

Appendix 16

Stuarts Point Sewerage Scheme Health Impact Assessment

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Stuarts Point Sewerage Scheme

Health Impact Assessment



Stuarts Point Sewerage Scheme

Health Impact Assessment

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Description **This report presents a Health Impact Assessment (HIA) undertaken as part of the Environmental Impact Statement (EIS) for the proposed Stuarts Point Sewerage Scheme (SPSS) project**

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Executive Summary

Ramboll Australia Pty Ltd (Ramboll) was engaged by Kempsey Shire Council (Council or KSC) to prepare a Health Impact Assessment (HIA) to support an Environmental Impact Statement (EIS) for the proposed Stuarts Point Sewerage Scheme (SPSS) project (the project). The SPSS project is a State Significant Development (SSD) located in Stuarts Point, Grassy Head and Fishermans Reach, New South Wales (NSW) within the Kempsey Shire Council local government area (LGA).

The HIA has been undertaken in accordance with the NSW Health (2007) and enHealth (2017) health impact assessment to meet the requirements SEARs in relation to Health and Public Safety.

The HIA has assessed both positive and negative health impacts associated with the project. This has been based on the removal/decommissioning of the existing OSMSs and establishment of a new sewerage scheme including low pressure sewerage collect, WWTP and dunal discharge for tertiary treated effluent. The HIA focussed on operational aspects of the project, including the following key components of the project:

- low pressure sewerage collection system
- activities within the footprint of the WWTP
- effluent transfer and disposal

This HIA has conducted a detailed assessment of the following priority modifiable health determinants: air quality (including odour); noise and vibration; waste (excluding wastewater); and wastewater.

These priority health determinants were identified from the EIS scoping and extensive community and stakeholder engagement activities undertaken as part of the EIS and SIA.

Positive health impacts were rated as high to very high for odour and water/wastewater related to removal/decommissioning of the existing OSMSs in Stuarts Point. The removal of the OSMSs is expected to have a significant positive impact on human health for most of the community. Positive impacts associated with noise were rated as low. This is because noise associated with the existing OSMSs has not been identified as an issue of concern, hence limited potential for improvement due to removal/decommissioning of the OSMSs.

For all the modifiable health determinants the negative health impacts were characterised as low in relation to operation of the proposed SPSS. This was based on the design of the system, expected management controls and findings from the various relevant technical studies. There is some potential for insignificant to minor health impacts for odour, noise and water quality during atypical conditions. However, these are expected to be short-lived and limited to a small proportion of the community. Any negative health impacts during these atypical events are likely to be related to aesthetics / amenity concerns, and minor, short-term pathogenic responses, rather than significant long-term health impacts.

The SPSS project has been designed to incorporate controls to manage the potential negative health impacts to acceptable levels and to meet relevant standards / guidelines. The design and management controls have been informed by the various technical studies undertaken as part of the EIS. The main EIS report provides further details on the management and monitoring controls for the project.

Overall, the project is expected to result in significant positive health outcomes / benefits for the community. This is consistent with the findings from the other technical studies and overall EIS.

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Abbreviations and Acronyms

Term	Definition
AGWR	Australian Guidelines for Water Recycling
AHD	Australian Height Datum
BTEXN	Benzene, Toluene, Ethylbenzene, Xylenes and Naphthalene
bgl	below ground level
BoM	Bureau of Meteorology
CLM Act	<i>Contaminated Land Management Act 1997</i>
CoPC	Contaminants of Potential Concern
Council	Kempsey Shire Council
CSM	Conceptual site model
DO	Dissolved oxygen
EC	Electrical conductivity
EIS	Environmental Impact Statement
EP	Equivalent persons
EPA	Environment Protection Authority
ET	Estimated tenements
FSANZ	Food Standards Australia New Zealand
Ha	Hectares
HDD	Horizontal Directionless Drilling
HIA	Health Impact Assessment
IDEA	Intermittently Decanted Extended Aeration
IRSD	Index of Relative Socio-economic Disadvantage
km	kilometres
LALC	Local Aboriginal Land Council
LGA	Local Government Area
LSPS	Local Strategic Planning Statement
m	meters
NHMRC	National Health and Medical Research Council
NPI	National Pollutant Inventory

Term	Definition
NSW	New South Wales
OSMS	On-site Sewage Management System
ou	Odour unit
PAH	Polycyclic aromatic hydrocarbons
PFAS	per- and polyfluoroalkyl substances
POAA	Priority Oyster Aquaculture Area
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
PSA	Primary Study Area
PSI	Preliminary Site Investigation
Ramboll	Ramboll Australia Pty Ltd
SEARS	Secretary's Environmental Assessment Requirements
SIA	Social Impact Assessment
SPSS	Stuarts Point Sewerage Scheme
SSD	State Significant Development
STP	Sewerage Treatment Plant
TDS	Total Dissolved Solids
TN	Total nitrogen
TP	Total phosphorous
TRH	Total Recoverable Hydrocarbons
UV	Ultra violet
WHO	World Health Organisation
WWTP	Wastewater Treatment Plant

1. Introduction

1.1 Preamble

Ramboll Australia Pty Ltd (Ramboll) was engaged by Kempsey Shire Council (Council or KSC) to prepare an Environmental Impact Statement (EIS) for the proposed Stuarts Point Sewerage Scheme (SPSS) project (the project). The SPSS project is a State Significant Development (SSD) located in Stuarts Point, Grassy Head and Fishermans Reach, New South Wales (NSW) within the Kempsey Shire Council local government area (LGA). Refer to **Figure 1-1** for the project's regional context and layout. This report presents a Health Impact Assessment (HIA) prepared as part of the project's Environmental Impact Statement (EIS).

1.2 Project background

The communities of Stuarts Point, Grassy Head and Fishermans Reach currently rely on individual onsite sewer management systems (OSMS) for the servicing and disposal of wastewater. These systems are aged and subject to regular failures, particularly during heavy rainfall or flood events whereby OSMS have been identified as a point source of groundwater pollution.

The project would consist of the installation of a pressure sewer network to service approximately 540 properties across Stuarts Point, Grassy Head and Fishermans Reach. It would include the individual property connection system infrastructure required to connect existing properties into the pressure sewer network. Treatment of the collected wastewater would be supplied by a new wastewater treatment plant (WWTP) with a proposed design capacity of approximately 5,300 Equivalent Persons (EP) per day located to the south of Stuarts Point township.

The project would include disposal of treated effluent within a designated effluent disposal area located in the dune system between the Pacific Ocean and Macleay Arm to the east of Stuarts Point. Effluent would be transferred from the WWTP to the effluent disposal area via a new effluent transfer pipeline, inclusive of 450 metres of pipework installed beneath the Macleay Arm via trenchless underground boring.

In addition to providing essential wastewater infrastructure and services, the project would also provide the opportunity to decommission the redundant OSMS for all properties to be serviced by the SPSS project to facilitate improved groundwater quality in the region.

The project is considered an SSD under Part 4 of the *Environmental Planning and Assessment Act 1979* and the State Environmental Planning Policy (Planning Systems 2021). An EIS was required to be prepared to support a development application for determination by the Minister of Planning.

A Scoping Report and request for the Planning Secretary's Environmental Assessment Requirements (SEARs) was submitted on 28 March 2023. The SEARs for the project were issued by the Department of Planning, Housing and Infrastructure (the Department) on 21 April 2023 (Application Number SSD-56884966). The SEARs include a series of requirements to be addressed in the EIS. In relation to Health and Public Safety there is a requirement to prepare 'a *Health Impact Assessment in accordance with current guidelines*'. New South Wales Department of Health (NSW Health) confirmed that the current guidelines referred to is: '*Health Impact Assessment: A Practical Guide*' (NSW Health, 2007).

