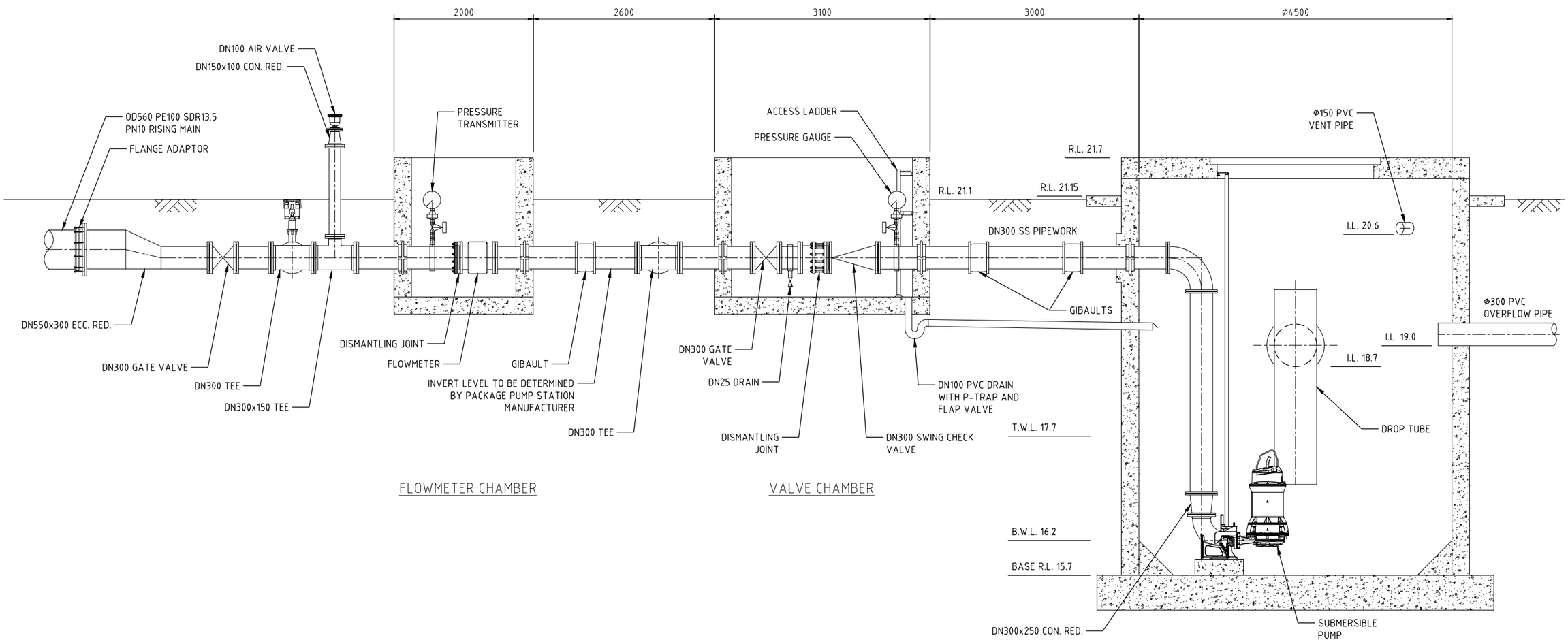
MVR-N SEWER PUMPING STATION

PLAN

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
	8202010301	C1014	1	A

100 mm on original

Plotted: 27/10/20 - 11:10 CAD File: \\cardno.corp\global\AU\NSW\DirectoryStructure\Projects\820\FY20\197_Moss Vale Rd Concept Design\Des-An_General\C1014_MASTER.dwg



FLOWMETER CHAMBER

VALVE CHAMBER

WETWELL

SECTION 1
SCALE 1:30 -

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	JQ	27/10/20

CONSULTANT DETAILS:
CARDNO

1:30 0 1500 3000mm

SIZE: A1 | SCALE FACTOR: AS SHOWN | CO-ORDINATE SYSTEM: MGA Zone 56 | HEIGHT DATUM: AHD

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		DATE:	COMPANY:
SURVEYED:			
DESIGNED:	LM	27/10/20	CARDNO
DRAWN:	JQ	27/10/20	CARDNO
CHECKED:	JA	27/10/20	CARDNO
APPROVED:			

TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION

MVR-N SEWER PUMPING STATION

SECTION

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
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Plotted: 27/10/20 - 11:10 CAD File: \\cardno.corp\global\AU\NSW\DirectoryStructure\Projects\820\FY20\197_Moss Vale Rd Concept Design\Des-An_General\C1014_MASTER.dwg

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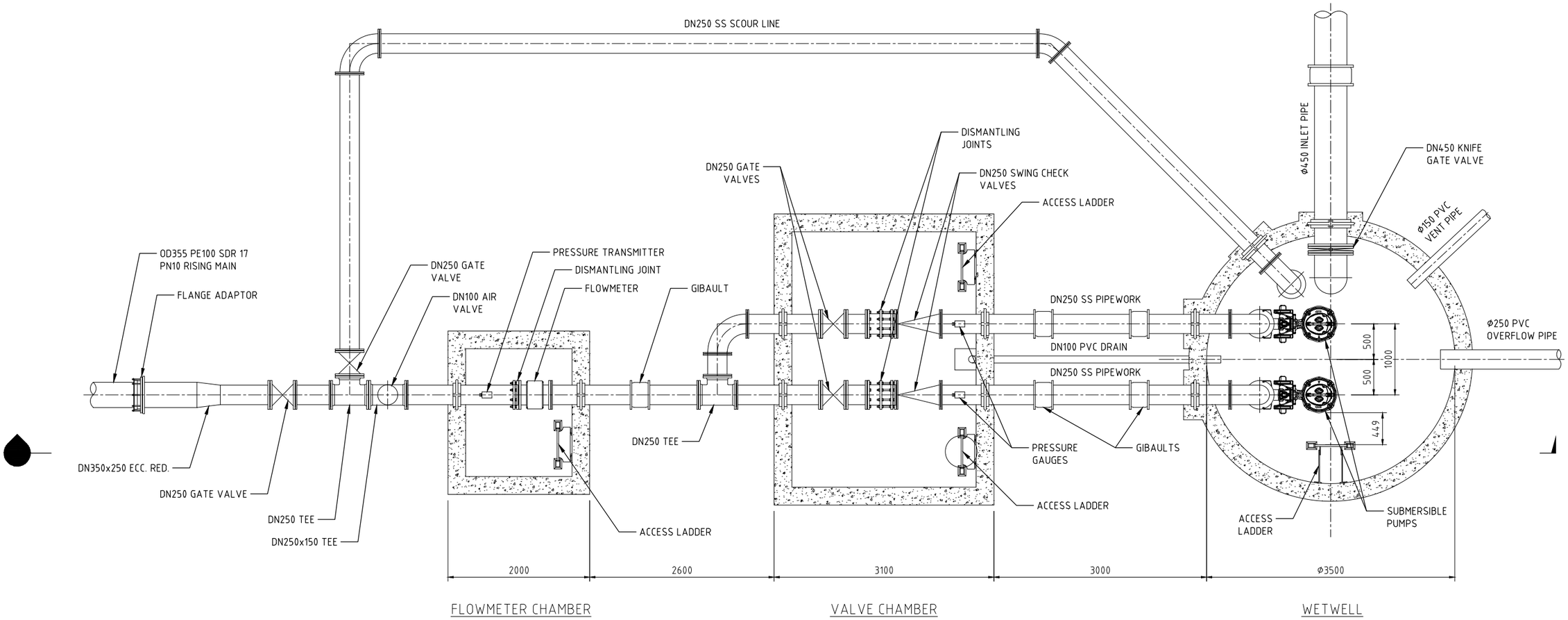

PLAN
SCALE 1:30

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	JQ	27/10/20

CONSULTANT DETAILS:
CARDNO

1:30 0 1500 3000mm

SIZE: A1 | SCALE FACTOR: AS SHOWN | CO-ORDINATE SYSTEM: MGA Zone 56 | HEIGHT DATUM: AHD

Shoalhaven Council's Water Utility
WATER
City Administrative Centre
PO Box 42, Nowra, NSW 2541
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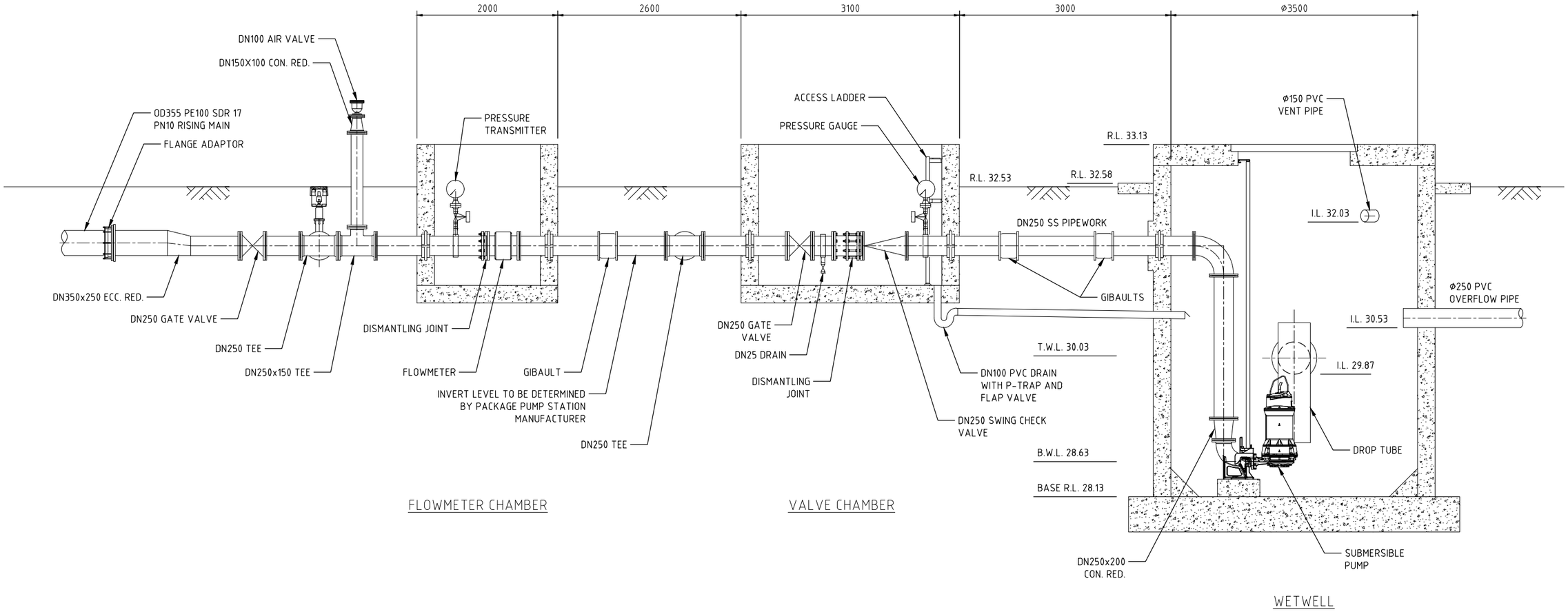
		DATE:	COMPANY:
SURVEYED:			
DESIGNED:	LM	27/10/20	CARDNO
DRAWN:	JQ	27/10/20	CARDNO
CHECKED:	JA	27/10/20	CARDNO
APPROVED:			

TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION
MVR-S SEWER PUMPING STATION
PLAN

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
	8202010301	C1016	1	A

100 mm on original

Plotted: 27/10/20 - 11:10 CAD File: \\cardno.corp\global\AU\NSW\DirectoryStructure\Projects\820\FY20\197_Moss Vale Rd Concept Design\Des-An_General\C1014_MASTER.dwg



SECTION 1
SCALE 1:30 -

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	JQ	27/10/20

CONSULTANT DETAILS:
CARDNO

1:30 0 1500 3000mm

SIZE: A1 | SCALE FACTOR: AS SHOWN | CO-ORDINATE SYSTEM: MGA Zone 56 | HEIGHT DATUM: AHD

Shoalhaven Council's Water Utility
WATER
City Administrative Centre
PO Box 42, Nowra, NSW 2541
Ph 02 4429 3111
www.shoalwater.nsw.gov.au

SURVEYED:	DATE:	COMPANY:	
DESIGNED: LM	DATE: 27/10/20	COMPANY: CARDNO	
DRAWN: JQ	DATE: 27/10/20	COMPANY: CARDNO	
CHECKED: JA	DATE: 27/10/20	COMPANY: CARDNO	
APPROVED:	DATE:	COMPANY:	

TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION

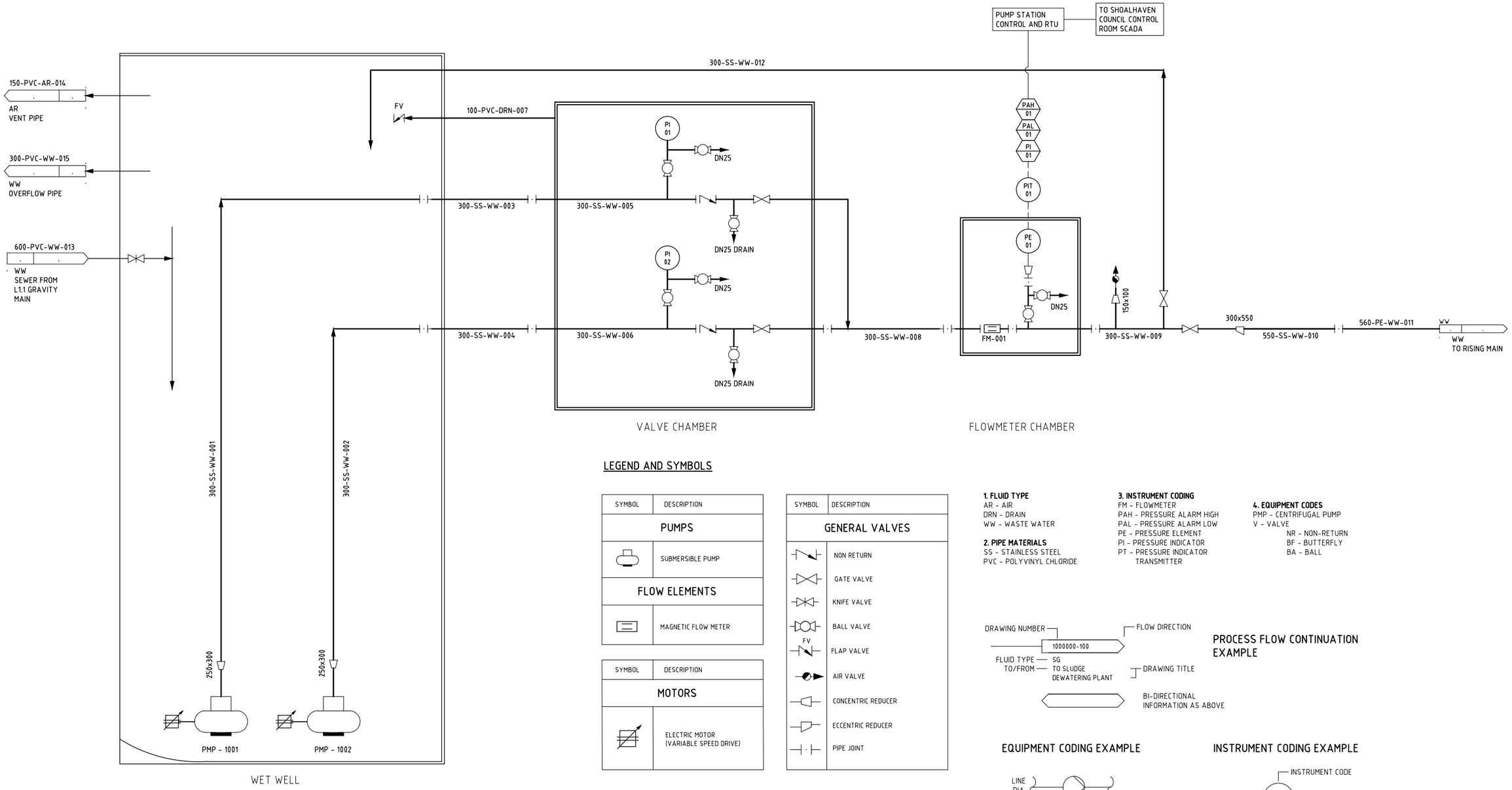
MVR-S SEWER PUMPING STATION

SECTION

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
	8202010301	C1017	1	A

100 mm on original

Plotted: 27/10/20 - 11:10 CAD File: \\cardno.corp\global\AU\NSW\DirectoryStructure\Projects\820\FY20\197_Moss Vale Rd Concept Design\Des-An_General\C1014_MASTER.dwg



LEGEND AND SYMBOLS

SYMBOL	DESCRIPTION
PUMPS	
	SUBMERSIBLE PUMP
FLOW ELEMENTS	
	MAGNETIC FLOW METER

SYMBOL	DESCRIPTION
MOTORS	
	ELECTRIC MOTOR (VARIABLE SPEED DRIVE)