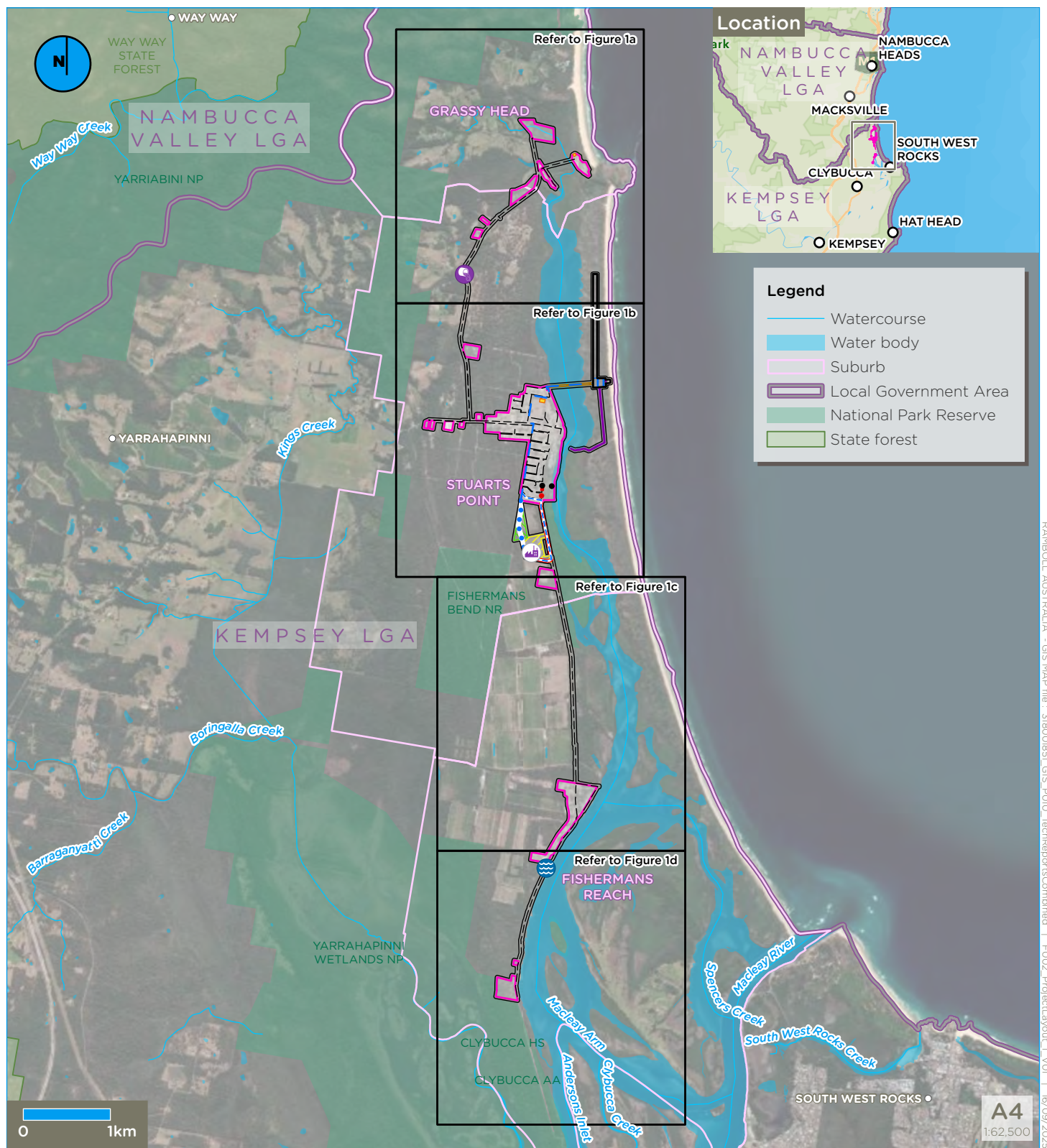


Figure 1-1: Site Layout and Locality

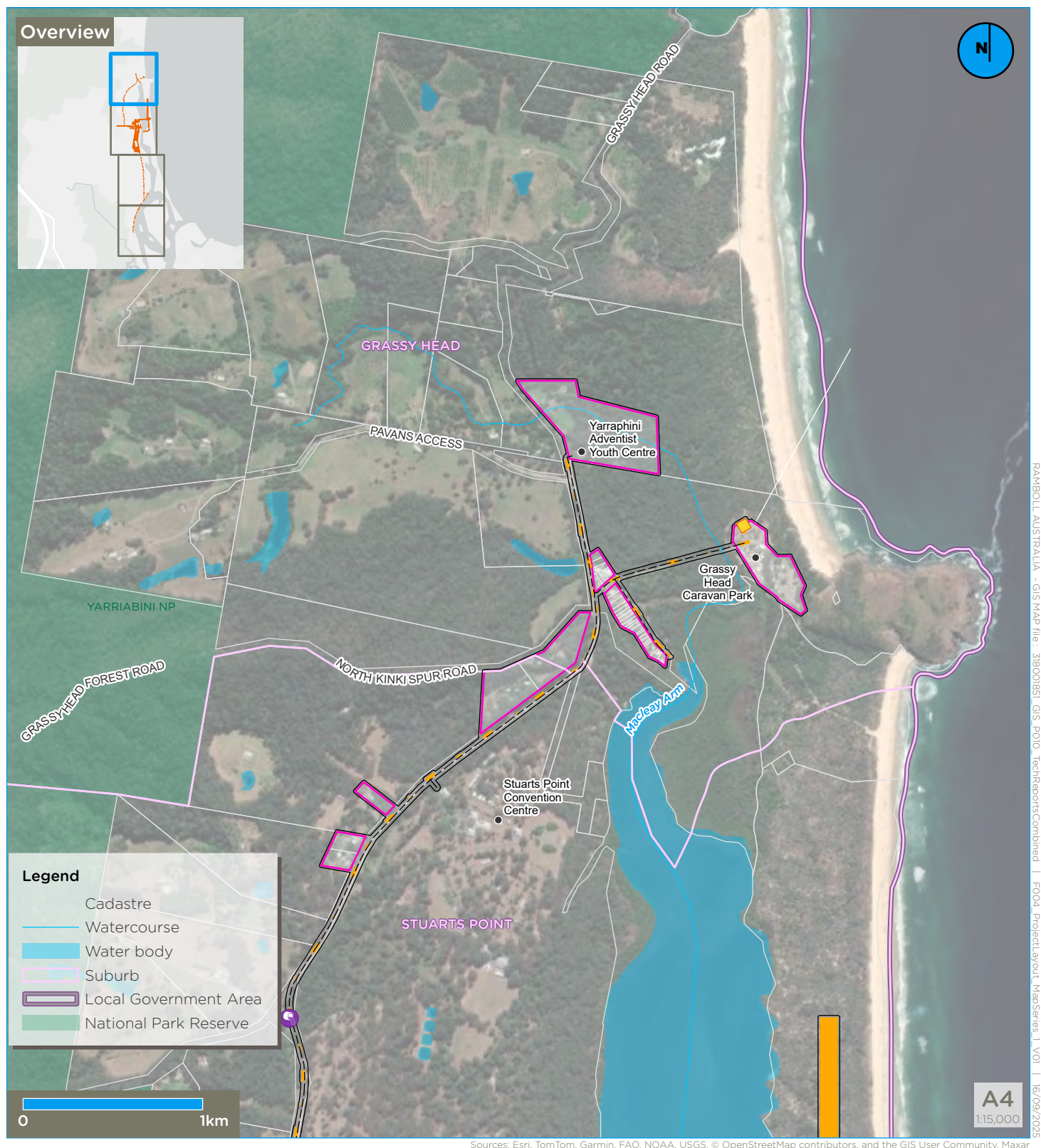


Figure 1-1a: Site Layout and Locality

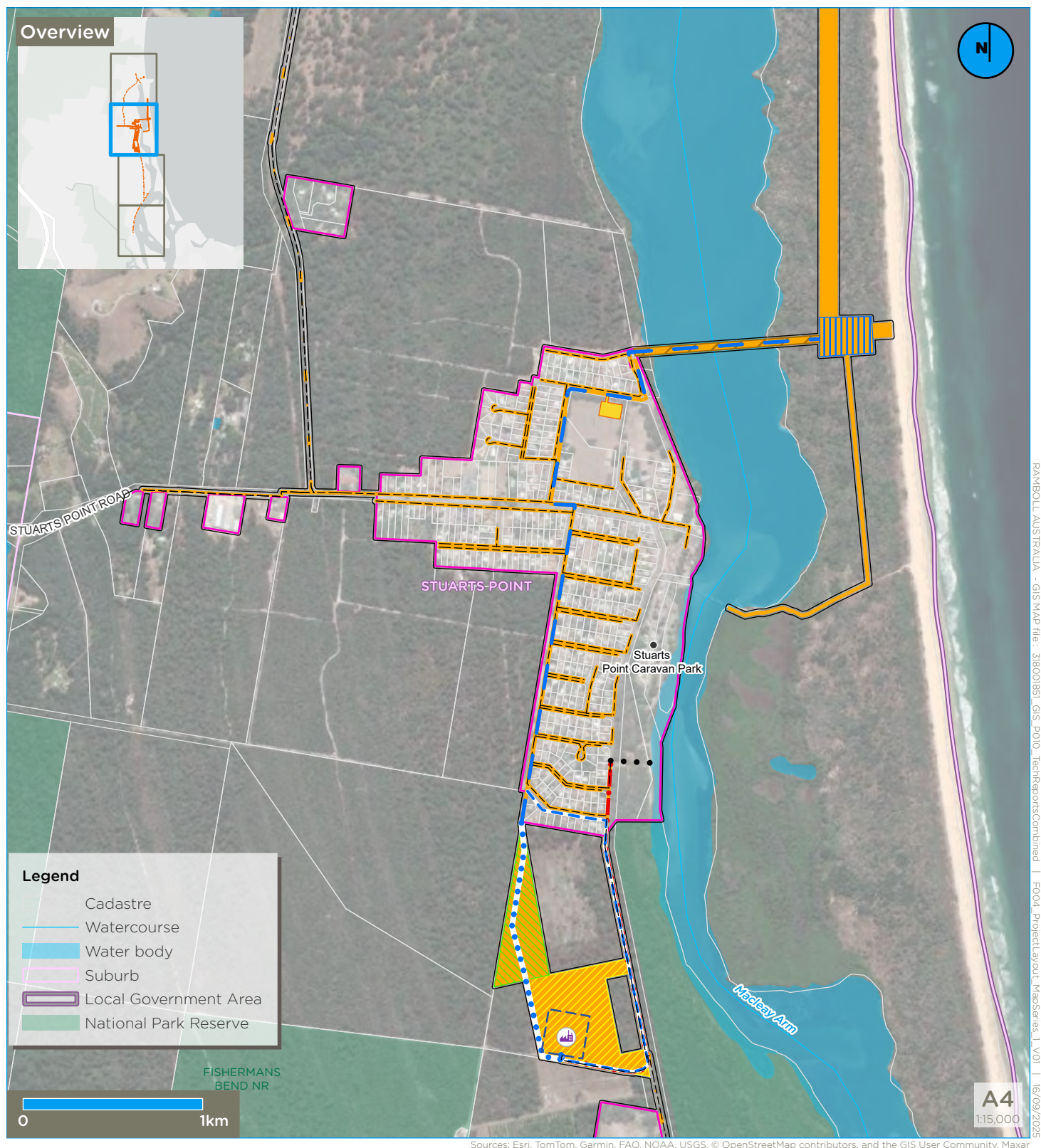


Figure 1-1b: Site Layout and Locality

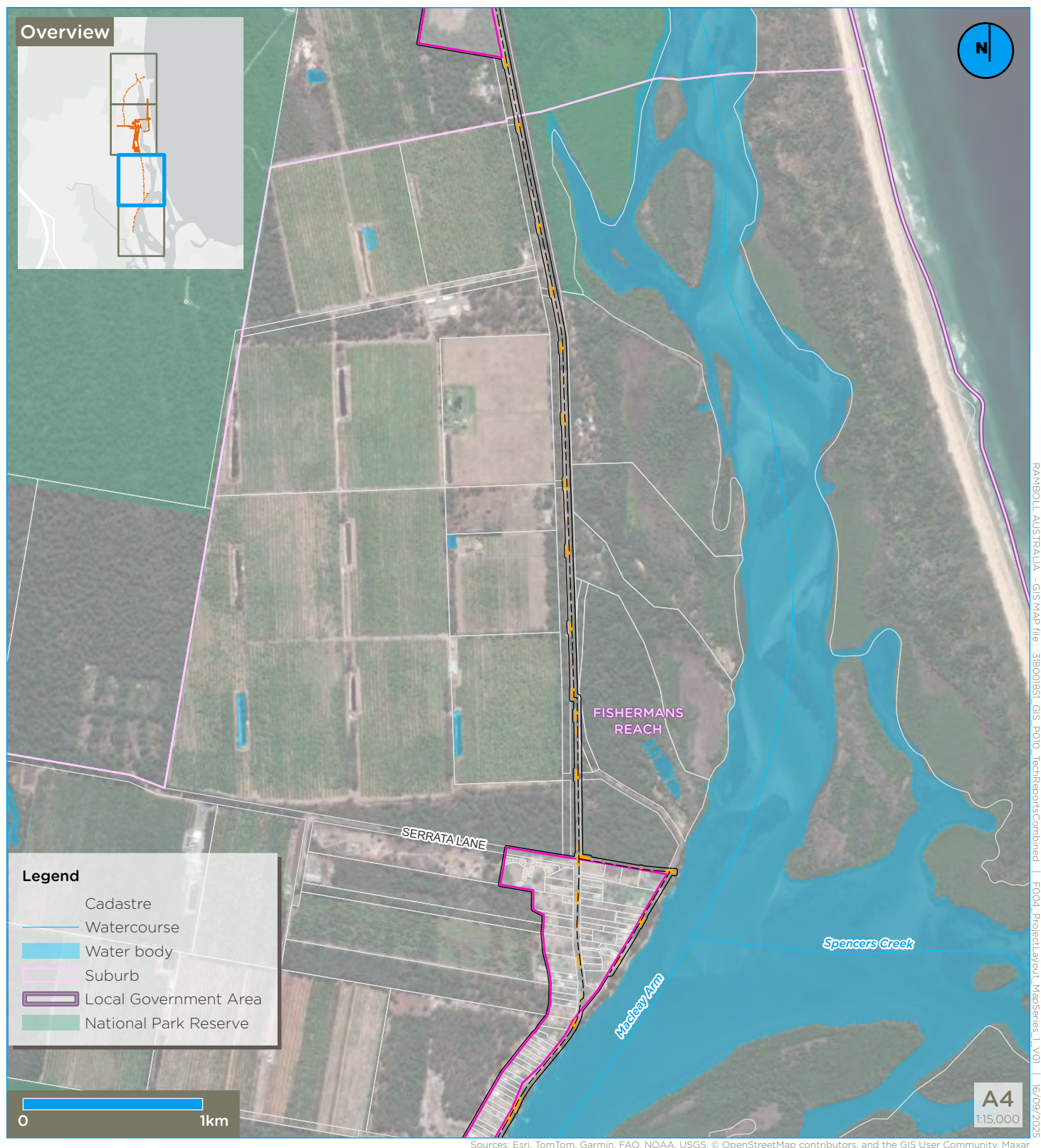


Figure 1-1c: Site Layout and Locality

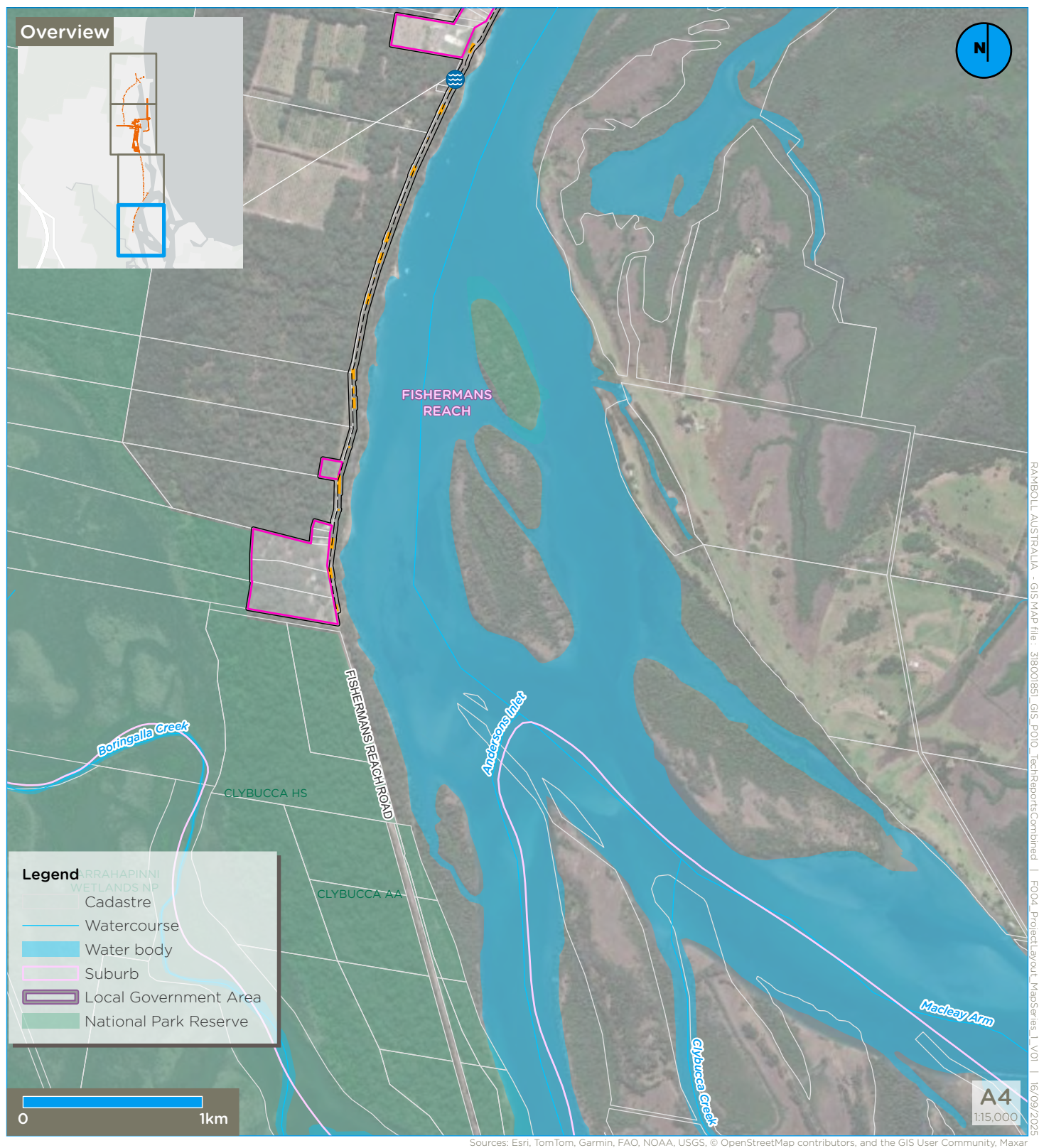


Figure 1-1d: Site Layout and Locality

1.3 Purpose and objectives

The purpose of this HIA is evaluate and document the public health impacts associated with the project to meet the SEARs requirement for the EIS.

The specific objectives of the HIA were to:

- identify the priority health determinants / factors relevant to the project based on community and stakeholder consultation
- describe the baseline health impacts associated with the current individual OSMS in the study area
- assess the positive and negative health impacts associated with proposed project, including the likelihood and magnitude of the impacts
- recommend risk management / mitigation measures and monitoring for identified health impacts and risks.

1.4 Health Impact Assessment Approach

The purpose of a Health Impact Assessment (HIA) has been defined by the International Association for Impact Assessment (Quigley et al, 2006). It is described as a systematic process which reviews the health hazards and health promoters associated with a development policy or project. It assesses risk factors associated with hazards and opportunities associated with promoters as they change during a development. The HIA process is primarily focussed on determinants of health at the population level. It develops evidence-based recommendations to inform decision making process on health protection and promotion.

This HIA has been prepared in accordance with:

- *Health Impact Assessment: A Practical Guide* (NSW Health, 2007)
- *Health Impact Assessment Guidelines* (enHealth, 2017)

Other relevant guidance documents used in this HIA include:

- *Environmental Health Risk Assessment, Guidelines for Assessing Human Health Risks from Environmental Hazards* (enHealth, 2012)
- *Health Risk Assessment (Scoping) Guidelines* (Western Australian Department of Health, 2010)
- *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1)* (NHMRC, 2016)
- *Australian Exposure Factor Guide* (enHealth, 2012)
- *Communicating risks to health from environmental hazards – General guidance for environmental public health professionals* (enHealth, 2024)

The HIA has been undertaken according to the framework in NSW Health (2017) and enHealth (2017). The key steps in the HIA process are illustrated in **Figure 1-2**. This HIA report has been structured around the suggested content of a HIA report as outlined in enHealth (2017).

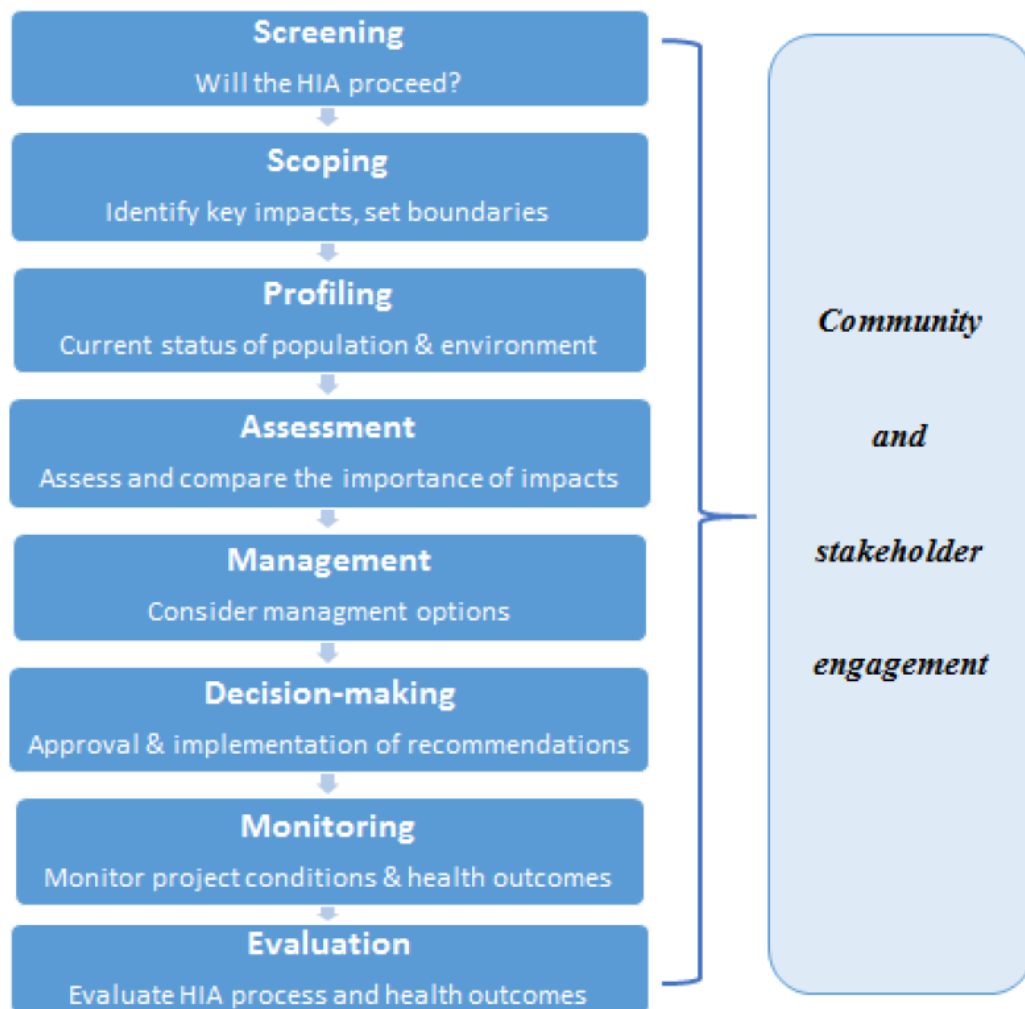


Figure 1-2: Steps in the HIA process (from enHealth, 2017)

The 'Assessment' step in the HIA process has included assessment of risks to health based on the environmental health risk assessment framework provided in enHealth (2012), as illustrated in **Figure 1-3**.

The risk / health impact characterisation step has been undertaken based on the qualitative risk rating approaches outlines in enHealth (2017) and NHMRC (2016), i.e. based on the likelihood and consequence of a hazard / impact. This has considered both positive and negative health impacts.

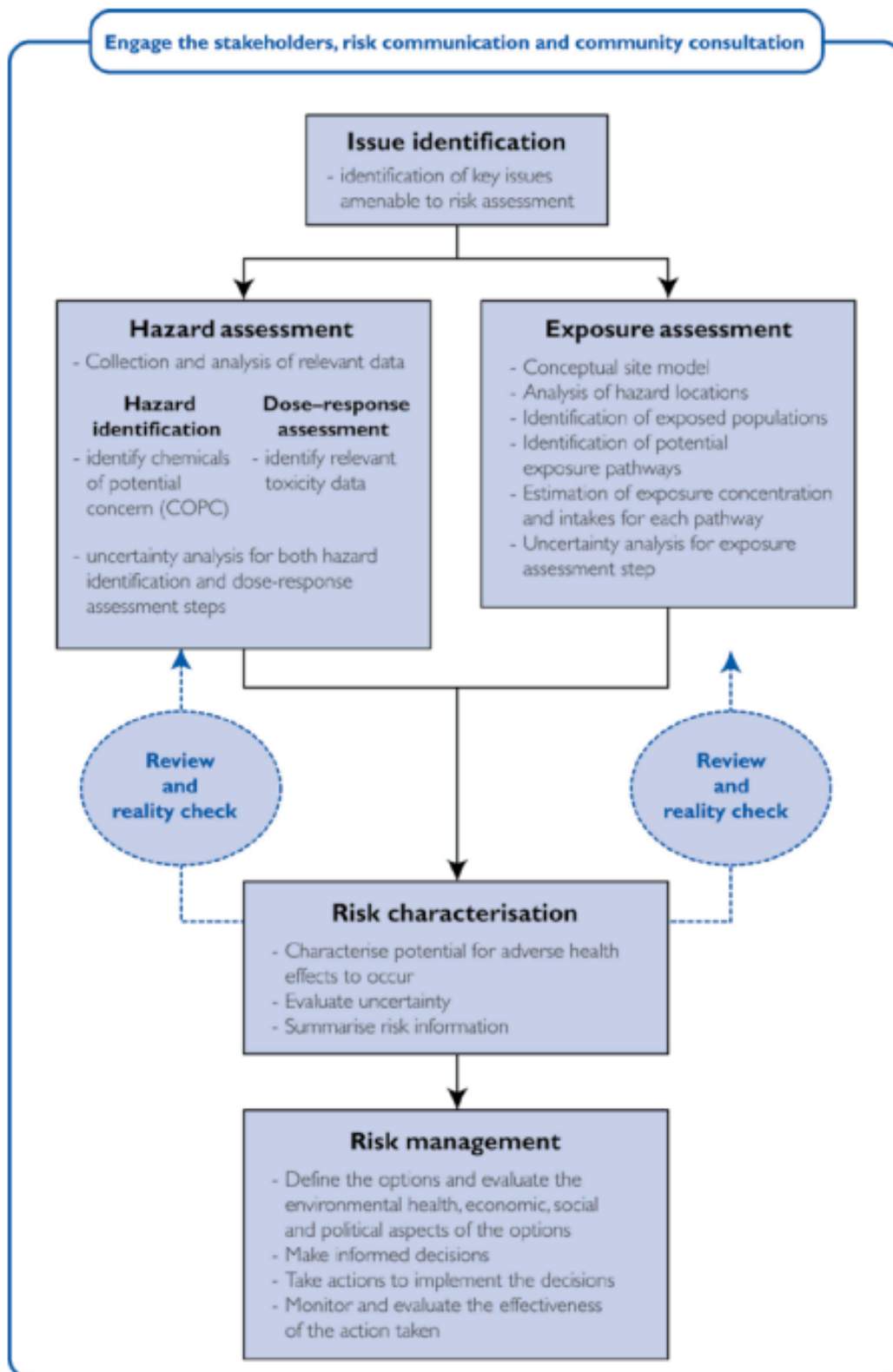


Figure 1-3: Environmental health risk assessment framework (enHealth, 2012)

1.5 Modifiable determinants of health

The HIA process is focussed on assessment of modifiable determinants of health. As stated in enHealth (2017) the WHO definition of health is often used in HIA as follows:

'A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'

Factors that can influence health are referred to as determinants of health under the HIA framework. HIA focuses on determinants of health that can be modified and result in protection or promotion of health at the population level. Key modifiable determinants of health considered in HIA for major infrastructure projects are:

- air quality
- noise and vibration
- food
- water (excluding wastewater)
- wastewater
- land and soil
- storage, handling and disposal of hazard materials
- built environment
- infrastructure and services
- transport
- socio-economic determinants of health.

These key modifiable determinants of health have been considered in this HIA.

1.6 Supporting environmental reports and documents

The following reports and documents have been reviewed for the purpose of this HIA. This includes other technical studies undertaken specifically for the EIS.