SYMBOL	DESCRIPTION
GENERAL VALVES	
	NON RETURN
	GATE VALVE
	KNIFE VALVE
	BALL VALVE
FV	FLAP VALVE
	AIR VALVE
	CONCENTRIC REDUCER
	ECCENTRIC REDUCER
	PIPE JOINT

1. FLUID TYPE
AR - AIR
DRN - DRAIN
WW - WASTE WATER

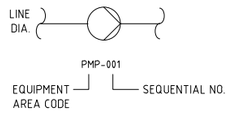
2. PIPE MATERIALS
SS - STAINLESS STEEL
PVC - POLYVINYL CHLORIDE

3. INSTRUMENT CODING
FM - FLOWMETER
PAH - PRESSURE ALARM HIGH
PAL - PRESSURE ALARM LOW
PE - PRESSURE ELEMENT
PI - PRESSURE INDICATOR
PT - PRESSURE INDICATOR TRANSMITTER

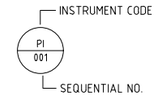
4. EQUIPMENT CODES
PMP - CENTRIFUGAL PUMP
V - VALVE
NR - NON-RETURN
BF - BUTTERFLY
BA - BALL

PROCESS FLOW CONTINUATION EXAMPLE

EQUIPMENT CODING EXAMPLE



INSTRUMENT CODING EXAMPLE



PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	A.A.	27/10/20

CONSULTANT DETAILS:

NOT TO SCALE

SIZE: A1 | SCALE FACTOR: N.T.S | CO-ORDINATE SYSTEM: MGA94 Zone56 | HEIGHT DATUM: AHD

Shoalhaven Council's Water Utility
WATER
City Administrative Centre
PO Box 42, Nowra, NSW 2541
Ph 02 4429 3111
www.shoalwater.nsw.gov.au

		DATE:	COMPANY:
SURVEYED:	TBC	-	-
DESIGNED:	J.A.	27/10/20	CARDNO
DRAWN:	A.A.	27/10/20	CARDNO
CHECKED:	N.M.	27/10/20	CARDNO
APPROVED:	B.E.	27/10/20	CARDNO

TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION
MVR-N SEWER PUMP STATION
PIPING & INSTRUMENTATION DIAGRAM

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
	8202010301	C1018	1	A

Plotted: 27/10/20 - 11:13 CAD File: \\cardno.corp\global\AU\NSW\DirectoryStructure\Projects\820\FY20\197_Moss Vale Rd Concept Design\Des-An_General\C1018.dwg

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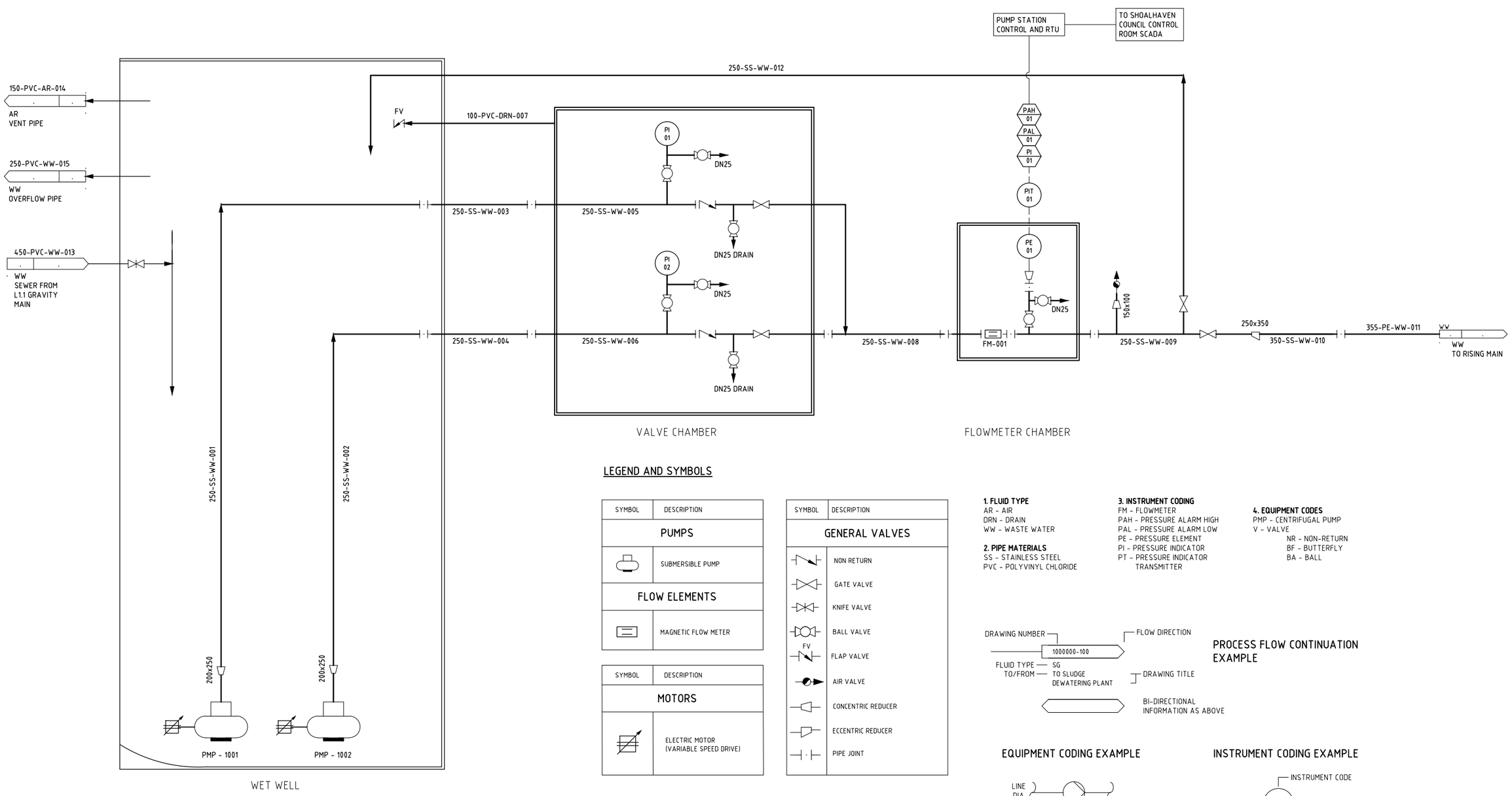


LEGEND AND SYMBOLS

SYMBOL	DESCRIPTION
PUMPS	
	SUBMERSIBLE PUMP
FLOW ELEMENTS	
	MAGNETIC FLOW METER

SYMBOL	DESCRIPTION
MOTORS	
	ELECTRIC MOTOR (VARIABLE SPEED DRIVE)

SYMBOL	DESCRIPTION
GENERAL VALVES	
	NON RETURN
	GATE VALVE
	KNIFE VALVE
	BALL VALVE
FV	FLAP VALVE
	AIR VALVE
	CONCENTRIC REDUCER
	ECCENTRIC REDUCER
	PIPE JOINT

1. FLUID TYPE
AR - AIR
DRN - DRAIN
WW - WASTE WATER

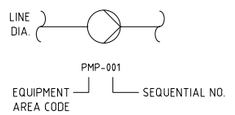
2. PIPE MATERIALS
SS - STAINLESS STEEL
PVC - POLYVINYL CHLORIDE

3. INSTRUMENT CODING
FM - FLOWMETER
PAH - PRESSURE ALARM HIGH
PAL - PRESSURE ALARM LOW
PE - PRESSURE ELEMENT
PI - PRESSURE INDICATOR
PT - PRESSURE INDICATOR TRANSMITTER

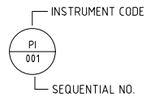
4. EQUIPMENT CODES
PMP - CENTRIFUGAL PUMP
V - VALVE
NR - NON-RETURN
BF - BUTTERFLY
BA - BALL

PROCESS FLOW CONTINUATION EXAMPLE

EQUIPMENT CODING EXAMPLE



INSTRUMENT CODING EXAMPLE



PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	A.A.	27/10/20

CONSULTANT DETAILS:

NOT TO SCALE

SIZE: A1 | SCALE FACTOR: N.T.S | CO-ORDINATE SYSTEM: MGA94 Zone56 | HEIGHT DATUM: AHD

Shoalhaven Council's Water Utility WATER
City Administrative Centre
PO Box 42, Nowra, NSW 2541
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www.shoalwater.nsw.gov.au

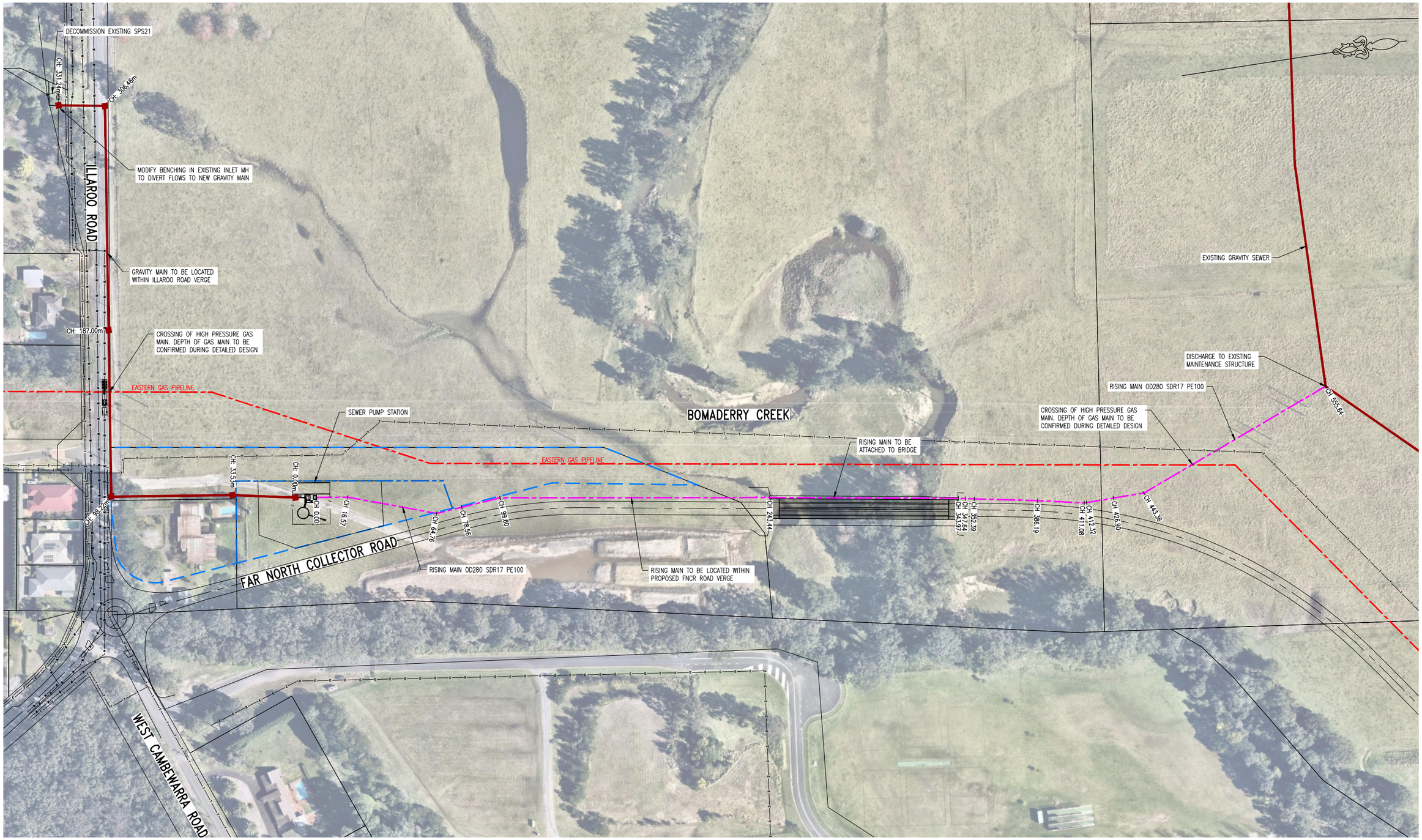
SURVEYED: TBC	DATE: -	COMPANY: -
DESIGNED: J.A.	DATE: 27/10/20	COMPANY: CARDNO
DRAWN: A.A.	DATE: 27/10/20	COMPANY: CARDNO
CHECKED: N.M.	DATE: 27/10/20	COMPANY: CARDNO
APPROVED: B.E.	DATE: 27/10/20	COMPANY: CARDNO

TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION
MVR-S SEWER PUMP STATION
PIPING & INSTRUMENTATION DIAGRAM

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
	8202010301	C1019	1	A

100 mm on original

Plotted: 27/10/20 - 11:13 CAD File: \\cardno.corp\global\AU\NSW\DirectoryStructure\Projects\820\FY20\197_Moss Vale Rd Concept Design\Des-An_General\C1019.dwg



SEWER PUMP STATION – LAYOUT PLAN

SCALE 1:1000

CONCEPT DESIGN
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	LBM	27/10/20

CONSULTANT DETAILS:
CARDNO

1:1000 0 50 100m

SIZE: A1 | SCALE FACTOR: N.T.S. | CO-ORDINATE SYSTEM: MGA Zone 56 | HEIGHT DATUM: AHD

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SURVEYED:	DATE:	COMPANY:	
DESIGNED: LM	DATE: 27/10/20	COMPANY: CARDNO	
DRAWN: LM	DATE: 27/10/20	COMPANY: CARDNO	
CHECKED:	DATE:	COMPANY:	
APPROVED:	DATE:	COMPANY:	

TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION

SPS21 SEWER PUMP STATION

LAYOUT PLAN

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
	8202010301	C2000	1	A

100 mm on original

Plotted: 27/10/20 - 10:05 CAD File: C:\Users\lachlan.moore\AppData\Local\Temp\AcPublish_13632\C2000_MASTER.dwg

SEWER PUMP STATION – TURNING PATH LAYOUT PLAN

SCALE 1:250

CONCEPT DESIGN
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	LBM	27/10/20

CONSULTANT DETAILS:
CARDNO

1:250 0 12.5 25m

SIZE: A1 | SCALE FACTOR: N.T.S. | CO-ORDINATE SYSTEM: MGA Zone 56 | HEIGHT DATUM: AHD

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SURVEYED:	DATE:	COMPANY:	
DESIGNED: LM	DATE: 27/10/20	COMPANY: CARDNO	
DRAWN: LM	DATE: 27/10/20	COMPANY: CARDNO	
CHECKED:	DATE:	COMPANY:	
APPROVED:	DATE:	COMPANY:	

TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION
SPS21 SEWER PUMP STATION
TURNING PATH LAYOUT PLAN

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
	8202010301	C2001	1	A

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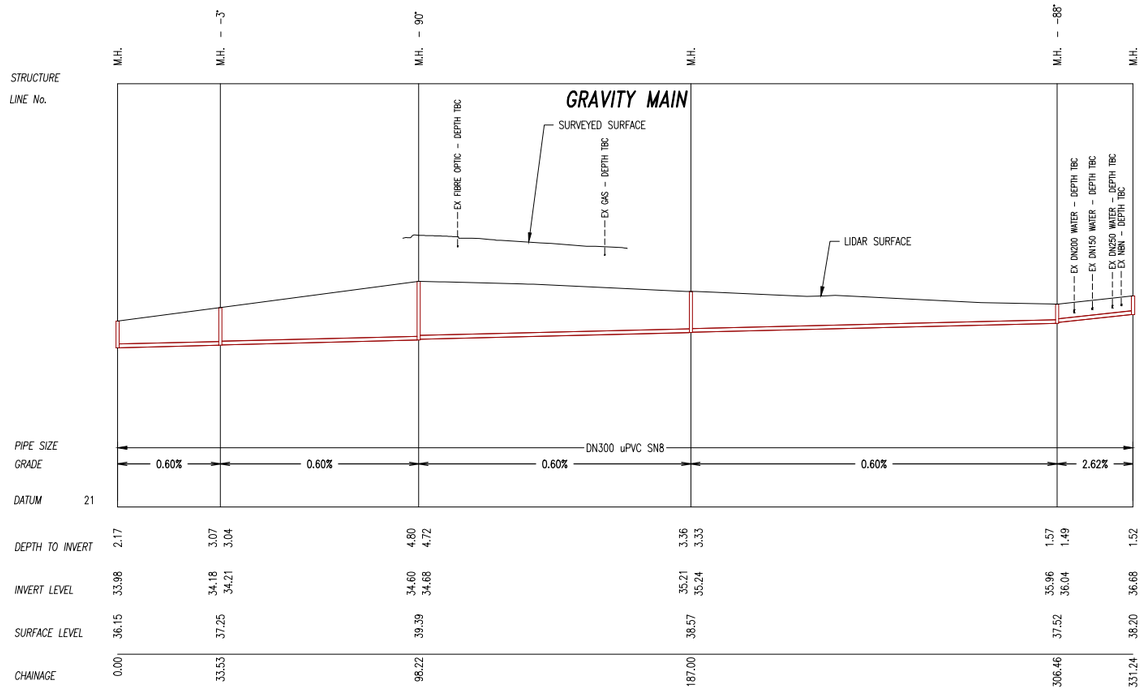