- *Stuarts Point Sewerage Strategy*, Kempsey Council, dated August 1995 prepared by CMPS&F Environmental (CMPS&F, 1995)
- *Stuarts Point Sewerage Scheme Stakeholder Engagement Plan*, Kempsey Shire Council, dated December 2018 by GHD (GHD, 2018)
- *Stuarts Point Sewerage Scheme Collection Options Study Report*, Kempsey Shire Council, dated August 2019 by GHD (GHD, 2019)
- *Implementation of Wastewater Treatment at Stuarts Point Review Effluent Licence and Options Assessment*, dated October 2020 by GHD (GHD, 2020)
- *Stuarts Point Sewerage Scheme, Report to Inform EIS on Social Impact of Flooding at Stuarts Point 2021/2022* by Kempsey Shire Council (Kempsey Shire Council, n.d.).
- *Groundwater Resource Assessment and Simulations for Historical and Climate Change Scenarios for the Stuarts Point Borefield. Stage 1: Performance assessment of the Stuarts Point coastal borefields*, dated September 2022 by Ecoseal Developments Pty Ltd (Ecoseal, 2022)
- *Stuarts Point Sewerage Scheme – Effluent Transfer and Disposal Design. Concept Design Report*, Kempsey Shire Council, dated 31 January 2023 by GHD (GHD, 2023)
- *Stuarts Point Sewerage Scheme Scoping Report*, dated March 2023 by Ramboll (Ramboll, 2023)
- *Stuarts Point WWTP Reference Design, Basis of Design Report*, Kempsey Shire Council, dated 12 March 2024 by GHD (GHD, 2024)
- *Stuarts Point WWTP Reference Design Report*, Kempsey Shire Council, dated 12 March 2024 by GHD (GHD, 2024)
- *Stuarts Point Wastewater Treatment Plant Design and Construct Specification*, Kempsey Shire Council, dated 13 March 2024 by GHD (GHD, 2024)
- *Stuarts Point Sewerage Scheme – Consultation Report to Inform EIS*, Dated March 2024 by Kempsey Shire Council (KSC, 2024)
- *Stuarts Point and surrounds – Stormwater and Flooding Study*, Dated 14 June 2024 by GHD (GHD, 2024)
- *Stuarts Point and surrounds – Groundwater Study*, dated 13 August 2024 by GHD (GHD, 2024)
- *Stuarts Point Sewerage Servicing Design Report*, dated December 2024 by Pressure System Solutions Pty Ltd (PS Solutions, 2024)
- *Stuarts Point Sewerage Scheme Preliminary Site Investigation*, Kempsey Shire Council, dated October 2025 by Ramboll (Ramboll, 2025)
- *Stuarts Point Sewerage Scheme Hydrogeological Assessment*, Kempsey Shire Council, dated October 2025 by Ramboll (Ramboll, 2025)
- *Stuarts Point Waste Water Treatment Plant – Odour Assessment*, dated 10 October 2025 by Astute Environmental Consulting Pty Ltd (Astute, 2025)
- *Stuarts Point WWTP Marine and Estuarine Mixing Modelling*, Kempsey Shire Council, dated July 2025 by GHD (GHD, 2025)
- *Stuarts Point Sewer Scheme: Stuarts Point WWTP Design Guidance Report*, dated October 2025, by Beca Hunter H₂O (Beca Hunter H₂O, 2025)
- *Stuarts Point Treated Effluent Management System: Dunal Discharge Concept Design Report*, dated 13 October 2025 by Beca Hunter H₂O (Beca Hunter H₂O, 2025)
- *Acoustic Assessment – Stuarts Point Sewerage Scheme*, dated October 2025 by RAPT Consulting (RAPT Consulting, 2025)
- *Social Impact Assessment, Stuarts Point Sewerage Scheme*, dated October 2025 by AAP Consulting (AAP Consulting, 2025)

2. Project Description

2.1 Site information

The project is located in Stuarts Point, Grassy Head and Fishermans Reach approximately eight kilometres northwest of South West Rocks on the NSW Mid North Coast. This area is closely aligned with the Macleay Arm, a tributary forming a part of the Macleay River estuary. The Macleay River, along with its tributaries, serves as a natural boundary, separating these communities from South West Rocks. The scheme boundary represents approximately 540 existing allotments to be connected into and serviced by the SPSS project including the Grassy Head Caravan Park, the Stuarts Point Caravan Park and the Yarraphini Adventist Youth Centre.

The SPSS site locality and layout are shown on **Figure 1-1**. The SPSS site and study identification details are summarised in **Table 2-1**.

Table 2-1: Site and study area identification

Information	Description										
Stuarts Point Sewerage Scheme (SPSS) site	The SPSS site boundary represents the outer boundary of the land that would be: - used for the project's operational infrastructure - used for the temporary construction infrastructure (the 'disturbance footprint') - connected into and serviced by the project across Stuarts Point, Grassy Head and Fishermans Reach (the 'scheme area'). These three elements are further defined below and the SPSS site is shown on Figure 1-1. The SPSS project infrastructure in addition to the land that would be connected into and serviced by the SPSS project across Stuarts Point, Grassy Head and Fishermans Reach including the following key components: <table> <tr> <td>Pressure sewer network</td><td>Lot 7007 DP 1054244 Lot 139 DP 752438 Lot 1 DP 1284907</td></tr> <tr> <td>Property collection systems</td><td>Multiple affected properties within the scheme boundary (refer to Appendix 2 of the EIS)</td></tr> <tr> <td>Stuarts Point WWTP</td><td>Lot 1 DP 1284907</td></tr> <tr> <td>Effluent transfer pipeline</td><td>Lot 7300 DP 115278</td></tr> <tr> <td>Effluent disposal area</td><td>Lot 7300 DP 1152758</td></tr> </table>	Pressure sewer network	Lot 7007 DP 1054244 Lot 139 DP 752438 Lot 1 DP 1284907	Property collection systems	Multiple affected properties within the scheme boundary (refer to Appendix 2 of the EIS)	Stuarts Point WWTP	Lot 1 DP 1284907	Effluent transfer pipeline	Lot 7300 DP 115278	Effluent disposal area	Lot 7300 DP 1152758
Pressure sewer network	Lot 7007 DP 1054244 Lot 139 DP 752438 Lot 1 DP 1284907										
Property collection systems	Multiple affected properties within the scheme boundary (refer to Appendix 2 of the EIS)										
Stuarts Point WWTP	Lot 1 DP 1284907										
Effluent transfer pipeline	Lot 7300 DP 115278										
Effluent disposal area	Lot 7300 DP 1152758										
Site Area	Approximately 436.85 hectares										
Local Government	Kempsey Shire Council (Council)										
Zoning	Under the <i>Kempsey Local Environmental Plan 2013</i>, the land zoning underlain by the main development components are as follows: the low pressure sewer main network is proposed on land zoned as RU1 (Primary Production); RU2 (Rural Landscape); RU5 (Village); and, C3 (Environmental Management).										

Information	Description
	- Stuarts Point WWTP site is proposed on land zoned as RU1 (Primary Production); RU2 (Rural Landscape); and, C2 (Environmental Conservation). - The treated effluent disposal system is proposed on land zoned as C3 (Environmental Management); W1 (Natural Waterways); and, RU5 (Village).
County and Parish	Parish of Arakoon, County of Macquarie
Owner	The land pertaining to the project is predominately contained to Crown Land including the WWTP site, effluent pipeline and dunal discharge site. The pressure sewer network will be located on both Crown Land and within the Council owned road reserve, with an exception for connections to each of the dwellings and businesses to be serviced by the project which will be on private land.
Current site use	The SPSS site is generally characterised as rural-residential and predominantly used for agricultural, residential or nature reserve purposes. The SPSS site is also known as a high tourism area with two caravan parks (Grassy Head Holiday Park and Stuarts Point Caravan Park).
Disturbance footprint	The disturbance footprint represents the expected maximum extent of ground disturbing work and vegetation clearing associated with construction of the project. All permanent components (that form the development footprint) and temporary components would be located within the disturbance footprint. The project infrastructure may be installed anywhere within the disturbance footprint to allow for flexibility regarding any small alignment changes resulting from detailed design investigation, or other constraints. The disturbance footprint is presented within Figure 1-1.
Scheme area	The scheme area represents the land containing all the properties proposed to be connected into and serviced by the project across Stuarts Point, Grassy Head and Fishermans Reach. The scheme area comprises approximately 540 existing allotments including the three major commercial facilities as Grassy Head Caravan Park, Stuarts Point Caravan Park and the Yarrahapinni Adventist Youth Centre. The scheme area is presented within Figure 1-1.
Study area	The study area represents the area of investigation for environmental assessment and varies for each specialist study but generally forms a broader area of investigation compared to disturbance and development footprints.
Sensitive receptors	The study area includes several sensitive areas including national parks and nature reserves: - Yarriabini National Park: located approximately 1.5 kilometres (km) west of Stuarts Point and Grassy Head. - Yarrahapinni Wetlands National Park: situated approximately 1.2 km southwest of Fishermans Reach. - Fishermans Bend Nature Reserve: located approximately 1.5 km south of Stuarts Point and 1.3 km northwest of Fishermans Reach. - Macleay River catchment: The SPSS site runs adjacent to the Macleay Arm, which forms part of the Macleay River which it also underbores to reach the dunal

Information	Description
	discharge area. Other waterways within the Macleay River catchment include Spencer's Creek, Anderson Inlet and Clybucca Creek. Stuarts Point Buildings: Stuarts Point Workers Recreation and Bowls Club, Stuarts Point Preschool and Stuarts Point Public school are all considered sensitive receptors within the SPSS site boundary.

2.2 The applicant

The applicant of the project is Council. Details of the applicant are provided in **Table 2-2**.

Table 2-2: Details of the applicant

Item	Details
Applicant name	Kempsey Shire Council
Australian Business Number (ABN)	70 705 618 663
Postal address	Kempsey Shire Council PO Box 3078 West Kempsey NSW 2440
Website	https://www.kempsey.nsw.gov.au/Home

2.3 Project components

The project consists of the following key components

- Low pressure sewer network
- Property connection systems
- Wastewater treatment plant (WWTP)
- Effluent transfer pipeline
- Effluent disposal area (dunal discharge)
- Decommission of existing and redundant OSMS

A summary of the project components is provided below, further details are provided in the main EIS report.

2.3.1 Low-pressure sewer network

The low-pressure sewer network proposes to transfer wastewater generated from residential, commercial and industrial properties within the scheme area spanning Grassy Head, Stuarts Point and Fishermans Reach to the Stuarts Point WWTP via a network of low-pressure sewer mains.

The low-pressure sewer network would span approximately 21.1 kilometres in total length. One primary spine sewer main, proposed as a 200mm/250mm sewer rising main, would connect three separate sewer main systems to service the three villages to be connected into the scheme being the Grassy Head System, the Stuarts Point System and the Fishermans Reach System.