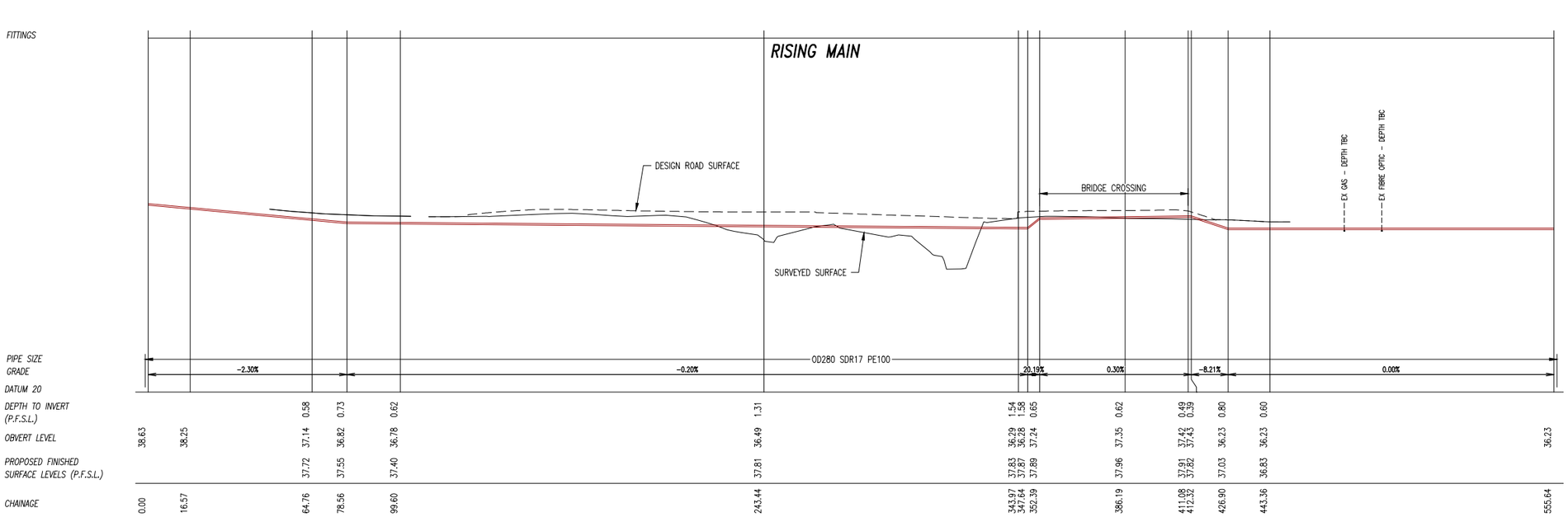

CONCEPT DESIGN
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION – NOT FOR CONSTRUCTION	LBM	27/10/20

CONSULTANT DETAILS:
CARDNO

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SIZE: A1 | SCALE FACTOR: N.T.S. | CO-ORDINATE SYSTEM: MGA Zone 56 | HEIGHT DATUM: AHD

Shoalhaven Council's Water Utility
WATER
City Administrative Centre
PO Box 42, Nowra, NSW 2541
Ph 02 4429 3111
www.shoalwater.nsw.gov.au

SURVEYED:	DATE:	COMPANY:	
DESIGNED: LM	DATE: 27/10/20	COMPANY: CARDNO	
DRAWN: LM	DATE: 27/10/20	COMPANY: CARDNO	
CHECKED:	DATE:	COMPANY:	
APPROVED:	DATE:	COMPANY:	

TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION
SPS21 SEWER PUMP STATION
LONGITUDINAL SECTIONS

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
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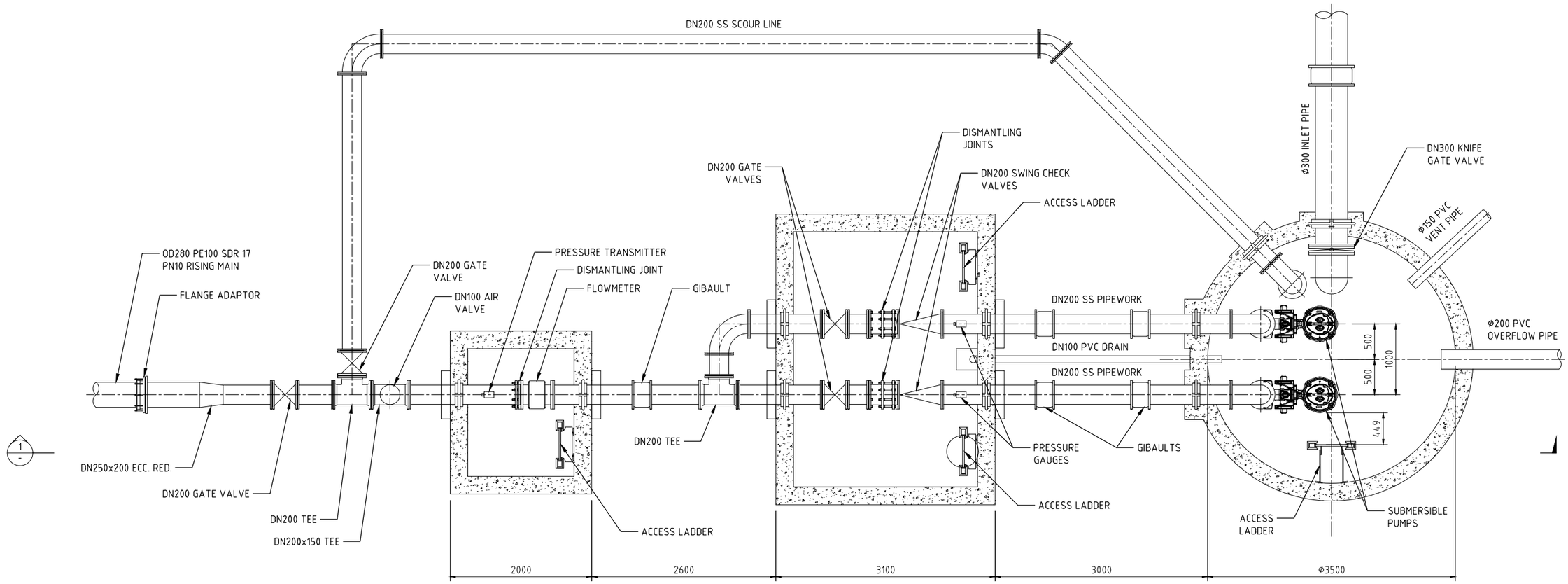

PLAN
SCALE 1:30

CONCEPT DESIGN
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No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	LBM	27/10/20

CONSULTANT DETAILS:
CARDNO

1:30 0 1500 3000mm

SIZE: A1 | SCALE FACTOR: N.T.S. | CO-ORDINATE SYSTEM: MGA Zone 56 | HEIGHT DATUM: AHD

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SURVEYED:	DATE:	COMPANY:	
DESIGNED: LM	DATE: 27/10/20	COMPANY: CARDNO	
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CHECKED:	DATE:	COMPANY:	
APPROVED:	DATE:	COMPANY:	

TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION
SPS21 SEWER PUMP STATION
PLAN

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
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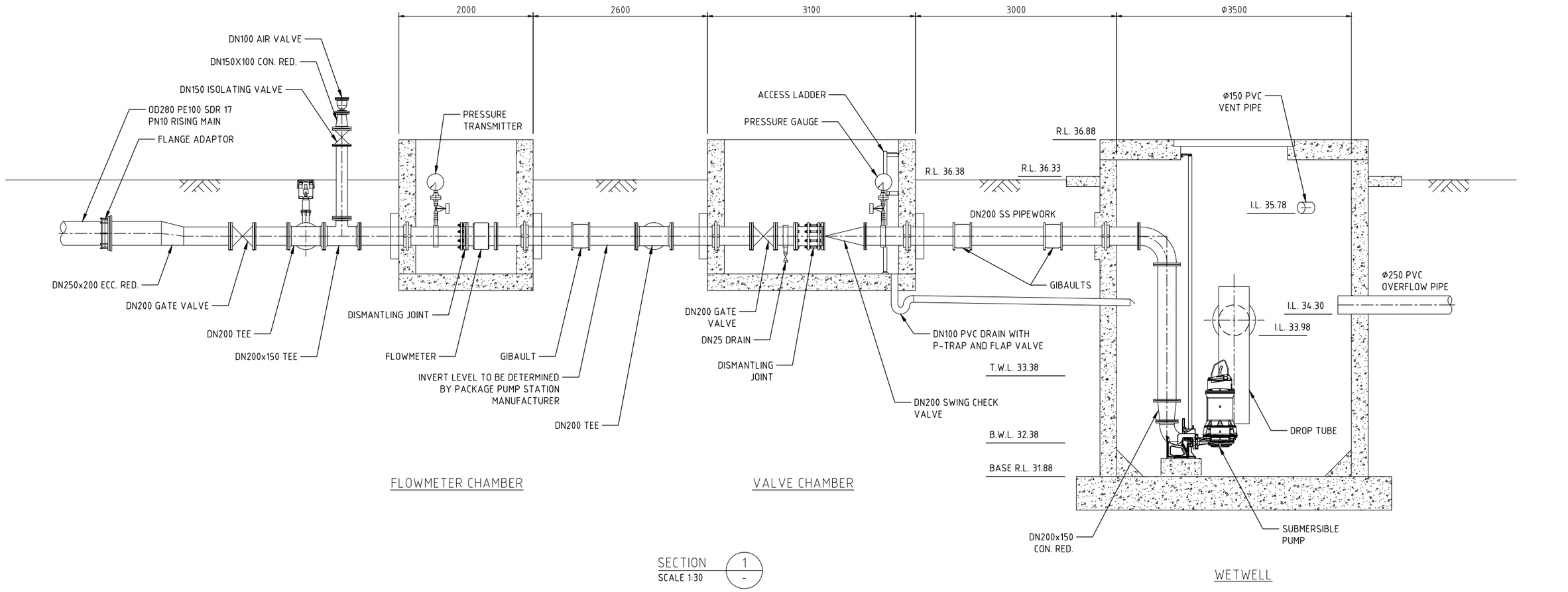

FLOWMETER CHAMBER

VALVE CHAMBER

WETWELL

SECTION 1
SCALE 1:30 -

CONCEPT DESIGN
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	LBM	27/10/20

CONSULTANT DETAILS:
CARDNO

1:30 0 1500 3000mm

SIZE: A1 | SCALE FACTOR: N.T.S. | CO-ORDINATE SYSTEM: MGA Zone 56 | HEIGHT DATUM: AHD

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		DATE:	COMPANY:
SURVEYED:			
DESIGNED:	LM	27/10/20	CARDNO
DRAWN:	LM	27/10/20	CARDNO
CHECKED:			
APPROVED:			

TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION

SPS21 SEWER PUMP STATION

SECTION

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
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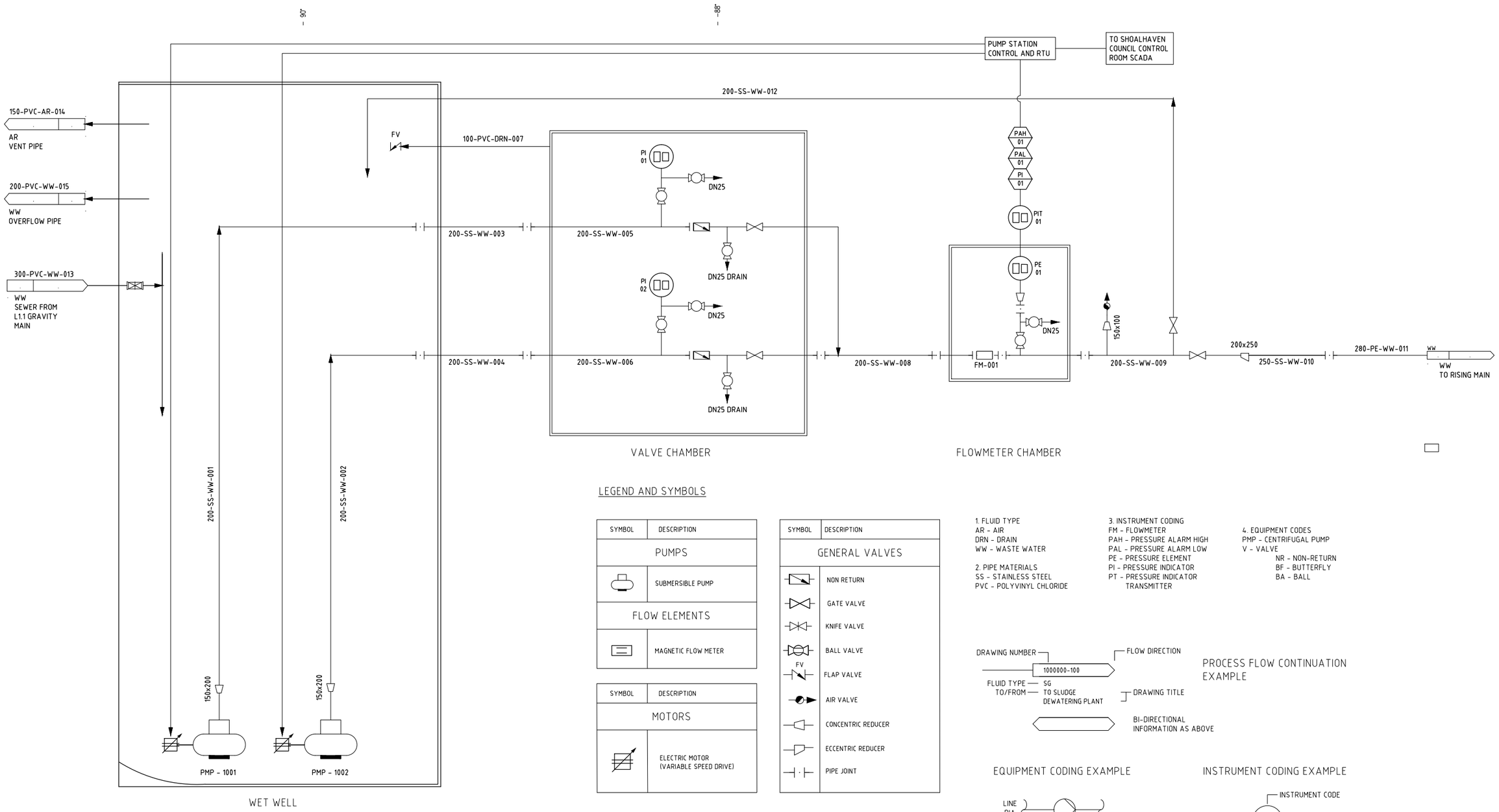
100 mm on original

Plotted: 27/10/20 - 10:05 CAD File: C:\Users\lachlan.moore\AppData\Local\Temp\AcPublish_13632\C2000_MASTER.dwg



LEGEND AND SYMBOLS

SYMBOL	DESCRIPTION
PUMPS	
	SUBMERSIBLE PUMP
FLOW ELEMENTS	
	MAGNETIC FLOW METER

SYMBOL	DESCRIPTION
MOTORS	
	ELECTRIC MOTOR (VARIABLE SPEED DRIVE)

SYMBOL	DESCRIPTION
GENERAL VALVES	
	NON RETURN
	GATE VALVE
	KNIFE VALVE
	BALL VALVE
FV	FLAP VALVE
	AIR VALVE
	CONCENTRIC REDUCER
	ECCENTRIC REDUCER
	PIPE JOINT

1. FLUID TYPE
AR - AIR
DRN - DRAIN
WW - WASTE WATER

2. PIPE MATERIALS
SS - STAINLESS STEEL
PVC - POLYVINYL CHLORIDE

3. INSTRUMENT CODING
FM - FLOWMETER
PAH - PRESSURE ALARM HIGH
PAL - PRESSURE ALARM LOW
PE - PRESSURE ELEMENT
PI - PRESSURE INDICATOR
PT - PRESSURE INDICATOR TRANSMITTER

4. EQUIPMENT CODES
PMP - CENTRIFUGAL PUMP
V - VALVE
NR - NON-RETURN
BF - BUTTERFLY
BA - BALL

DRAWING NUMBER — 1000000-100 — FLOW DIRECTION
FLUID TYPE TO/FROM — SG TO SLUDGE DEWATERING PLANT — DRAWING TITLE
BI-DIRECTIONAL INFORMATION AS ABOVE

PROCESS FLOW CONTINUATION EXAMPLE

EQUIPMENT CODING EXAMPLE

LINE DIA. — PMP-001 — EQUIPMENT AREA CODE — SEQUENTIAL NO.

INSTRUMENT CODING EXAMPLE

INSTRUMENT CODE — PI 001 — SEQUENTIAL NO.

CONCEPT DESIGN
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
A	ISSUED FOR INFORMATION - NOT FOR CONSTRUCTION	LBM	27/10/20

CONSULTANT DETAILS:
CARDNO

1:1000 0 50 100m

SIZE: A1 | SCALE FACTOR: N.T.S. | CO-ORDINATE SYSTEM: MGA Zone 56 | HEIGHT DATUM: AHD

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		DATE:	COMPANY:
SURVEYED:			
DESIGNED:	LM	27/10/20	CARDNO
DRAWN:	LM	27/10/20	CARDNO
CHECKED:			
APPROVED:			

TITLE:
MOSS VALE SEWER GRAVITY MAIN INVESTIGATION
SPS21 SEWER PUMP STATION
PIPING & INSTRUMENTATION DIAGRAM

CONSULTANT REFERENCE No.	INDEX No.	DRAWING No.	SHEET	REV No.
	8202010301	C2005	1	A

100 mm on original

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APPENDIX

B

REVIEW OF ENVIRONMENTAL FACTORS

REVIEW OF ENVIRONMENTAL FACTORS (REF)
SHOALWATER INFRASTRUCTURE – MOSS VALE RD URAs PART 2 : SEWER INFRASTRUCTURE

(Not included as this is this REF document itself)

APPENDIX B – Likelihood of Occurrence Table (NSW Threatened Species)

Likelihood of occurrence table

The table of likelihood of occurrence evaluates the likelihood of threatened species to occur on the subject site. This list is derived from previously recorded species within a 5 km radius (taken from NSW BioNet Atlas) around the subject site. Ecology information unless otherwise stated, has been obtained from the *Threatened Biodiversity Profile Search* on the NSW OEH (Office of Environment & Heritage) online database (https://www.environment.nsw.gov.au/threatenedspeciesapp/).

Likelihood of occurrence in study area

1. Unlikely – Species, population or ecological community is not likely to occur. Lack of previous recent (<25 years) records and suitable potential habitat limited or not available in the study area.
2. Likely – Species, population or ecological community could occur and study area is likely to provide suitable habitat. Previous records in the locality and/or suitable potential habitat in the study area.
3. Present – Species, population or ecological community was recorded during the field investigations.

Possibility of impact

1. Unlikely – The proposal would be unlikely to impact this species or its habitats. No NSW *Biodiversity Conservation Act 2016* “Test of Significance” or EPBC Act significance assessment is necessary for this species.
2. Likely – The proposal could impact this species, population or ecological community or its habitats. A NSW *Biodiversity Conservation Act 2016* “Test of Significance” and/or EPBC Act significance assessment is required for this species, population or ecological community.

Endangered Ecological Community name	*Status*	*Likelihood of presence within areas impacted by the activity*
Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Endangered - *NSW* BC *Act*	Does not occur on-site and is not mapped as occurring in close proximity to the site (nearest records are approx. 1.1km south-west from the southern-most part of the site).
Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	Endangered - *NSW* BC *Act* Critically Endangered - Commonwealth *EPBC Act*	Mapped as occurring in close proximity to the site. Site survey confirmed the EEC within the project footprint. Further assessment required.
Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	Endangered - *NSW* BC *Act*	Does not occur on-site and is not mapped as occurring in close proximity to the site (nearest records are approx. 1.8km to the north of the site).
Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	Endangered - *NSW* BC *Act* Endangered - Commonwealth *EPBC Act*	Does not occur on-site and is not mapped as occurring in close proximity to the site (nearest records are approx. 1.1km south-west from the southern-most part of the site).

Species name	*Status*	*Habitat requirements (www.environment.nsw.gov.au)*	*Likelihood of presence within areas impacted by the activity*
FLORA			
Cryptostylis hunteriana Leafless tongue Orchid	Vulnerable EPBC Act Vulnerable NSW BC Act	Occurs in a wide variety of habitats from moist sandy soil to dense heathland, sedgeland and verges of fire trails. The larger populations typically occur in woodland dominated by Scribbly Gum (Eucalyptus sclerophylla), Silvertop Ash (E. sieberi), Red Bloodwood (Corymbia gummifera) and Black Sheoak (Allocasuarina littoralis); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (C. subulata) and the Tartan Tongue Orchid (C. erecta).	Unlikely to occur. No suitable habitat present within or in vicinity of site.
Eucalyptus langleyi Albatross Mallee	NSW BC Act Vulnerable EPBC Act Vulnerable	Found in Mallee shrub land on poorly drained, shallow, sandy soils on sandstone.	No suitable habitat. Does not occur. A conspicuous species, not detected during site surveys
Genoplesium baueri Bauer's Midge Orchid	Endangered *EPBC Act* Endangered *NSW* BC *Act*	Grows in dry sclerophyll forest and moss gardens over sandstone.	Marginal suitable habitat occurs. Further assessment required.

Hibbertia stricta subsp. furcatula	Endangered NSW BC Act	Habitat of the Southern Sydney population is broadly dry eucalypt forest and woodland. This population appears to occur mainly on upper slopes and above the Woronora River gorge escarpment, at or near the interface between the Lucas Heights soil landscape and Hawkesbury sandstone. Toelken & Miller (2012) note that the species usually grows in 'gravelly loam or clay soil in heath under open woodland'. Habitat of the South Coast population is poorly recorded, but appears to be dry sclerophyll forest or woodland associations in sandy soils over sandstone.	Marginal suitable habitat occurs. Survey within potential habitat concluded that the species does not occur within the site (refer to Section 2.1)
Pterostylis gibbosa Illawarra Greenhood	Endangered EPBC Act Endangered NSW BC Act	All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by Forest Red Gum Eucalyptus tereticornis, Woollybutt E. longifolia and White Feather Honey-myrtle Melaleuca decora. Near Nowra, the species grows in an open forest of Spotted Gum Corymbia maculata, Forest Red Gum and Grey Ironbark E. paniculata. In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark E. crebra, Forest Red Gum and Black Cypress Pine Callitris endlicheri. The Illawarra Greenhood is a deciduous orchid that is only visible above the ground between late summer and spring, and only when soil moisture levels can sustain its growth. The leaf rosette grows from an underground tuber in late summer,	Marginal suitable habitat occurs. Further assessment required.

		followed by the flower stem in winter. After a spring flowering, the plant begins to die back and seed capsules form (if pollination has taken place). As with many other greenhoods, male fungus gnats are believed to be the pollinator. The Illawarra Greenhood can survive occasional burning and grazing because of its capacity to reshoot from an underground tuber.	
Pterostylis pulchella Waterfall Greenhood	NSW BC ACT Vulnerable EPBC Act Vulnerable	The Waterfall Greenhood is found on cliff faces close to waterfalls and creek banks and mossy rocks alongside running water. Flowers appear from February to May	Unlikely to occur. No suitable habitat present within or in vicinity of site.
Pterostylis ventricosa	Critically endangered NSW BC Act	Predominantly in more open areas of tall coastal eucalypt forest often dominated by one or more of the following tree species:- Turpentine, Spotted Gum, Grey Ironbark, Blackbutt, White Stringybark, Scribbly Gum and Sydney Peppermint. Often favours more open areas such as along powerline easements and on road verges where the tree overstorey has been removed or thinned. Grows in a range of groundcover types, including moderatley dense low heath, open sedges and grasses, leaf litter, and mosses on outcropping rock. Soil type ranges from moisture retentive grey silty loams to grey sandy loams. Sometimes found in skeletal soils on sandstone rock shelves	Unlikely to occur. No suitable habitat present within or in vicinity of site.

Pterostylis vernalis	Critically Endangered EPBC Act Critically Endangered NSW BC Act	Pterostylis vernalis grows in open sites in shallow soil over sandstone sheets, in heath and heathy forest.	Unlikely to occur. No suitable habitat present within or in vicinity of site.
Rhodamnia rubescens Scrub Turpentine	Critically Endangered NSW BC Act	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	No suitable habitat. Does not occur. A conspicuous species, not detected during site surveys
Solanum celatum	NSW BC Act Endangered	Grows in rainforest clearings or in wet sclerophyll forests. Flowers August to October and produces fruit between December and January. Normally recorded in disturbed margins and clearings.	No suitable habitat. Does not occur. A conspicuous species, not detected during site surveys
Triplarina nowraensis Nowra Heath Myrtle	NSW BC Act Endangered EPBC Act Endangered	Nowra Heath Myrtle occurs on poorly drained, gently sloping sandstone shelves or along creek lines underlain by Nowra Sandstone. The sites are often treeless or have a very open tree canopy due to the impeded drainage.	No suitable habitat. Does not occur. A conspicuous species, not detected during site surveys

Zieria baeuerlenii Bomaderry Zieria	NSW BC Act Endangered EPBC Act Endangered	Occurs on skeletal sandy loam overlaying sandstone, on a rocky plateau amongst sandstone boulders in either shrubby open forest, shrubby woodland or closed shrub.	No suitable habitat. Does not occur. A conspicuous species, not detected during site surveys
Zieria tuberculata Warty Zieria	NSW BC Act Vulnerable EPBC Act Vulnerable	Grows in heath amongst rocky outcrops on rain forest edges and in tall forest and shrubland.	No suitable habitat. Does not occur. A conspicuous species, not detected during site surveys
AMPHIBIANS			
Giant Burrowing Frog *Heleioporus australiacus*	Vulnerable EPBC Act Vulnerable NSW BC Act	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. While in these areas, individuals burrow below the soil surface or in the leaf litter. Individual frogs occupy a series of burrow sites, some of which are used repeatedly. Breeding habitat of this species is generally soaks or pools within first or second order streams. They are also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water. Frogs breed after heavy rain mainly in late summer and Autumn from February to April. Eggs usually laid out of water in a moist burrow in	Unlikely to occur. No suitable habitat within the site.

		sandy clay banks of smaller creeks, dams or ephemeral pools in forest (Anstis 2017).	
Green and Golden Bell Frog *Litoria aurea*	Vulnerable *EPBC Act* Endangered *NSW* BC *Act*	Heath, woodland and open dry sclerophyll forest on a variety of soil types except clay based. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Breeding frogs will call from open spaces, under vegetation or rocks or from within burrows in the creek bank. Egg masses are laid in burrows or under vegetation in small pools. After rains, tadpoles are washed into larger pools where they complete their development in ponds or ponded areas of the creekline. Tadpole development ranges from Breeding habitat of this species is generally soaks or pools within first or second order streams. They are also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water.	Marginal habitat occurs in north-east corner of site. Further assessment required.
REPTILES			
Broad-headed Snake *Hoplocephalus bungaroides*	Endangered *NSW* BC *Act* Vulnerable *EPBC Act*	The Broad-headed snake is largely confined to Triassic and Permian sandstones, including Hawkesbury, Narrabeen and Shoalhaven groups, within the coast and ranges in an area within approximately 250 km of Sydney. They are a nocturnal species that shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. It moves from the sandstone rocks to shelter in crevices or	Unlikely to occur. No suitable habitat within the site.

		hollows in large trees within 500 m of escarpments in summer. Feeds mostly on geckoes and small skinks; will also eat frogs and small mammals occasionally.	
MICRO-CHIROPTERAN BATS			
Eastern Bentwing-bat *Miniopterus orianae oceanensis*	NSW BC Act Vulnerable	Specific caves are known maternity sites with other caves being primary roosting habitat outside breeding period. Also uses derelict mines, storm-water tunnels, buildings and other man-made structures. Hunts in forested areas, catching moths and other flying insects above the tree tops.	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	NSW BC Act Vulnerable	Prefers moist habitat that contains trees greater than 20 m high with a dense undertstorey. They are fast flyers. Roosts in hollow trunks of eucalyptus trees, in colonies of 3 – 80. Also may roost in caves and old wooden buildings. This species changes roost every night. Roosts on consecutive nights are usually less than 750 m apart. This species has a home range of up to 136 ha (Churchill, S 2008, Australian Bats, Jacana Books, Crows Nest, NSW). Although they prefer habitat with a dense understorey, they prefer to forage along flyways	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.

		to avoid the thick understorey. They prefer continuous forest and avoid remnant vegetation. However, they have been recorded in open forests (Churchill, S 2008, Australian Bats, Jacana Books, Crows Nest, NSW).	
Eastern Freetail-Bat *Micronomus norfolkensis*	*Vulnerable NSW* BC *Act* Vulnerable *EPBC Act*	Small tree hollows/fissures in bark for roosting in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range.	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.
Greater Broad-nosed Bat *Scoteanaux ruepelli*	Vulnerable *NSW* BC *Act*	Found mainly in gullies and river systems that drain the Great Dividing Range, it utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, below 500m, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.
Large –eared Pied Bat *Chalinobolus dwyeri*	Vulnerable *NSW* BC *Act* Vulnerable *EPBC Act*	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required..

		elevation dry open forest and woodland close to these features	
Southern Myotis (Large-footed Myotis) *Myotis macropus*	Vulnerable *NSW* BC *Act*	This species is predominantly roosts in caves, however, is known to roost in trees and man-made structures close to water. Roosts are generally located close to water, where the bats forage in small groups of three or four. They have a strong association with streams and permanent waterways in areas that are vegetated rather than cleared (Churchill, S 2008, Australian Bats, Jacana Books, Crows Nest, NSW They feed on small fish, prawns and aquatic macroinvertebrates. They have a preference towards large still pools, rather than flowing streams. They will also forage an aerial insects flying over water. They use their large feet to capture prey items (Churchill 2008).	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	Vulnerable *NSW* BC *Act*	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.

BIRDS			
Black Bittern *Ixobrychus flavicollis*	Vulnerable *NSW* BC *Act*	Terrestrial and estuarine wetlands generally in areas of permanent water and dense vegetation that may comprise grassland, woodland forest rainforest and mangroves. Roosts in trees or on ground amongst dense reeds, nests in branches overhanging water	Unlikely to occur. No suitable habitat occurs within the site.
Black Falcon *Falco subniger*	*Vulnerable NSW* BC *Act*	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres (Marchant & Higgins 1993)	Possibly occurring transiently over the site. Unlikely to rely on habitat within the site. No important habitat would be removed or otherwise impacted.
Bush Stone-curlew *Burhinus grallarius*	NSW BC Act Endangered	Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Nest on the ground in a scrape or small bare patch.	Unlikely to occur. No suitable habitat occurs within the site.
Caspian Tern *Hydroprogne caspia*	Migratory EPBC Act	Occur along the Australian coastline, and also occur inland along major rivers, especially in the Murray-Darling and Lake Eyre drainage basins, preferring wetlands with clear water to allow easy prey detection.	Unlikely to occur. No suitable habitat occurs within the site.
Dusky Woodswallow *Artamus cyanopterus cyanopterus*	Vulnerable NSW BC Act	The Dusky Woodswallow is often reported in woodlands is eastern, southern and southwestern Australia. In New South Wales it is widespread from coast to inland, including the	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.

		western slopes of the great Diving Range and farther west. It is often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalyptus, including mallee associations. It have also been recorded in shrublands and heathlands and carious modified habitats including regenerating forests; very occasionally in moist forests of rainforests. At sites where Dusky Woodswallows are recorded the understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, including heath. The ground cover may consist of grasses, sedges or open ground, often with course woody debris. Birds are often observed in farmland usually at the edges of forests, woodlands or in roadside remnants or wind breaks with dead timber. Nesting occurs from late September to late February, with eggs present between October and early December. They nest in an open shallow untidy cup, frequently in an open hollow, crevice or stump.	
Eastern Bristlebird- *Dasyornis brachypterus*	Endangered EPBC Act Endangered NSW BC Act	Sedgeland/heathland/dry sclerophyll and woodlands- / requires thick shrub/heath layer for shelter, nesting and foraging	Unlikely to occur. No suitable habitat occurs within the site.
Eastern Curlew *Numenius madagascariensis*	Critically Endangered *EPBC Act*	Most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats	Unlikely to occur. No suitable habitat occurs within the site.

		fringed by mangroves, and sometimes use the mangroves. The birds are also found in saltworks and sewage farms (Marchant & Higgins 1993). The numbers of Eastern Curlew recorded during one study were correlated with wetland areas. Mainly forages on soft sheltered intertidal sandflats or mudflats, open and without vegetation or covered with seagrass, often near mangroves, on saltflats and in saltmarsh, rockpools and among rubble on coral reefs, and on ocean beaches near the tideline. The birds are rarely seen on near-coastal lakes and in grassy areas. Roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. It occasionally roosts on reef-flats, in the shallow water of lagoons and other near-coastal wetlands. Eastern Curlews are also recorded roosting in trees and on the upright stakes of oyster-racks. At Roebuck Bay, Western Australia, birds fly from their feeding areas on the tidal flats to roost 5 km inland on a claypan. In some conditions, waders may choose roost sites where a damp substrate lowers the local temperature. This may have important conservation implications where these sites are heavily disturbed beaches. It may be possible to create artificial roosting sites to replace those destroyed by development. Eastern Curlews typically roost in large flocks, separate from other waders.	