Grassy Head System

The Grassy Head system would transport wastewater from residential properties, tourist accommodations, the Grassy Head Caravan Park, and the Yarrahapinni Youth Centre, and would ultimately discharge into the sewage pumping station on Grassy Head Road.

Stuarts Point System

The Stuarts Point system would connect to the primary spine main extending from the sewage pumping station on Grassy Head Road, running to the system's discharge point at the Stuarts Point WWTP and would connect into all the properties in the Stuarts Point township (including residences, the caravan park, school, bowling club, and tavern).

Fishermans Reach System

The Fishermans Reach system would connect the residences in Fishermans Reach into the primary spine main at the Stuarts Point WWTP.

The main construction method for pipes will be trenchless underground boring using horizontal directional drilling (HDD), which requires significantly less surface disturbance compared to traditional trenching methods. This involves establishing discrete drill sites with shallow entry pits for a surface launched drill to install the pipe through the subsurface in a shallow arc and linking sections approximately every 100 metres as required for valve placements, drill exit sites and pipe joining. Operation of the sewer network will see the network continually transfer wastewater to the WWTP and will involve routine maintenance to address blockages and leaks.

2.3.2 Servicing strategy

One combined collection system is proposed for all areas within the service catchment, including all existing residential, commercial, schools and caravan parks within Grassy Head, Stuarts Point and Fishermans Reach, with a sewage pumping station located in Grassy Head Road collecting the wastewater from Grassy Head. The system includes provision for connection from future development areas in Stuarts Point:

- 560 estimated tenements (ET) in the future North Residential Area
- 480 ET in the future South Residential Area
- 50 ET from the future industrial area.

For planning purposes, the system is designed to accommodate interim operational conditions, allowing for 80 ET connections from the North Residential Area and 200 ET connections from the South Residential Area. The planning also includes allowance for a possible future connection from the Grassy Head Convention Centre, discharging to the Grassy Head Road sewage pumping station. The Grassy Head Road SPS rising main shall be integrated into the Stuarts Point pressure sewerage system, acting as a hybrid sewer rising main and part of the Stuarts Point pressure sewerage system.

The servicing strategy includes:

- a Pressure Sewerage System provided to service Grassy Head, discharging to a Sewage Pumping Station located in Grassy Head Road. A sewage pumping station is to be provided in Grassy Head Road near the Grassy Head Convention Centre, with a 200mm/250mm spine main extending to the sewage treatment plant in Stuarts Point
- a pressure sewerage system shall be provided to Stuarts Point integrating with the 200mm/250mm sewer rising main from the Grassy Head sewage pumping station
- Fishermans Reach shall be provided with a pressure sewerage system, connecting to the primary spine main at the sewage treatment plant in Stuarts Point.

Ancillary fixtures of the low pressure sewer network system will include:

- A sewage pumping station (SPS) proposed to be located along the northern section of the low-pressure sewer network system in Grassy Head and would be designed to cater for the hydraulic load from Grassy Head sewage collection system, in addition to the loadings from a possible future connection from the Stuarts Point Convention Centre located along Grassy Head Road.

- A flushing station is proposed along the southern alignment of the low pressure sewer network within Fishermans Reach and would incorporate a high-pressure pump capable of delivering 2 L/s at a 72 metres head.

2.3.3 Property connection systems

Property connection systems would connect individual properties to the low pressure sewer network. The property connection system configuration would vary for standard property connections (residential properties and small-scale businesses) and for non-standard property connections (such as caravan parks and the youth centre).

The standard property connection system would include infrastructure required to connect the approximately 540 existing residential properties in the scheme area to the pressure sewer network. The standard property connection would include a boundary kit, pressure sewer unit, property discharge line and electrical works.

The non-standard property connection system would include the infrastructure required to connect the non-residential properties in the scheme area to the low-pressure sewer main. Each non-standard property connection system would comprise a configuration of a boundary kit, several duplex pump stations, and gravity main connections.

Non-standard property connection system configurations would be required for the Grassy Head Caravan Park, the Stuarts Point Caravan Park and the Yarrahapinni Adventist Youth Centre.

The final design and installation of the property connection systems would be undertaken in consultation with property owners during a property audit that would be undertaken by specialist auditors.

2.3.4 Wastewater treatment plant (WWTP)

The WWTP would service the properties connected to the sewer networks in the townships of Grassy Head, Stuarts Point and Fishermans Reach and would be located south of the township of Stuarts Point at Lot 1 DP 1284907.

The design of the WWTP is detailed in the two parts:

- GHD (2024) *Stuarts Point WWTP Reference Design Report*
- Beca Hunter H2O (2025) *Stuarts Point Sewer Scheme: Stuarts Point WWTP Design Guidance Report*

The WWTP has been designed to have capacity to service the three systems comprising the low-pressure sewer network, and would have capacity to service Grassy Head, Stuarts Point and Fishermans Reach at holiday and off-peak loads to 2038 population forecasts (GHD, 2024a).

The proposed treatment level would be tertiary treatment and disinfection achieved via intermittently decanted extended aeration (IDEA) treatment processes and ultraviolet (UV) disinfection.

The effluent quality criteria are described in **Table 2-3**.

Table 2-3: WWTP effluent concentration criteria (GHD, 2024a)

Pollutant	Effluent concentration criteria	
	90 th percentile	100 th percentile
Biochemical oxygen demand (mg/L)	10	15
Total suspended solids (mg/L)	15	20
Oil and grease (mg/L)	2	10
pH	6.5 – 8.5	6.5 – 8.5
Ammonia (as N) (mg/L)	2	5
Total nitrogen (mg/L)	10	15
Total phosphorous (mg/L)	1	3
Faecal coliforms (cfu/100mL)	200	600

Construction of the WWTP would involve bulk earthworks, building of the plant, installation of treatment processes, and installation of services. The WWTP will operate 24/7 with up to three staff attending daily operations comprising regular monitoring and maintenance of treatment processes to ensure compliance with effluent quality criteria.

The WWTP general layout and main treatment process units are shown in **Figure 2-1** and **Figure 2-2** and further described in **Table 2-4**.

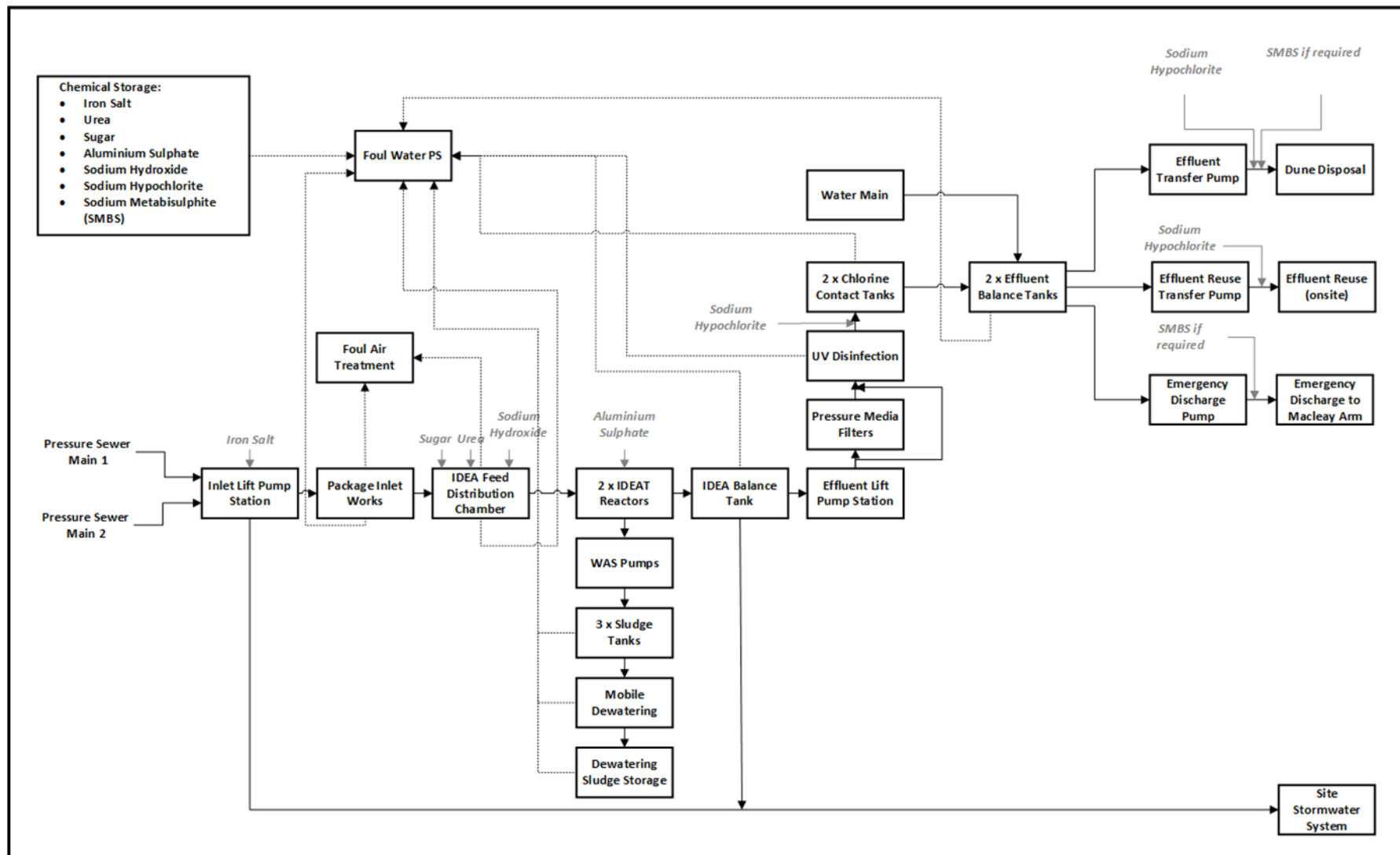


Figure 2-1: Stuarts Point WWTP process and block flow diagram (Beca Hunter H2O, 2025)