Eastern Osprey *Pandion cristatus*	*NSW* BC *Act* Vulnerable	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	Possibly occurring transiently over the site. Unlikely to rely on habitat within the site. No important habitat would be removed or otherwise impacted.
Freckled Duck *Stictonetta naevosa*	Vulnerable NSW BC Act	found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. The duck is forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat. The species may also occur as far as coastal NSW and Victoria during such times. Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds	Unlikely to occur. No suitable habitat occurs within the site.
Gang-gang Cockatoo *Callocephalon fimbriatum*	*Vulnerable NSW* BC *Act*	Tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.

		coastal areas. Favours old growth attributes for nesting and roosting	
Glossy Black-cockatoo *Calyptorhynchus lathami*	Vulnerable *NSW* BC *Act*	The GBC inhabits open forest and woodlands of the coast where stands of she-oak occur. In the Jervis Bay region they feed almost exclusively on the seeds of the black she-oak *Allocasuarina littoralis*, shredding the cones with their bill	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.
Little Lorikeet *Glossopsitta pusilla*	Vulnerable NSW BC ACT	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.

Masked Owl – *Tyto novaehollandiae*	Vulnerable *NSW* BC *Act*	Dry eucalypt forests and woodlands from sea level to 1100 m. Inhabits forest but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Requires old growth elements-hollow bearing tree resources for nesting and prey source.	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.
Olive Whistler *Pachycephala olivacea*	Vulnerable *NSW* BC *Act*	The Olive Whistler inhabits the wet forests on the ranges of the east coast. It has a disjunct distribution in NSW chiefly occupying the beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from Illawarra south to Victoria. In the south it is found inland to the Snowy Mountains and the Brindabella Range. Mostly inhabit wet forests above about 500m. During the winter months they may move to lower altitudes. Forage in trees and shrubs and on the ground, feeding on berries and insects. Make nests of twigs and grass in low forks of shrubs. Lay two or three eggs between September and January.	Unlikely to occur. No suitable habitat occurs within the site.
Powerful Owl *Ninox strenua*	Vulnerable NSW BC Act	Coastal Woodland, Dry Sclerophyll Forest, wet sclerophyll forest and rainforest- Can occur in fragmented landscapes Roosts in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia*	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.

		melanoxylon, Rough-barked Apple *Angophora floribunda,* Cherry Ballart Exocarpus cupressiformis and a number of eucalypt species. requires old growth elements-hollow bearing tree resources for nesting and prey resource. Nests in large tree hollows in large eucalypts that are at least 150yrs old. Often in riparian areas. Large home range	
Regent Honeyeater *Anthochaera phrygia*	Critically endangered EPBC Act Critically endangered NSW BC Act	Temperate woodlands and open forests- and drier coastal woodlands in some years (flowering coastal woodlands and forests including box-ironbark woodland, and riparian forests-that exhibit large numbers of mature trees, high canopy cover and abundance of mistletoes) Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises: Eucalyptus microcarpa, E. punctata, E. polyanthemos, E. moluccana, Corymbia robusta, E. crebra, E. caleyi, C. maculata, E.mckieana, E. macrorhyncha, E. laevopinea, and Angophora floribunda. Nectar and fruit from the mistletoes Amyema miquelii, A. pendula and A. cambagei are also eaten during the breeding season.	Unlikely to occur. No suitable habitat occurs within the site.
Scarlet Robin *Petroica boodang*	Vulnerable *NSW BC Act*	The Scarlet Robin is primarily a resident in dry forests and woodlands, but some adults and young birds disperse to more open habitats after breeding.	Unlikely to occur. No suitable habitat occurs within the site.
Sooty Owl *Tyto tenebricosa*	Vulnerable *NSW BC Act*	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests	Unlikely to occur. No suitable habitat occurs within the site.

Spotted Harrier *Circus assimilis*	Vulnerable *NSW* BC *Act*	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats or the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population.	Possibly occurring transiently over the site. Unlikely to rely on habitat within the site. No important habitat would be removed or otherwise impacted.
Square-Tailed Kite *Lophoictinia isura*	*Vulnerable NSW* BC *Act*	Summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses large hunting ranges of more than 100km2 Nest within large hollow bearing trees generally within 200m of riparian areas.	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.
Varied Sittella *Daphoenositta chrysoptera*	Vulnerable *NSW* BC *Act*	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.
Wedge-tailed Shearwater *Ardenna pacificus*	Migratory *EPBC Act*	A pelagic, marine bird known from tropical and subtropical waters. The species tolerates a range of surface-temperatures and salinities, but is most abundant where temperatures are greater than 21 °C and salinity is greater than 34.6 %. In tropical zones the species may feed over cool nutrient-rich waters. The species has been recorded in offshore waters of eastern Victoria and southern NSW, mostly over continental slope with sea-surface temperatures of 13.9–24.4 °C and usually off the continental shelf in north-west Australia.	Unlikely to occur. No suitable habitat occurs within the site.

White-bellied Sea-Eagle *Haliaeetus leucogaster*	*NSW* BC *Act* Vulnerable Migratory *EPBC Act*	Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterized by the presence of large areas of open water (larger rivers, swamps, lakes, the sea). Birds have been recorded in (or flying over) a variety of terrestrial habitats. The species is mostly recorded in coastal lowlands, but can occupy habitats up to 1400 m above sea level on the Northern Tablelands of NSW and up to 800 m above sea level in Tasmania and South Australia. Birds have been recorded at or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs, saltmarsh and sewage ponds. They also occur at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest (including rainforest) and even urban areas. Breeding has been recorded on the coast, at inland sites, and on offshore islands. Breeding territories are located close to water, and mainly in tall open forest or woodland, although nests are sometimes located in other habitats such as dense forest (including rainforest), closed scrub or in remnant trees on cleared land. Forages over large expanses of open water; this is particularly true of birds that occur in coastal environments close to the sea-shore, where they forage over in-shore waters. However, the White-	Possibly occurring transiently over the site. Unlikely to rely on habitat within the site. No important habitat would be removed or otherwise impacted.

		bellied Sea-Eagle will also forage over open terrestrial habitats (such as grasslands). Birds may move to and congregate in favorable sites during drought or food shortage.	
White-fronted Chat *Epthianura albifrons*	Vulnerable NSW BC Act	Commonly occurring in the saltmarshes of southern Australia, the White-fronted Chat is often seen foraging for insects and their larvae among the succulent leaves and stems of stunted saltmarsh plants.	Unlikely to occur. No suitable habitat occurs within the site.
MAMMALS			
Brush-tailed Rock-wallaby *Petrogale penicillata*	NSW BC Act Endangered EPBC Act Vulnerable	Occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night. Highly territorial and have strong site fidelity with an average home range size of about 15 ha.	Unlikely to occur. No suitable habitat occurs within the site.
Eastern Pygmy-possum *Cercatetus nanus*	Vulnerable NSW BC Act	Rainforest, sclerophylla forest & woodland to heath – but heath & woodland preferred. Forages on banksias, eucalypts & bottlebrushes.	Unlikely to occur. No suitable habitat occurs within the site.

Greater Glider *Petauroides Volans*	Vulnerable EPBC Act	Feeds exclusively on eucalypt leaves, buds, flowers and mistletoe. Shelter during the day in tree hollows and will use up to 18 hollows in their home range. Occupy a relatively small home range with an average size of 1 to 3 ha. Give birth to a single young in late autumn or early winter which remains in the pouch for approximately 4 months and is independent at 9 months of age. Usually solitary, though mated pairs and offspring will share a den during the breeding season and until the young are independent. Can glide up to a horizontal distance of 100m including changes of direction of as much as 90 degrees. Very loyal to their territory.	Unlikely to occur. No suitable habitat occurs within the site.
Grey-headed Flying-fox *Pteropus poliocephalus*	Vulnerable *EPBC Act* Vulnerable *NSW* BC *Act*	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.
Parma Wallaby *Macropus parma*	NSW BC Act Vulnerable	Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	Unlikely to occur. No suitable habitat occurs within the site.
Southern Brown Bandicoot (eastern) *Isoodon obesulus obesulus*	Endangered EPBC Act Endangered NSW BC Act	Southern Brown Bandicoots are largely crepuscular (active mainly after dusk and/or before dawn). They are generally only found in heath or open forest with a heathy understorey on sandy or friable soils. They feed on a variety of ground-dwelling invertebrates and the fruit-	Unlikely to occur. No suitable habitat occurs within the site.

		bodies of hypogeous (underground-fruiting) fungi. Their searches for food often create distinctive conical holes in the soil. Males have a home range of approximately 5-20 hectares whilst females forage over smaller areas of about 2-3 hectares. Nest during the day in a shallow depression in the ground covered by leaf litter, grass or other plant material. Nests may be located under Grass trees Xanthorrhoea spp., blackberry bushes and other shrubs, or in rabbit burrows. The upper surface of the nest may be mixed with earth to waterproof the inside of the nest.	
Spotted-tailed Quoll *Dasyurus maculatus*	Endangered *EPBC Act* Vulnerable *NSW* BC *Act*	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt during the day; spends most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by multiple individuals and can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares. Are	Unlikely to occur. No suitable habitat occurs within the site.

		known to traverse their home ranges along densely vegetated creeklines.	
Yellow-bellied Glider - *Petaurus Australis*	Vulnerable *NSW* BC *Act*	Forest with old growth elements. Large Eucalypt Hollows for denning- Inhabits mature or old growth Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia mid storey. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar. Very mobile and occupy large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources.	Possibly occurring within the site. May utilise foraging and roosting habitat within the site. Further assessment required.

APPENDIX C – AHIMS Web Services Extensive Search – Site List Report

Office of Environment & Heritage NSW GOVERNMENT

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Moss Vale URA Sewer
Client Service ID : 540454

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
52-5-0541	BCRP 005 Leaning Cliff-Line Site	GDA	56	279983	6140798	Closed site	Valid	Artefact : 1		102506
Contact		Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-5-0580	PASA45	GDA	56	280118	6142323	Open site	Not a Site	Potential Archaeological Deposit (PAD) : 1		102506
Contact		Recorders	Mr.Kelvin Officer,Mr.Adrian Cressey					Permits	3791	
52-5-0564	G2BA1	GDA	56	280171	6142391	Open site	Destroyed	Artefact : 1		103068
Contact		Recorders	Mr.Kelvin Officer,Artefact - Cultural Heritage Management - Pyrmont,Mr.Alex Timn					Permits	3791	
52-5-0753	G2B A61	GDA	56	280248	6142928	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		103718
Contact		Recorders	Mr.Adrian Cressey					Permits	3791	
52-5-0712	PASA 52	GDA	56	280341	6143016	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		103068
Contact		Recorders	Mr.Adrian Cressey,Mr.Adrian Cressey					Permits	3791	
52-5-0752	G2B A60	GDA	56	280375	6143357	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		103718
Contact		Recorders	Mr.Adrian Cressey					Permits	3791	
52-5-0683	PASA 1 (Berry - Bomaderry)	GDA	56	280412	6143352	Open site	Valid	Potential Archaeological Deposit (PAD) : -		103068
Contact		Recorders	Mr.Kelvin Officer,Mr.Adrian Cressey					Permits	3791,4067	
52-5-0754	Abernethy's Creek 1	GDA	56	280423	6143083	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
Contact		Recorders	Mr.Adrian Cressey					Permits		
52-5-0751	G2B A59	GDA	56	280458	6143469	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
Contact		Recorders	Mr.Adrian Cressey					Permits	3791	
52-5-0287	Abernethys Creek 1;	GDA	56	280464	6142990	Open site	Partially Destroyed	Artefact : -	Open Camp Site	102301,102506
Contact		Recorders	Mr.Kelvin Officer,Mr.Matthew Kelleher,Mr.Matthew Kelleher,Kelleher Nightingale (					Permits	3791	
52-5-0840	MM-AD1	GDA	56	280517	6143246	Open site	Valid	Artefact : -		
Contact		Recorders	Biosis Pty Ltd - Sydney,Mr.James Cole					Permits	4067	
52-5-0838	Abernethys Creek 2	GDA	56	280581	6143181	Open site	Valid	Artefact : -		
Contact		Recorders	Biosis Pty Ltd - Sydney,Mr.James Cole					Permits	4067	

Report generated by AHIMS Web Service on 07/10/2020 for Jeff Bryant for the following area at Datum :GDA, Zone : 56, Eastings : 278740 - 282139, Northings : 6140752 - 6143495 with a Buffer of 50 meters. Additional Info : Due diligence assessment. Number of Aboriginal sites and Aboriginal objects found is 39

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Office of Environment & Heritage NSW GOVERNMENT

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Moss Vale URA Sewer
Client Service ID : 540454

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
52-5-0839	MM-AD2	GDA	56	280671	6143226	Open site	Valid	Artefact : -		
	Contact	Recorders	Biosis Pty Ltd - Sydney,Mr.James Cole					Permits	4067	
52-5-0694	EDWARDS AVENUE IF1	GDA	56	281938	6142393	Open site	Valid	Artefact : 1		
	Contact	Recorders	Artefact - Cultural Heritage Management - Pyrmont					Permits		
52-5-0544	BCRP 012 Pitt Street Narang	AGD	56	278907	6141032	Open site	Valid	Artefact : 1		102506
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-5-0545	BCRP 013 West Cambewarra	AGD	56	279206	6141669	Open site	Valid	Artefact : 1		102506
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-5-0546	BCRP 014 West Cambewarra	AGD	56	279266	6141794	Open site	Valid	Artefact : 1		102506
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-2-1797	West Cambewarra Rd.;Bomaderry Creek;	AGD	56	279300	6141700	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	98511,103143
	Contact	Recorders	T Bartlett					Permits		
52-5-0390	Bomaderry Site	AGD	56	279350	6141300	Open site	Valid	Artefact : -		2254,98511,102506,103143
	Contact	Recorders	Terry Barratt					Permits		
52-5-0263	Bomaderry Ck 4;Bomaderry Creek Nowra;	AGD	56	279350	6141400	Closed site	Valid	Artefact : -	Shelter with Deposit	2254,98511,102506,103143
	Contact	Recorders	Kerry Navin,Mr.Kelvin Officer					Permits		
52-5-0421	NO.LC1	AGD	56	279350	6143000	Open site	Valid	Artefact : 4		102301,102506
	Contact	Recorders	Mr.Sam Wickman					Permits		
52-5-0262	Bomaderry Ck 5;Bomaderry Creek Nowra;	AGD	56	279420	6141260	Closed site	Valid	Artefact : 5	Shelter with Deposit	2254,98511,102506,103143
	Contact	Recorders	Kerry Navin,Mr.Kelvin Officer,Mr.Edward Clarke					Permits		
52-5-0454	BC1/B	AGD	56	279450	6141160	Closed site	Valid	Artefact : 8		102506,103143
	Contact T Russell	Recorders	Mr.Edward Clarke					Permits		
52-5-0547	BCRP 015 West Cambewarra	AGD	56	279472	6141712	Open site	Valid	Artefact : 1		102506
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-5-0556	BCRP 025 Trenched Drip-line	AGD	56	279496	6141091	Open site	Valid	Artefact : 1		102506
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-5-0542	BCRP 006 Pipeline Shelter	AGD	56	279545	6141313	Closed site	Valid	Artefact : 1		102506
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-5-0543	BCRP 007 Stone Circle Site	AGD	56	279551	6141181	Open site	Valid	Artefact : 1		102506
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-5-0555	BCRP 024 One Silcrete Flake	AGD	56	279675	6141006	Open site	Valid	Artefact : 1		102506

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Office of Environment & Heritage NSW GOVERNMENT

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Moss Vale URA Sewer

Client Service ID : 540454

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-5-0539	BCRP 002 The black caves	AGD	56	279701	6141045	Open site	Valid	Artefact : 1		102506
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-5-0554	BCRP 023 Charcoal Oval Art	AGD	56	279757	6140987	Open site	Valid	Artefact : 1		102506
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-5-0538	BCP 001 Mosquito Shelter	AGD	56	279793	6141045	Closed site	Valid	Artefact : 1		102506
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-5-0552	BCRP 020 Spotted Gum	AGD	56	279868	6140699	Closed site	Valid	Artefact : 1		102506
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-5-0389	Shelter Cave	AGD	56	279900	6140800	Open site	Valid	Habitation Structure : -		98511,102506, 103143
	Contact	Recorders	Terry Barratt					Permits		
52-5-0553	BCRP 022-30 Metres West of Shelter Cave	AGD	56	279917	6140870	Closed site	Valid	Artefact : 1		102506
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-5-0453	BC1/E	AGD	56	279930	6141030	Closed site	Valid	Artefact : 6		102506,103143
	Contact T Russell	Recorders	Mr.Edward Clarke					Permits		
52-5-0540	BCRP 003 The blue metal site	AGD	56	279952	6141083	Open site	Valid	Artefact : -		102506
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-5-0455	BC1/F	AGD	56	279970	6140860	Closed site	Valid	Artefact : 1		102506
	Contact T Russell	Recorders	Mr.Edward Clarke					Permits		
52-5-0551	BCRP 019 Boulder Shelter	AGD	56	280000	6140599	Closed site	Valid	Artefact : 1		102506
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		
52-5-0557	BCRP 026 Rock Fall Canyon Shelter	AGD	56	281896	6140560	Closed site	Valid	Artefact : 1		102506
	Contact	Recorders	Kelleher Nightingale Consulting Pty Ltd					Permits		

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APPENDIX D – Aboriginal Heritage Sites – location maps

NB: Maps extracted from AHIMS site cards unless otherwise stated

Figure D-1. Site 52-5-0302

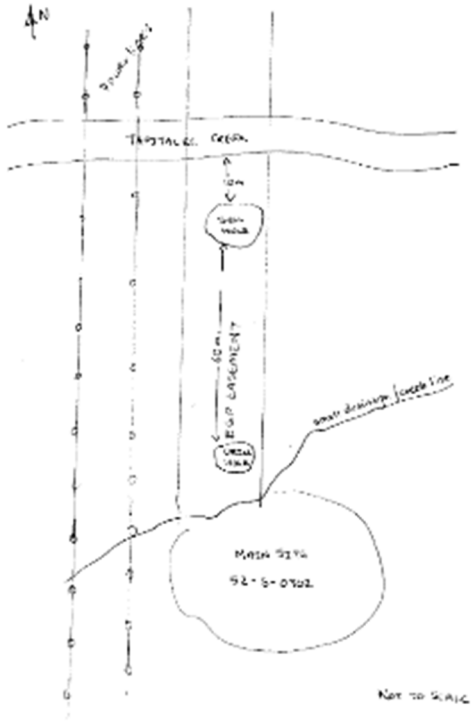


Figure D-2. Site 52-5-0421

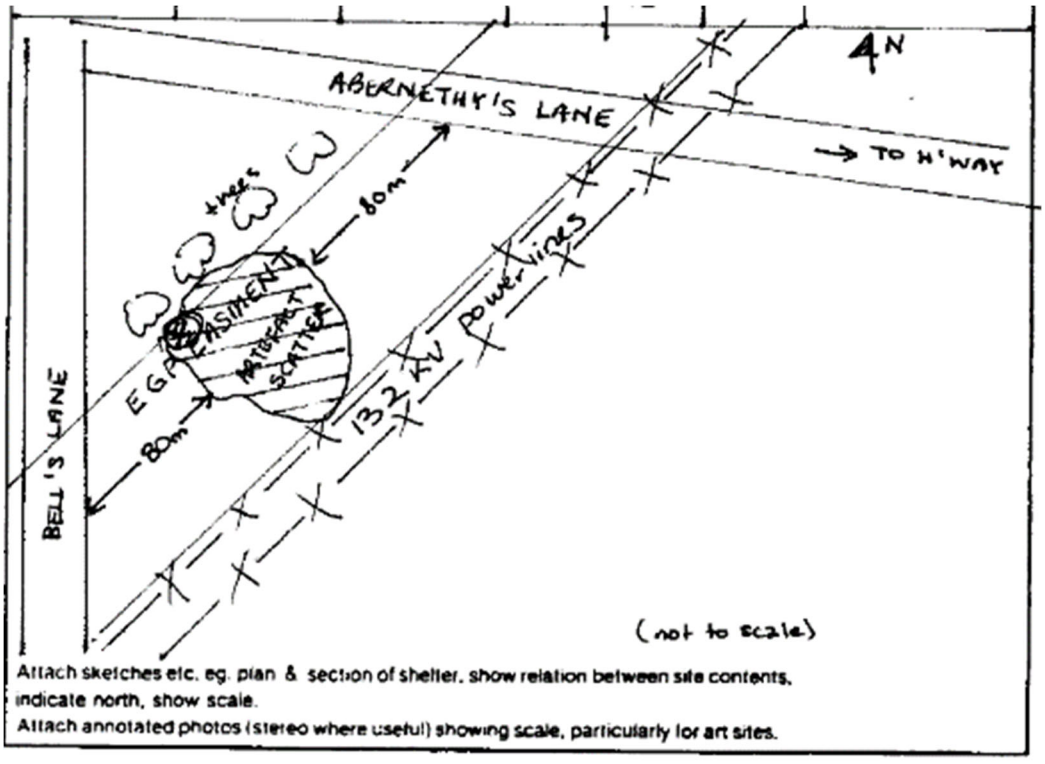


Figure D-3. Site 52-5-0694

Figure D-4. Sites 52-5-0712, 52-5-0753 and 52-5-0754

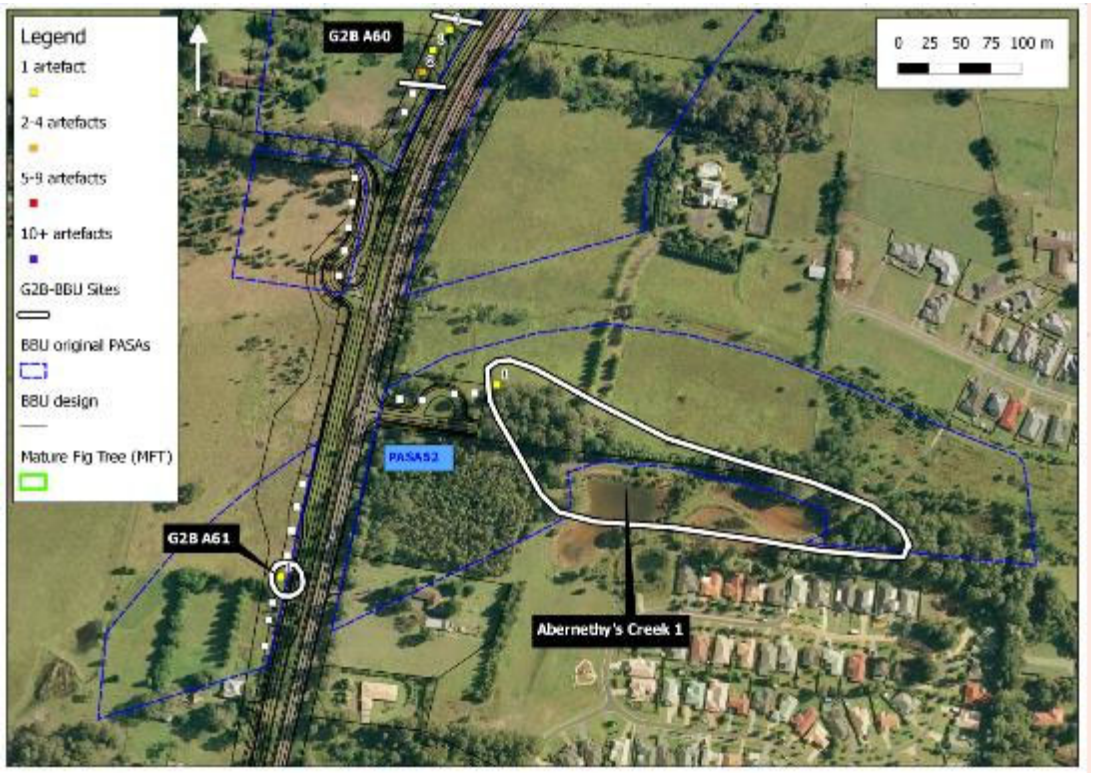


Figure D-5. Site 52-5-0839

Figure D-6. Site 52-5-0840

Figure D-7a. Sites 52-5-9031, 52-5-0932 and 52-5-0933 (from Feary 2020)

Figure 17: Test pit locations in relation to the road alignment

Table D1. Sites 52-5-9031, 52-5-0932 and 52-5-0933 (from Feary 2020)

AREA	TEST PIT #	DEPTH OF PIT (Datum 20cm)	NO. OF ARTEFACTS	EXCAVATION UNIT WITH ARTEFACTS	DEPTH RANGE OF ARTEFACTS
C	NN1	46.5	0		
C	NN2	42.0	0		
A	NN3	43.5	0		
A	NN4	43.0	1	Spit 3	20-30 cm
A	NN5	45.0	3	Spit 3	10-15 cm
A	NN6	32.0	2	Spit 2 and 3	10-30 [disturbed]
A	NN7	40.0	0		
A	NN8	39.0	3	Spit 2	10-15
A	NN12	49.0	1	Spit 3/4	20-25
B	NN9	43.0	1	Spit 4	20-30
B	NN10	35.0	0		
B	NN11	47.0	1	Spit 3	10-20
TOTAL ARTEFACTS = 12					

Figure D-7b. Site 52-5-9031 (from Feary 2020)

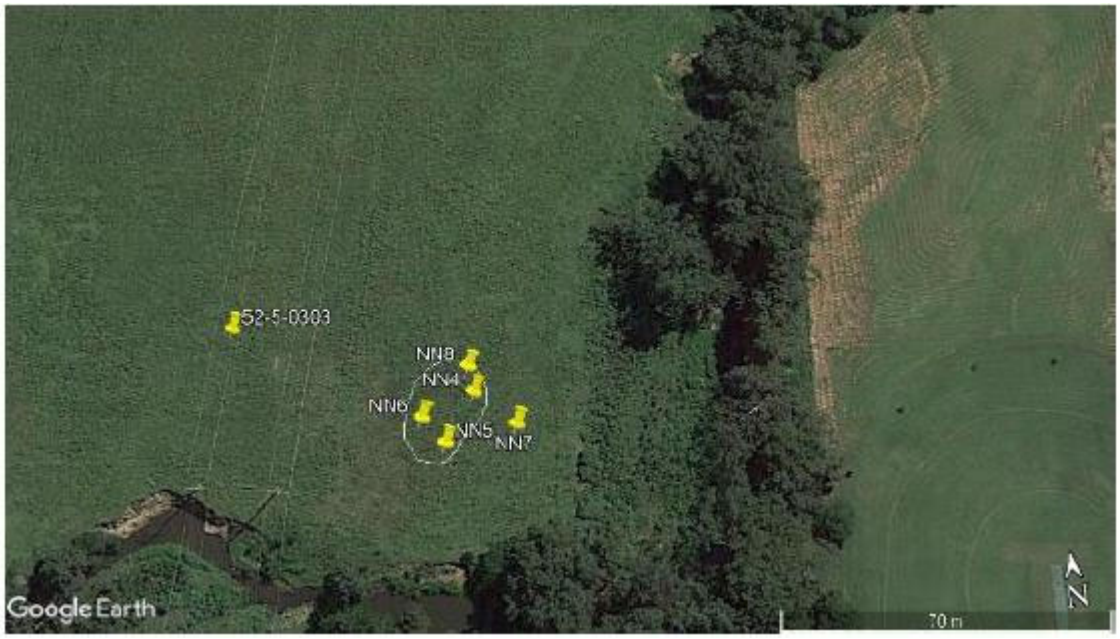
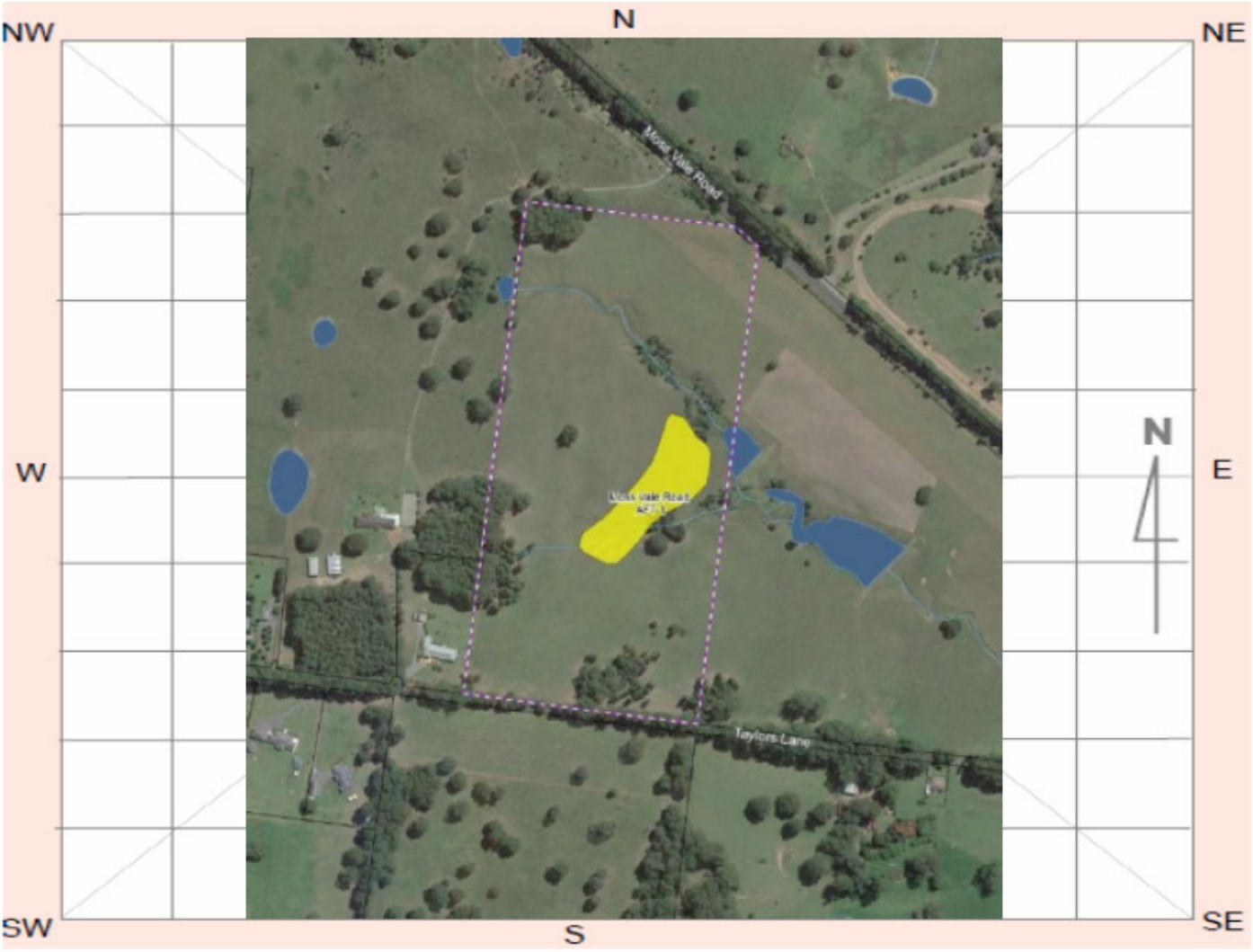
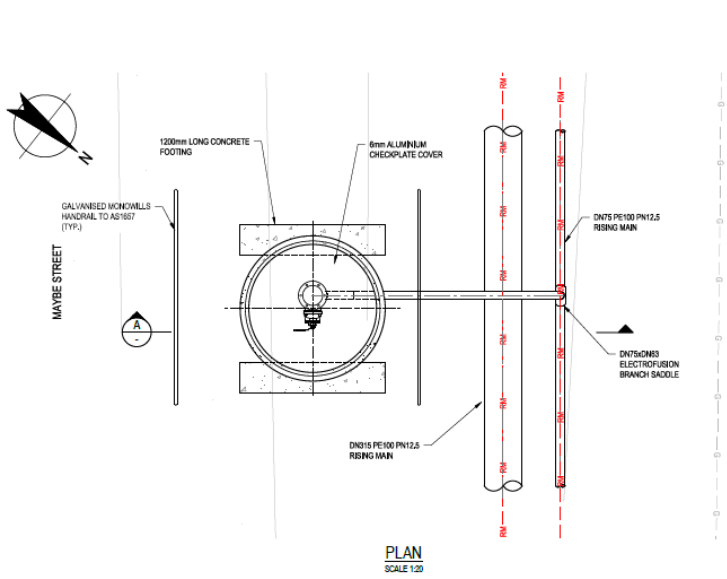


Figure D-7b. Site 52-5-9031 (from Feary 2020)