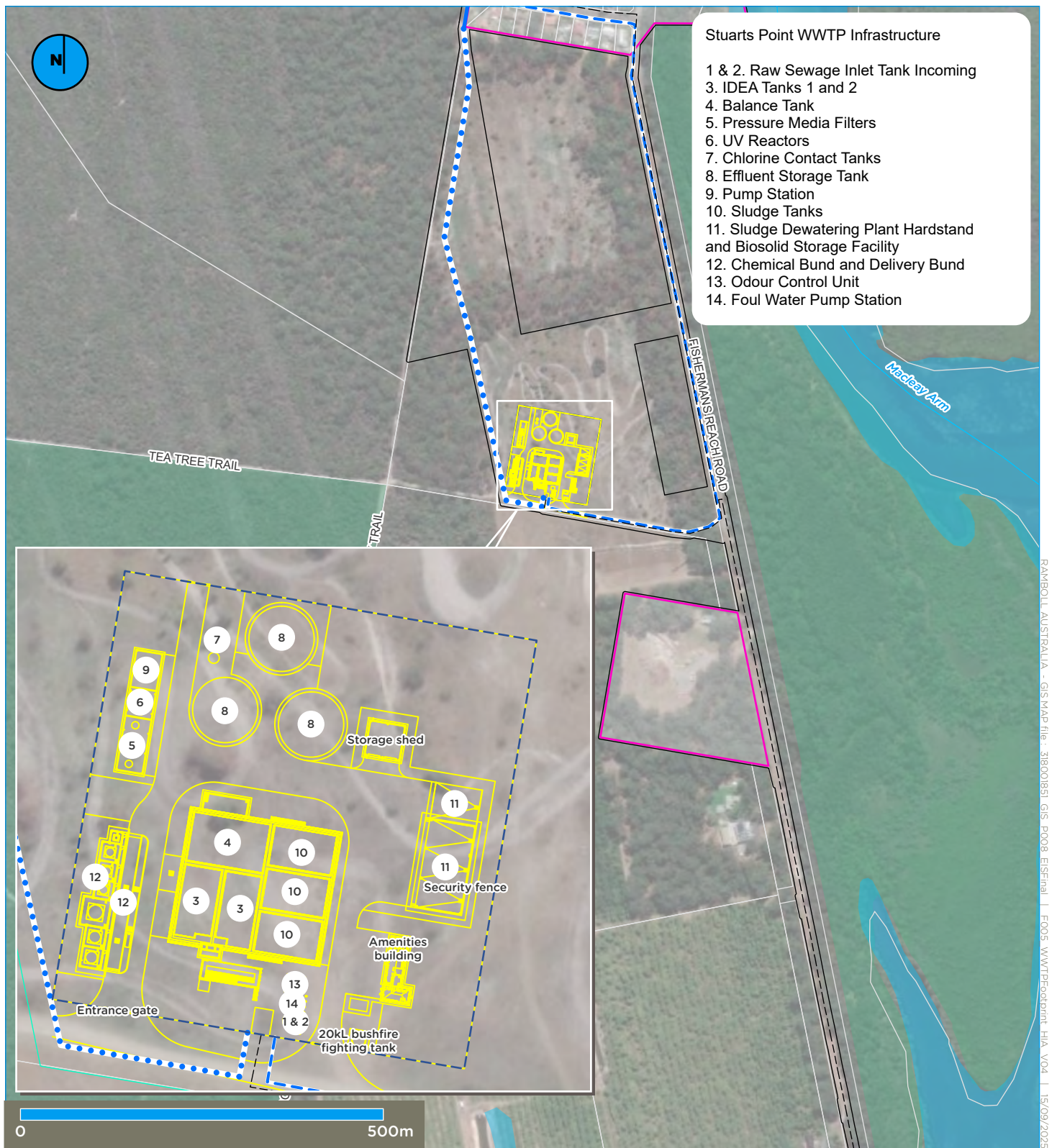


Figure 2-2 : Stuarts Point Wastewater Treatment Plant (WWTP) layout

Table 2-4: WWTP treatment process units (GHD, 2024a)

WWTP Infrastructure	Description	Figure 2-2 Reference
Lift pump station	The lift pump station would receive wastewater from the low-pressure sewer network and raise it to the inlet works for treatment. The lift pump station would also involve chemical dosing to reduce the risk of odour and corrosion in downstream processes.	1
Inlet works	Inlet works would provide preliminary (primary) treatment to remove coarse debris and dense matter. The inlet works would include mechanical screening and grit removal systems. Mechanical screening would occur bypass with manually raked bar screen. The grit removal system would include aeration or mechanical mixing to keep organic particles in suspension.	2
IDEA bioreactors	The IDEA bioreactors would provide biological (secondary) treatment to reduce biochemical oxygen demand and total nitrogen, chemical treatment to remove total phosphorous and caustic dosing for alkalinity correction. The WWTP would employ two bioreactors comprising rectangular reinforced concrete tanks which would include a storm cycle for wet weather flow treatment. The IDEA bioreactors would include a decanter scum baffle for scum management and a mechanical surface aerator to facilitate aerobic treatment.	3
IDEA effluent balance tank	The IDEA balance tank would receive decanted effluent from the two IDEA bioreactors and equalise the flow passed to downstream treatment processes. A submersible centrifugal pump or similar would be included for desludging the tank.	4
Tertiary pressure media filters	Tertiary pressure media filters would polish effluent to prevent blockage of the dune disposal system and improve disinfection performance. Spent backwash from the filtration system would be sent to the IDEA feed distribution chamber for treatment.	5
UV disinfection	UV disinfection would be used to disinfect tertiary treated effluent following the IDEA process to provide one pathogen removal barrier for the discharged effluent. UV disinfection would be achieved via a closed vessel UV reactor with low pressure UV lamps.	6

WWTP Infrastructure	Description	Figure 2-2 Reference
Chlorine disinfection	Chlorine disinfection of the effluent would provide a second pathogen removal barrier and be used to prevent pipe fouling, including: - baffled chlorine contact tanks (CCT) in duty/standby configuration. - sodium hypochlorite (hypo) dosing to the inlet of the CCT for disinfection.	7
Effluent storage tanks	There would be two effluent storage tanks (each 1.5 ML) with space provided for a future third tank. Storage tanks would be used for onsite reuse storage and flow buffering for times when the dunal discharge area is not available.	8
Effluent pump station	The effluent pump station would be sized for the discharge of treated effluent along the pipeline to the dunal discharge area, including: - duty/ standby pumps - sodium hypochlorite (hypo) dosing for maintenance and controlling biofouling (infrequent use) - sodium metabisulphite (SMBS) dosing for de-chlorination (infrequent use).	9
Emergency discharge pump station	The emergency discharge pump station would facilitate discharge the effluent to Macleay Arm during times when the storage tanks are full and the dunal discharge area is not available. This station incorporates: - duty/ standby pumps - sodium metabisulphite (SMBS) dosing for de-chlorination.	9
Effluent reuse transfer pump station	The effluent reuse transfer pump station would transfer effluent for reuse for process water demands within the WWTP. This station incorporates: - a pressure pump skid including at least one standby pump - sodium hypochlorite (hypo) dosing.	9
Sludge tanks	The sludge tanks would stabilise the waste activated sludge generated by the IDEA bioreactors to produce stabilisation grade "B" biosolids. The WWTP would employ three sludge tanks, and each would comprise a rectangular reinforced concrete tank. Each tank would have a total sludge storage volume of 985m ³ . The sludge stabilisation process would involve three phases: feed, aging, and desludging. During the feed phase, waste activated sludge would be pumped to the sludge tank from the IDEA bioreactors. The sludge would gradually consolidate as a supernatant and drain to the foul water pump station for treatment. During	10

WWTP Infrastructure	Description	Figure 2-2 Reference
	the aging phase, no new waste activated sludge is introduced to the sludge tank and sludge is allowed to age for a minimum period of six months. During desludging, biosolids would be drawn from the sludge tank and pumped to Council's mobile dewatering plant. A level transmitter would be in each sludge tank to monitor sludge levels in each tank as a mitigation measure against the potential for an overflow.	
Mobile sludge dewatering area	The sludge tanks would be desludged using Council's mobile dewatering plant, which includes a semi-trailer that contains a horizontal decanter centrifuge and powdered flocculant batching system, and a separate outloading hopper with belt conveyors. The WWTP design provides flexibility for mobile sludge dewatering systems using centrifuge, screw press or belt filter press. Provisions for the sludge dewatering area would include an area of hardstand for operation of Council's dewatering plant as well as a sheltered bunded area of hardstand to serve as the temporary biosolids storage area prior to transportation offsite. Any residual leachate would drain to the Foul Water pump station Biosolids would be stored in the stockpile until testing for biosolids classification is completed and the biosolids are assigned a classification to determine a suitable reuse location.	11

WWTP Infrastructure	Description	Figure 2-2 Reference
Chemical delivery and storage area	The chemical storage area would comprise a bunded area for the storage of: • ferrous chloride, used for odour and corrosion management and (secondarily) chemical phosphorus removal • alum (aluminium sulphate), used for chemical phosphorus removal • sodium hydroxide, used for alkalinity replacement • urea, as a nitrogen source to acclimate the biological treatment process to holiday loads • liquid sugar, used to support denitrification of the nitrogen added as urea • sodium hypochlorite (hypo), used for disinfecting treated effluent for discharge to the dunal site and the Macleay Reach overflow. Sodium metabisulphite (SMBS) dosing for de-chlorination of treated effluent for discharge to the environment. A chemical delivery bund would facilitate chemical delivery by a bulk road tankers to the WWTP. During offloading, tankers would park within the tanker delivery bund which would capture any chemical spills from the tank or tanker hoses. The tanker delivery bund would normally drain to the foul water pump station, however, during delivery activities, the outlet valve would close so that any spills are drained to an underground storage tank. In the event of a chemical spill a plant operator would use a portable pump to remove contaminated liquids from the underground storage tank for disposal. Prior to the valve being opening to the foul water pump station, the underground storage tank would be inspected for contamination.	12
Odour control unit	The odour control unit would treat foul air from the inlet lift pump station, inlet works, and IDEA feed distribution chamber to reduce odour, particularly by targeting and removing hydrogen sulfide.	13
Foul water pump station	The foul water pump station would receive wastewater generated within the WWTP and pump it to the IDEA feed distribution chamber for treatment.	14