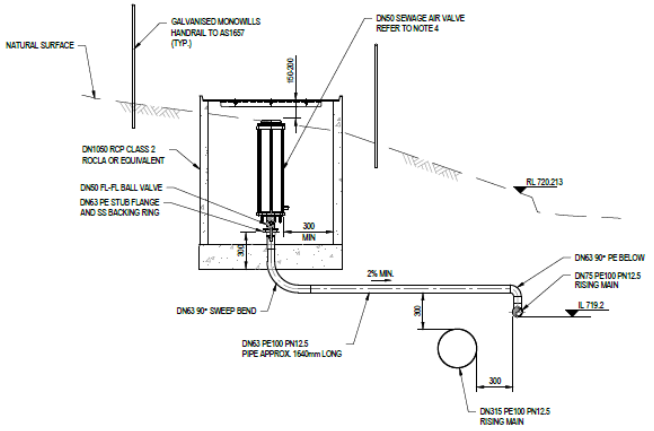
Figure D-8. Site 52-5-0880



APPENDIX E – Offset Air Valve indicative design and location details



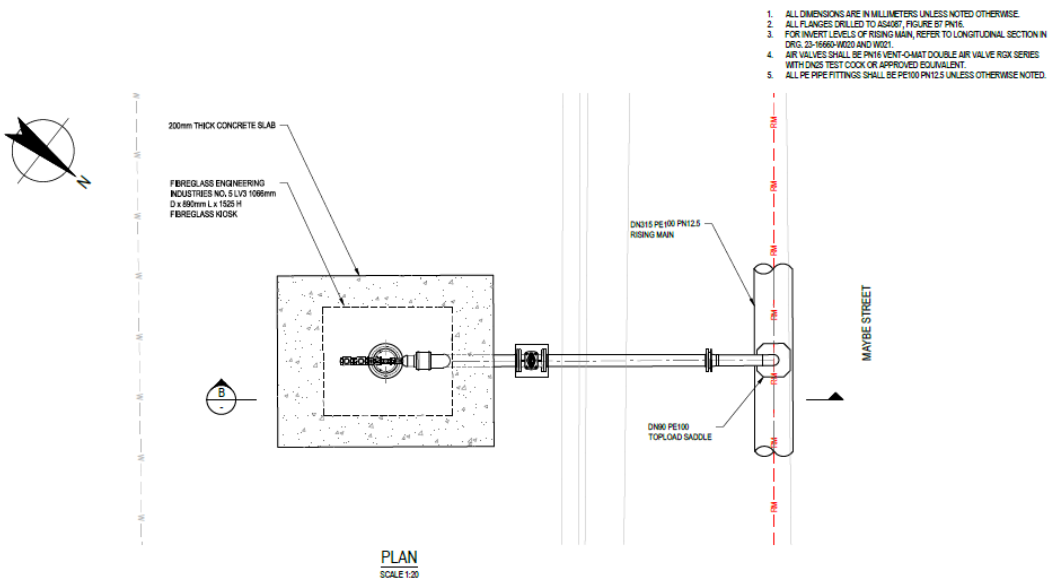
PLAN
SCALE 1:20



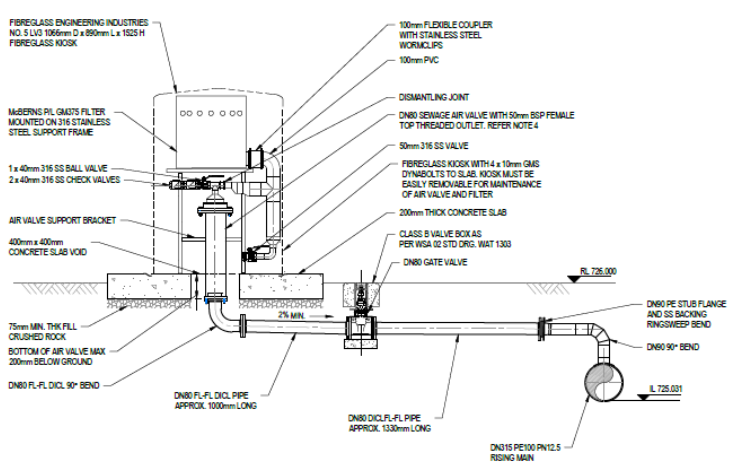
A SECTION
SCALE 1 : 20

OFFSET AIR VALVE PIT (OFF MAYBE STREET)

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. ALL FLANGES DRILLED TO AS4087, FIGURE B7 PN16.
3. FOR INVERT LEVELS OF RISING MAIN, REFER TO LONGITUDINAL SECTION IN DRG. 23-16660-W020 AND W021.
4. AIR VALVES SHALL BE PN16 VENT-O-MAT DOUBLE AIR VALVE RGX SERIES WITH DN25 TEST COCK OR APPROVED EQUIVALENT.
5. ALL PE PIPE FITTINGS SHALL BE PE100 PN12.5 UNLESS OTHERWISE NOTED.



PLAN
SCALE 1:20



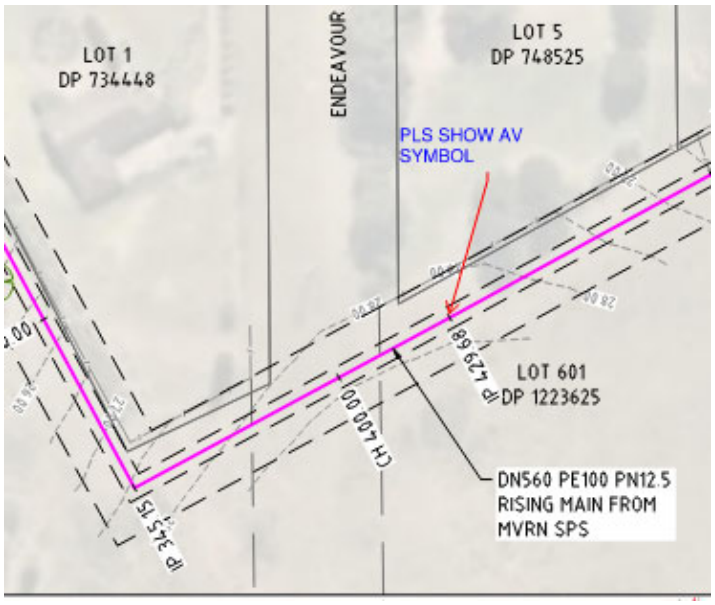
B SECTION
SCALE 1 : 20

OFFSET AIR VALVE PIT (MAYBE STREET)

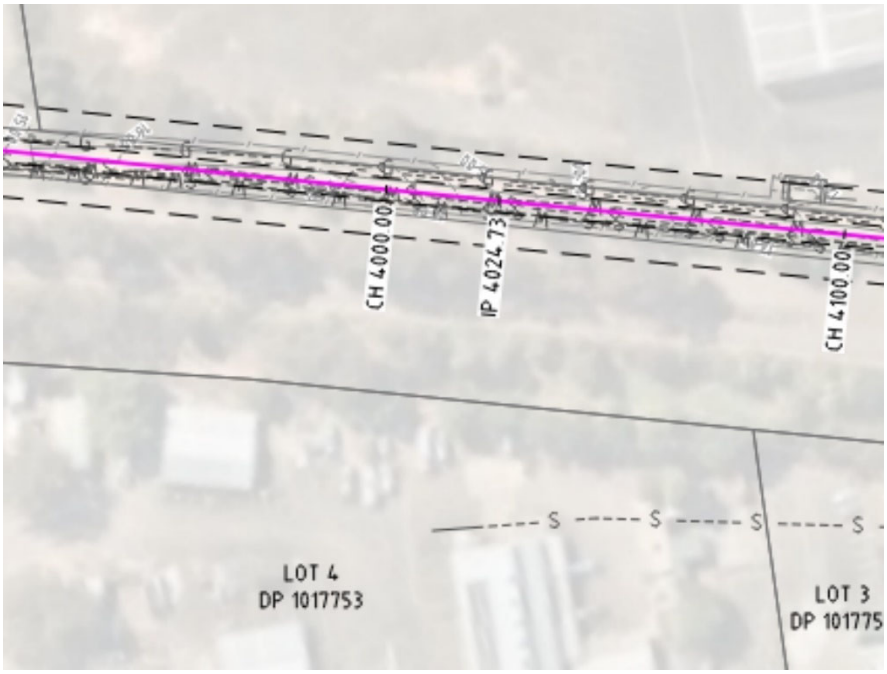
DIAL BEFORE YOU DIG www.1100.com.au
WARNING
BEWARE OF UNDERGROUND SERVICES
THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

The location of air valves for which regular (daily) venting of odorous air will occur are as follows:

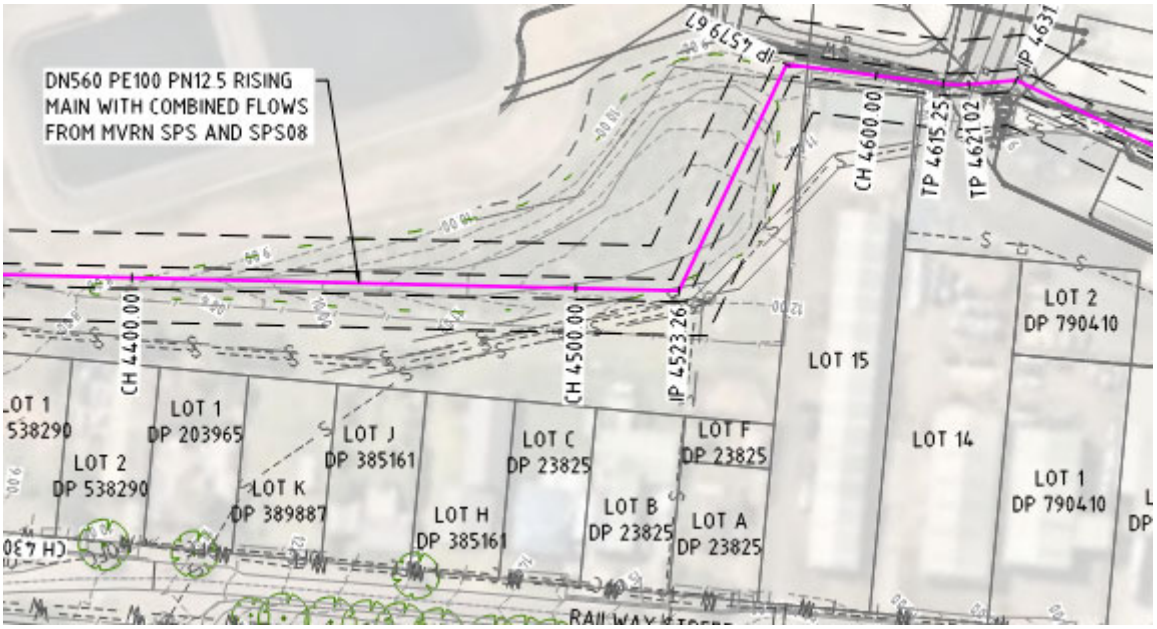
1. CH430, which is in a semi-rural area with a few houses around (refer snapshots below). An air valve with an attached odour treatment (activated carbon) would be required at this location. Initial investigations indicate that a vent stack is not required in this location, however this requirement will be further reviewed during detailed design.



2. CH3970, which is located along the rail line opposite to the industrial estate. Whilst odours are not considered to be an issue in this location, the design will provide provision for an air valve with attached odour treatment (activated carbon) in this location.



3. CH4525, which is located near the treatment plant (where the cars are parked in the image). Whilst odours are not considered to be an issue in this location, the design will provide provision for an air valve with attached odour treatment (activated carbon) in this location.



APPENDIX B - Likelihood of Occurrence Table (NSW Threatened Species)

NSW Threatened Species Likelihood of Occurrence Table

The table of likelihood of occurrence evaluates the likelihood of threatened species to occur on the subject site. This list is derived from previously recorded species within a 5 km radius (taken from NSW BioNet Atlas) around the subject site. Ecology information unless otherwise stated, has been obtained from the *Threatened Biodiversity Profile Search* on the NSW OEH (Office of Environment & Heritage) online database (https://www.environment.nsw.gov.au/threatenedspeciesapp/).

Likelihood of occurrence in study area

1. Unlikely – Species, population or ecological community is not likely to occur. Lack of previous recent (<25 years) records and suitable potential habitat limited or not available in the study area.
2. Likely – Species, population or ecological community could occur and study area is likely to provide suitable habitat. Previous records in the locality and/or suitable potential habitat in the study area.
3. Present – Species, population or ecological community was recorded during the field investigations.

Possibility of impact

1. Unlikely – The proposal would be unlikely to impact this species or its habitats. No NSW *Biodiversity Conservation Act 2016* “Test of Significance” or EPBC Act significance assessment is necessary for this species.
2. Likely – The proposal could impact this species, population or ecological community or its habitats. A NSW *Biodiversity Conservation Act 2016* “Test of Significance” and/or EPBC Act significance assessment is required for this species, population or ecological community.

Endangered Ecological Community name	***Status***	***Likelihood of presence within areas impacted by the activity***
Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Endangered - *NSW* BC *Act*	Does not occur on-site and is not mapped as occurring in close proximity to the site, with nearest records occurring 1.36km to the south-west.
Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	Endangered - *NSW* BC *Act* Critically Endangered - Commonwealth *EPBC Act*	Does not occur on-site and is not mapped as occurring in close proximity to the site, with nearest records occurring 2.5km to the west.
Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	Endangered - *NSW* BC *Act*	Does not occur on-site and is not mapped as occurring in close proximity to the site, with nearest records occurring 1.36km to the south-west.
Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	Endangered - *NSW* BC *Act* Endangered - Commonwealth *EPBC Act*	Does not occur on-site and is not mapped as occurring in close proximity to the site, with nearest records occurring 1.34km to the south-west.
Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Endangered - NSW BC Act	While not mapped within or in proximity to the site (nearest records occurring 5.4km to the south), indicative species of the EEC were noted as occurring within and in proximity to the site. Further assessment has been undertaken in Section 3.2.

Species name	*Status*	*Habitat requirements (www.environment.nsw.gov.au)*	*Likelihood of presence within areas impacted by the activity*
FLORA			
Bauer's Midge Orchid *Genoplesium baueri*	Endangered *EPBC Act* Endangered *NSW* BC *Act*	Grows in dry sclerophyll forest and moss gardens over sandstone.	Unlikely to occur. No suitable habitat present
Bomaderry Zieria *Zieria baeuerlenii*	NSW BC Act Endangered EPBC Act Endangered	Occurs on skeletal sandy loam overlaying sandstone, on a rocky plateau amongst sandstone boulders in either shrubby open forest, shrubby woodland or closed shrub.	Does not occur. A conspicuous species, not detected during survey. No suitable habitat present
Albatross Mallee *Eucalyptus langleyi*	NSW BC Act Vulnerable EPBC Act Vulnerable	Found in Mallee shrub land on poorly drained, shallow, sandy soils on sandstone.	Does not occur. No mallee shrubland on site. A conspicuous species. Not observed during survey.
Hibbertia stricta subsp. *furcatula*	Endangered *NSW* BC *Act*	Habitat of the Southern Sydney population is broadly dry eucalypt forest and woodland. This population appears to occur mainly on upper slopes and above the Woronora River gorge escarpment, at or near the interface between the Lucas Heights soil landscape and Hawkesbury sandstone. Toelken & Miller (2012) note that the species usually grows in 'gravelly loam or clay soil in heath under open woodland'. Habitat of the South Coast population is poorly recorded, but appears to be dry sclerophyll forest or woodland associations in sandy soils over sandstone.	Does not occur. A conspicuous species, not detected during survey. No suitable habitat present

Nowra Heath Myrtle *Triplarina nowraensis*	NSW BC Act Endangered EPBC Act Endangered	Nowra Heath Myrtle occurs on poorly drained, gently sloping sandstone shelves or along creek lines underlain by Nowra Sandstone. The sites are often treeless or have a very open tree canopy due to the impeded drainage.	Does not occur. A conspicuous species, not detected during survey. No suitable habitat present
Pterostylis ventricosa	Critically endangered NSW BC Act	Predominantly in more open areas of tall coastal eucalypt forest often dominated by one or more of the following tree species:- Turpentine, Spotted Gum, Grey Ironbark, Blackbutt, White Stringybark, Scribbly Gum and Sydney Peppermint. Often favours more open areas such as along powerline easements and on road verges where the tree overstorey has been removed or thinned. Grows in a range of groundcover types, including moderatley dense low heath, open sedges and grasses, leaf litter, and mosses on outcropping rock. Soil type ranges from moisture retentive grey silty loams to grey sandy loams. Sometimes found in skeletal soils on sandstone rock shelves	Unlikely to occur. No suitable habitat present
Pterostylis vernalis	Critically Endangered EPBC Act Critically Endangered NSW BC Act	*Pterostylis vernalis* grows in open sites in shallow soil over sandstone sheets, in heath and heathy forest.	Unlikely to occur. No suitable habitat present
Rhodamnia rubescens Scrub Turpentine	Critically Endangered NSW BC Act	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	Marginal suitable habitat. A conspicuous Does not occur. A conspicuous species, not detected during survey. No suitable habitat present
Solanum celatum	NSW BC Act Endangered	Grows in rainforest clearings or in wet sclerophyll forests. Flowers August to October and produces fruit between December and January. Normally recorded in disturbed margins and clearings.	Does not occur. A conspicuous species, not detected during survey. No suitable habitat present

AMPHIBIANS			
Giant Burrowing Frog *Heleioporus australiacus*	Vulnerable EPBC Act Vulnerable NSW BC Act	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Breeding habitat of this species is generally soaks or pools within first or second order streams. They are also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water.	Unlikely to occur. Poor quality habitat present. Generally not found away from sandstone (G.Daly pers.comm.) so unlikely to occur on loamy alluvial soils.
Green and Golden Bell Frog *Litoria aurea*	Vulnerable *EPBC Act* Endangered *NSW* BC *Act*	Heath, woodland and open dry sclerophyll forest on a variety of soil types except clay based. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Breeding frogs will call from open spaces, under vegetation or rocks or from within burrows in the creek bank. Egg masses are laid in burrows or under vegetation in small pools. After rains, tadpoles are washed into larger pools where they complete their development in ponds or ponded areas of the creekline. Tadpole development ranges from Breeding habitat of this species is generally soaks or pools within first or second order streams. They are also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water.	Unlikely to occur. No optimal habitat present, nearest records on north side of Shoalhaven River are over 10km to the east (associated with Coomonderry Swamp population), and poor connectivity between potential habitat areas.
REPTILES			

Green Turtle *Chelonia mydas*	Vulnerable *EPBC Act* Vulnerable *NSW* BC *Act*	Ocean-dwelling species spending most of its life at sea. Eggs are laid in holes dug in beaches throughout their range.	No – no habitat present
BIRDS			
Bar-tailed Godwit *Limosa lapponica*	Migratory EPBC Act	The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh. It has been sighted in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. It is rarely found on inland wetlands or in areas of short grass, such as farmland, paddocks and airstrips, although it is commonly recorded in paddocks at some locations overseas. Forages near the edge of water or in shallow water, mainly in tidal estuaries and harbours. They appear not to forage at high tide and prefer exposed sandy substrates on intertidal flats, banks and beaches. The also prefer soft mud; often with beds of eelgrass Zostera or other seagrasses. Occasionally they have been known to forage among mangroves, or on coral reefs or rock platforms among rubble, crevices and holes. They rarely forage in grassy or vegetated areas. On Heron Island they have been seen feeding on insect larvae among the roots of Casuarina. Roosts on sandy beaches, sandbars, spits and also in near-coastal saltmarsh. In some conditions, waders may choose roost sites where a damp substrate lowers the local temperature.	Unlikely to occur. No suitable habitat present

Black Bittern *Ixobrychus flavicollis*	Vulnerable *NSW* BC *Act*	Terrestrial and estuarine wetlands generally in areas of permanent water and dense vegetation that may comprise grassland, woodland forest rainforest and mangroves. Roosts in trees or on ground amongst dense reeds, nests in branches overhanging water	Unlikely to occur. No suitable habitat present. Habitat too degraded and not adequately sheltered, with no permanent water.
Black Falcon *Falco subniger*	*Vulnerable NSW* BC *Act*	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres (Marchant & Higgins 1993)	Possibly occurring transiently over or through the site. Unlikely to utilise habitat that would be impacted within the site.
Caspian Tern Hydroprogne caspia	*Migratory* *EPBC Act*	Occur along the Australian coastline, and also occur inland along major rivers, especially in the Murray-Darling and Lake Eyre drainage basins, preferring wetlands with clear water to allow easy prey detection.	Unlikely to occur. No suitable habitat present.
Cattle Egret *Ardea ibis*	Migratory *EPBC Act*	Typical habitat occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions however this is extremely rare. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. It has been recorded on earthen dam walls and ploughed fields. It is commonly associated with the habitats of farm animals, particularly cattle, but also pigs, sheep, horses and deer. The Cattle Egret is known to follow earth-moving machinery and has been located at rubbish tips. It uses predominately shallow, open	Possible – but not likely to be affected by the proposed activity. The species are transient and far ranging. It is possible that the species would fly over the site from time to time or to rest briefly. The proposed activity is unlikely to impact the species as the area does not provide important or useful habitat for the species. The species use of the site (flying over or resting) would not be affected by the proposal.

		and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. They have sometimes been observed in swamps with tall emergent vegetation. Feeding habitat occurs away from water on low lying grasslands, improved pastures and croplands. It is commonly found in cattle fields and other farm areas that contain livestock. The Cattle Egret has also been observed foraging in rubbish tips. It is becoming more frequent in drier regions; consuming the ticks of livestock in the absence of other food sources. This inland spread is believed to be due to the construction of artificial waterways. Roosts in trees, or amongst ground vegetation in or near lakes and swamps. It has also been recorded roosting near human settlement and industrial areas in Murwillumbah, NSW.	
Crested Tern Thalasseus bergii	Migratory EPBC Act	Crested Terns inhabit coastal areas, offshore waters, beaches, bays, inlets, tidal rivers, salt swamps, lakes and larger rivers. The species breeds during Sep-Jan in the south and Mar-Jun in the north in large, dense colonies on small islands. Nesting occurs on sand or shingle among low vegetation behind the beaches (Pizzey & Knight 2012; Morcombe 2011)	Unlikely to occur. No suitable habitat present.
Eastern Curlew Numenius madagascariensis	Critically Endangered EPBC Act	Most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes use the mangroves. The birds are also found in saltworks and sewage farms (Marchant & Higgins 1993).	Unlikely to occur. No suitable habitat present.

		The numbers of Eastern Curlew recorded during one study were correlated with wetland areas. Mainly forages on soft sheltered intertidal sandflats or mudflats, open and without vegetation or covered with seagrass, often near mangroves, on saltflats and in saltmarsh, rockpools and among rubble on coral reefs, and on ocean beaches near the tideline. The birds are rarely seen on near-coastal lakes and in grassy areas. Roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. It occasionally roosts on reef-flats, in the shallow water of lagoons and other near-coastal wetlands. Eastern Curlews are also recorded roosting in trees and on the upright stakes of oyster-racks. At Roebuck Bay, Western Australia, birds fly from their feeding areas on the tidal flats to roost 5 km inland on a claypan. In some conditions, waders may choose roost sites where a damp substrate lowers the local temperature. This may have important conservation implications where these sites are heavily disturbed beaches. It may be possible to create artificial roosting sites to replace those destroyed by development. Eastern Curlews typically roost in large flocks, separate from other waders.	
Eastern Hooded Dotteral (Hooded Plover) Thinornis cucullatus cucullatus (synThinornis rubricollis)	NSW BC Act: Critically Endangered EPBC Act: Vulnerable	In south-eastern Australia Hooded Plovers prefer sandy ocean beaches, especially those that are broad and flat, with a wide wave-wash zone for feeding, much beachcast seaweed, and backed by sparsely vegetated sand-dunes for shelter and nesting. Occasionally Hooded Plovers are found on tidal bays and estuaries, rock platforms and rocky or sand-covered reefs near sandy beaches, and small beaches in lines of cliffs. They	Unlikely to occur. No suitable habitat present.

		regularly use near-coastal saline and freshwater lakes and lagoons, often with saltmarsh. Hooded Plovers forage in sand at all levels of the zone of wave wash during low and mid-tide or among seaweed at high-tide, and occasionally in dune blowouts after rain. At night they favour the upper zones of beaches for roosting. When on rocks they forage in crevices in the wave-wash or spray zone, avoiding elevated rocky areas and boulder fields. In coastal lagoons they forage in damp or dry substrates and in shallow water, depending on the season and water levels. In eastern Australia, Hooded Plovers usually breed from August to March on sandy ocean beaches strewn with beachcast seaweed, in a narrow strip between the high-water mark and the base of the fore-dunes. They often nest within 6 m of the fore-dune, mostly within 5 m of the high-water mark, but occasionally among or behind dunes.	
Eastern Osprey *Pandion cristatus*	*NSW* BC *Act* Vulnerable	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	Possibly occurring transiently over or through the site. Unlikely to utilise habitat that would be impacted within the site. No suitably large trees for nesting occur within the site.
Freckled Duck *Stictonetta naevosa*	Vulnerable NSW BC Act	Found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. The duck is forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat. The species may also occur as far as coastal NSW and Victoria during such times.	Possibly occurring. Marginal, suitable ephemeral habitat exists within the site. Further assessment has been undertaken in Section 3.2.

		Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds	
Gang-gang Cockatoo *Callocephalon fimbriatum*	*Vulnerable NSW* BC *Act*	Tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. Favours old growth attributes for nesting and roosting	Unlikely to occur. Habitat is marginal, disconnected and far from other suitable areas.
Glossy Black-cockatoo *Calyptorhynchus lathami*	Vulnerable *NSW* BC *Act*	The GBC inhabits open forest and woodlands of the coast where stands of she-oak occur. In the Jervis Bay region they feed almost exclusively on the seeds of the black she-oak *Allocasuarina littoralis*, shredding the cones with their bill	Unlikely to occur. Habitat is marginal, disconnected and far from other suitable areas. No suitable foraging habitat occurs.
Little Lorikeet *Glossopsitta pusilla*	Vulnerable NSW BC ACT	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are	Possibly occurring transiently over or through the site. Unlikely to utilise habitat that would be impacted within the site. No hollows suitable for nesting by this species would be removed.

		limited. Riparian trees often chosen, including species like Allocasuarina	
Powerful Owl – *Ninox strenua*	Vulnerable NSW BC Act	Coastal Woodland, Dry Sclerophyll Forest, wet sclerophyll forest and rainforest- Can occur in fragmented landscapes Roosts in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda,* Cherry Ballart Exocarpus cupressiformis and a number of eucalypt species. requires old growth elements-hollow bearing tree resources for nesting and prey resource. Nests in large tree hollows in large eucalypts that are at least 150yrs old. Often in riparian areas. Large home range	Possibly occurring transiently over or through the site. Unlikely to utilise habitat that would be impacted within the site. No hollows suitable for nesting by this species would be removed.
Regent Honeyeater *Anthochaera phrygia*	Critically endangered EPBC Act Critically endangered NSW BC Act	Temperate woodlands and open forests- and drier coastal woodlands in some years (flowering coastal woodlands and forests including box-ironbark woodland, and riparian forests-that exhibit large numbers of mature trees, high canopy cover and abundance of mistletoes) Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises: Eucalyptus microcarpa, E. punctata, E. polyanthemos, E. moluccana, Corymbia robusta, E. crebra, E. caleyi, C. maculata, E.mckieana, E. macrorhyncha, E. laevopinea, and Angophora floribunda. Nectar and fruit from the mistletoes Amyema miquelii, A. pendula and A. cambagei are also eaten during the breeding season.	Unlikely to occur. No suitable habitat present.

Scarlet Robin *Petroica boodang*	Vulnerable NSW BC Act	The Scarlet Robin is primarily a resident in dry forests and woodlands, but some adults and young birds disperse to more open habitats after breeding.	Possibly occurring transiently over or through the site.
Sharp-tailed Sandpiper *Calidris acuminata*	Migratory EPBC Act	Prefers grassy edges of shallow inland freshwater wetlands. It is also found around sewage farms, flooded fields, mudflats, mangroves, rocky shores and beaches. Breeds in Siberia in the peat-hummock	Unlikely to occur. No suitable habitat present. Habitat too degraded and not adequately sheltered, with no permanent water.
Short-tailed Shearwater Ardenna tenuirostris	Migratory EPBC Act	Coastal, oceanic.	Unlikely to occur – no suitable habitat present
Spotted Harrier *Circus assimilis*	Vulnerable *NSW* BC *Act*	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats or the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population.	Possibly occurring transiently over or through the site. Unlikely to utilise habitat that would be impacted within the site. No suitably large trees for nesting occur within the site.
Square-Tailed Kite *Lophoictinia isura*	*Vulnerable NSW* BC *Act*	Summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses large hunting ranges of more than 100km2 Nest within large hollow bearing trees generally within 200m of riparian areas.	Possibly occurring transiently over or through the site. Unlikely to utilise habitat that would be impacted within the site.
Varied Sittella *Daphoenositta chrysoptera*	Vulnerable *NSW* BC *Act*	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland	Unlikely to occur – no suitable habitat present
White-bellied Sea-Eagle *Haliaeetus leucogaster*	*NSW* BC *Act* Vulnerable	Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland	Possibly occurring transiently over or through the site. Unlikely to utilise habitat that would be

	Migratory *EPBC Act*	Australia and its offshore islands. The habitats occupied by the sea-eagle are characterized by the presence of large areas of open water (larger rivers, swamps, lakes, the sea). Birds have been recorded in (or flying over) a variety of terrestrial habitats. The species is mostly recorded in coastal lowlands, but can occupy habitats up to 1400 m above sea level on the Northern Tablelands of NSW and up to 800 m above sea level in Tasmania and South Australia. Birds have been recorded at or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs, saltmarsh and sewage ponds. They also occur at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest (including rainforest) and even urban areas. Breeding has been recorded on the coast, at inland sites, and on offshore islands. Breeding territories are located close to water, and mainly in tall open forest or woodland, although nests are sometimes located in other habitats such as dense forest (including rainforest), closed scrub or in remnant trees on cleared land. Forages over large expanses of open water; this is particularly true of birds that occur in coastal environments close to the sea-shore, where they forage over in-shore waters. However, the White-bellied Sea-Eagle will also forage over open terrestrial habitats (such as grasslands). Birds may move to and congregate in favorable sites during drought or food shortage.	impacted within the site. No suitably large trees for nesting occur within the site.
MAMMALS			

Eastern Pygmy-possum *Cercatetus nanus*	Vulnerable NSW BC Act	Rainforest, sclerophyll forest & woodland to heath – but heath & woodland preferred. Forages on banksias, eucalypts & bottlebrushes.	Unlikely to occur. No suitable habitat present.
Grey-headed Flying-fox *Pteropus poliocephalus*	Vulnerable *EPBC Act* Vulnerable *NSW* BC *Act*	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	Possibly occurring transiently over or through the site. Unlikely to utilise habitat that would be impacted within the site.
Southern Brown Bandicoot (eastern) *Isoodon obesulus obesulus*	Endangered EPBC Act Endangered NSW BC Act	Southern Brown Bandicoots are largely crepuscular (active mainly after dusk and/or before dawn). They are generally only found in heath or open forest with a heathy understorey on sandy or friable soils. They feed on a variety of ground-dwelling invertebrates and the fruit-bodies of hypogeous (underground-fruiting) fungi. Their searches for food often create distinctive conical holes in the soil. Males have a home range of approximately 5-20 hectares whilst females forage over smaller areas of about 2-3 hectares. Nest during the day in a shallow depression in the ground covered by leaf litter, grass or other plant material. Nests may be located under Grass trees Xanthorrhoea spp., blackberry bushes and other shrubs, or in rabbit burrows. The upper surface of the nest may be mixed with earth to waterproof the inside of the nest.	Unlikely to occur. No suitable habitat present.
Spotted-tailed Quoll *Dasyurus maculatus*	Endangered *EPBC Act* Vulnerable *NSW* BC *Act*	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt	Unlikely to occur. No suitable habitat present.

		during the day; spends most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by multiple individuals and can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares. Are known to traverse their home ranges along densely vegetated creeklines.	
Yellow-bellied Glider - *Petaurus Australis*	Vulnerable *NSW* BC *Act*	Forest with old growth elements. Large Eucalypt Hollows for denning- Inhabits mature or old growth Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia mid storey. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar. Very mobile and occupy large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources.	Unlikely to occur. No suitable habitat present.
MAMMALS - MICROBATS			
Large (Eastern) Bentwing-bat *Miniopterus orianae oceanensis*	Vulnerable *EPBC Act*	Specific caves are known maternity sites with other caves being primary roosting habitat outside breeding period. Also uses derelict mines, storm-water tunnels, buildings and other man-made structures. Hunts in forested areas, catching moths and other flying insects above the tree tops.	Unlikely to occur. No suitable habitat present within or in proximity to the site

Eastern False Pipistrelle *Falsistrellus tasmaniensis*	Vulnerable *NSW* BC *Act*	Prefers moist habitat that contains trees greater than 20 m high with a dense undertstorey. They are fast flyers. Roosts in hollow trunks of eucalyptus trees, in colonies of 3 – 80. Also may roost in caves and old wooden buildings. This species changes roost every night. Roosts on consecutive nights are usually less than 750 m apart. This species has a home range of up to 136 ha (Churchill, S 2008, Australian Bats, Jacana Books, Crows Nest, NSW). Although they prefer habitat with a dense understorey, they prefer to forage along flyways to avoid the thick understorey. They prefer continuous forest and avoid remnant vegetation. However, they have been recorded in open forests (Churchill, S 2008, Australian Bats, Jacana Books, Crows Nest, NSW).	Unlikely to occur. No suitable habitat present within or in proximity to the site
Eastern Coastal Freetail-Bat *Micronomus norfolkensis*	Vulnerable *EPBC Act*	Small tree hollows/fissures in bark for roosting in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range.	Possibly occurring within or in proximity to the site. Marginal suitable habitat occurs. Further assessment has been undertaken in Section 3.2
Large –eared Pied Bat *Chalinobolus dwyeri*	Vulnerable *NSW* BC *Act* Vulnerable *EPBC Act*	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the	Unlikely to occur. No suitable habitat present within or in proximity to the site

		disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features	
Greater Broad-nosed Bat *Scoteanax rueppellii*	Vulnerable *NSW* BC *Act*	Found mainly in gullies and river systems that drain the Great Dividing Range, it utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, below 500m, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m	Possibly occurring within or in proximity to the site. Marginal suitable habitat occurs. Further assessment has been undertaken in Section 3.2
Southern Myotis (Large-footed Myotis) *Myotis macropus*	Vulnerable *NSW* BC *Act*	This species is predominantly roosts in caves, however, is known to roost in trees and man-made structures close to water. Roosts are generally located close to water, where the bats forage in small groups of three or four. They have a strong association with streams and permanent waterways in areas that are vegetated rather than cleared (Churchill, S 2008, Australian Bats, Jacana Books, Crows Nest, NSW They feed on small fish, prawns and aquatic macroinvertebrates. They have a preference towards large still pools, rather than flowing streams. They will also forage an aerial insects flying over water. They use their large feet to capture prey items (Churchill 2008).	Possibly occurring within or in proximity to the site. Marginal suitable habitat occurs. Further assessment has been undertaken in Section 3.2