WWTP Infrastructure	Description	Figure 2-2 Reference
Ancillary infrastructure	Ancillary infrastructure at the WWTP would include: • amenities building • electrical switch room • storage shed • emergency generator • parking • provisions for bushfire fighting tank • electrical works and utilities connections • sealed site access road connecting the WWTP to Fishermans Reach Road • pedestrian pathways and other sealed areas • permanent lighting • boundary security fencing • CCTV • vegetation screening and landscaping.	N/A

2.3.5 Treated effluent pipeline

The treated effluent pipeline would be located within Lot 1 DP 1284907 (the WWTP site), the road reserve and part of Lot 7300 DP115278 (the dunal discharge site) and comprise approximately 2.7 kilometres of pipework to transfer secondary treated and disinfected effluent from the WWTP to the dunal discharge area. The design of the effluent transfer pipeline is detailed in the report by GHD (2023) *Stuarts Point Sewerage Scheme – Effluent Transfer and Disposal Design: Concept Design Report*.

The treated effluent pipeline would include approximately 450 metres of pipeline to cross the Macleay Arm (west to east), via an underbore from the corner of Kimpton and Marine Parade in Stuarts Point. The pipeline would deliver effluent to the vegetated dunal discharge area located at Lot 7300 DP1152758, to the east of Stuarts Point.

Operation of the treated effluent pipeline will include routine maintenance to ensure the transfer of tertiary treated and disinfected effluent from the Stuarts Point WWTP to the dunal discharge.

The treated effluent pipeline alignment would include several ancillary network fixtures (as discussed including:

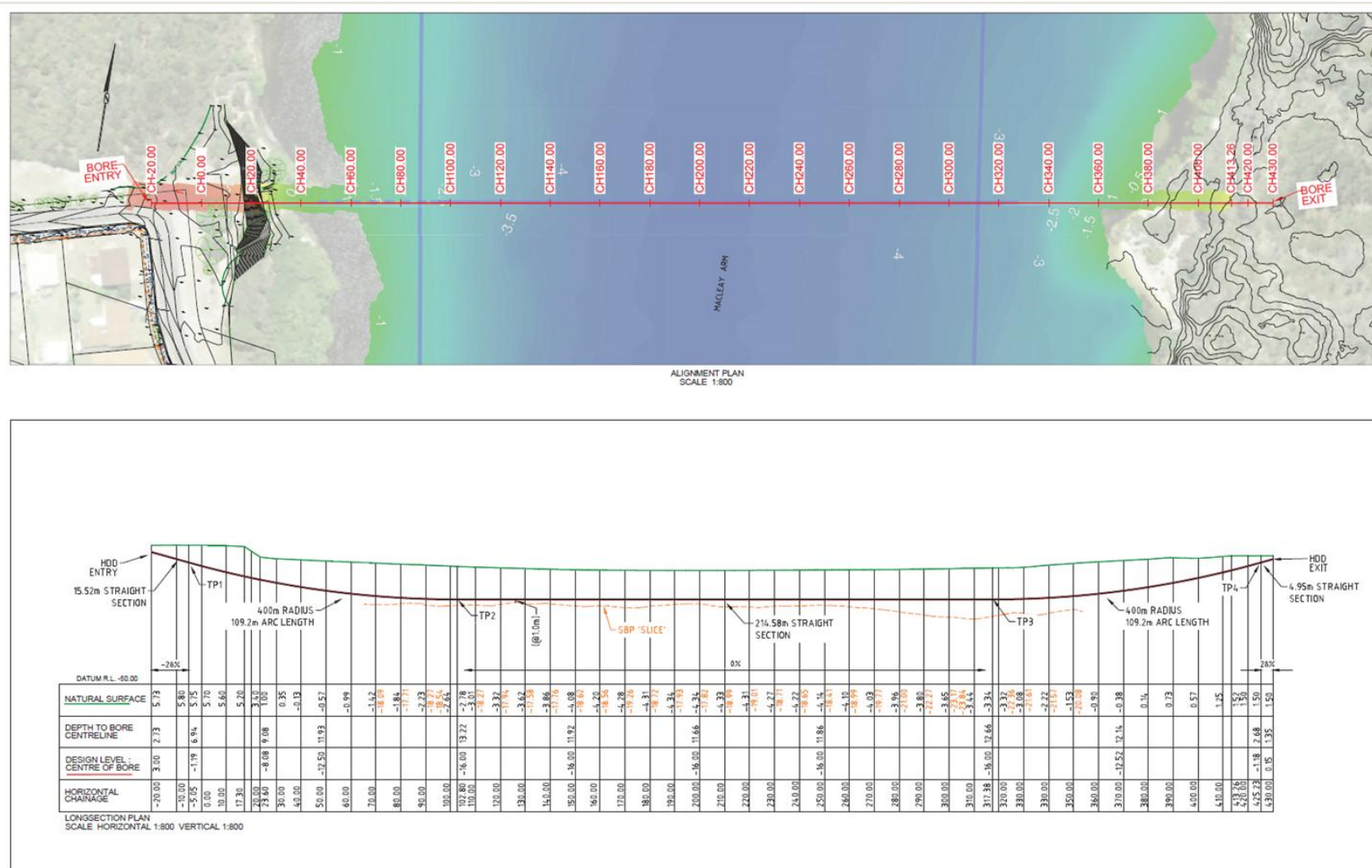
- air valves included at high points along the pipeline to facilitate air ventilation within the pipeline
- scour valves included at the low points along the pipeline for draining down during maintenance or to repair main breaks
- isolation valves included on the upstream and downstream sides of the pipeline.

2.3.5.1 Treated effluent emergency overflow

The treated effluent emergency overflow pipeline would be located within Lot 1 DP 1284907 (the WWTP site) and road reserves and comprise an approximate 1100m x DN150 pipeline connecting to the existing DN600 stormwater pipe in the road reserve adjacent Lot 13 DP255838 (66 Marine Parade Stuarts Point).

The existing stormwater pipe traverses Lot 7310 DP1147812 and Lot7003 DP106066 (Crown land reserve) before discharging into the Macleay Reach south of the Stuarts Point Caravan Park's existing onsite sewer treatment system.

This pipeline would transfer tertiary treated and disinfected effluent in longer duration rainfall events when unable to be discharged at the dunal site or stored within the effluent storage tanks at the WWTP, utilising spare capacity within the existing large diameter stormwater pipe.



2.3.6 Treated effluent disposal area: Dunal discharge

The treated effluent pipeline would discharge to the dunal discharge area on the eastern side of the Macleay Arm within Lot 7300 DP115278 via surface irrigation. A concept design of the dunal discharge area has been completed titled *Stuarts Point Treated Effluent Management System: Concept Design Report* by Beca Hunter H2O.

The concept design included hydrogeology studies and modelling of the dunal aquifer system to determine natural infiltration and aquifer capacity and the most optimal method for discharging treated effluent into the sand dunes while minimising the potential for localised mounding of groundwater breakout and surfacing as seepage onto the shorelines of the Macleay Reach and Stuarts Point Beach.

The dunal discharge area would include several key features and specifications. The discharge area would be 1,300 meters long and 40 meters wide, with a 10 metres wide access track. It would be divided into four zones, each 1,300 meters in length and 10 meters in width, to allow effluent discharge to be cycled through the full length of each zone at a time. The dunal discharge area would utilize pressure compensating drippers in driplines laid over the natural topography of the site to avoid unnecessary disturbance of the existing dunal system.

The irrigation area would be connected to a 150mm diameter treated effluent pipeline, which would extend underground to the midpoint of the dunal discharge area. This pipeline would then split into four smaller 125mm diameter zone feed underground pipelines, automatically valved and controlled to distribute effluent to each zone through a network of 90mm, 63mm, and ultimately 20mm dripper lines in a cycling sequence.

The total disposal discharge to the land field would comprise four rotations, each sized for the 1,248 kL/day flow to allow rest and recovery of the soils. The discharge area would be divided into four zones, each 10 meters wide and 1,300 meters long, with distribution lines feeding one zone at a time for a set duration, changing over to the next zone every couple of days. Effluent would be distributed to subzones of 160 meters length and 10 meters width with dripper lines. These dripper lines would be joined into a flushing manifold at the end, controlled by manually operated flushing valves.

Vehicle access to the site would be from the beach in the designated area. A bund with a vehicle access track would run along the western boundary of the disposal site to provide access and reduce the risk of overland runoff to the McLeay Arm. Pedestrian tracks would be situated between the irrigation zones and at the northern and southern ends of the field to allow for maintenance and operation of the flush valve. A flowmeter, filter, and pressure gauge in a central location with a main valve pit would be accessible from the main vehicle track. Hydraulically actuated valves in the central location valve pit would be accessible from the main vehicle track to minimize the use of electrical control cabling due to saline conditions and ease maintenance. Manually operated flushing valves would be accessible via footpath.

Native groundcover vegetation would be selected and maintained within the disposal area for erosion control, with existing vegetation mulched on-site to create a bed for laying drippers. The entire site would be fenced off, and signage would be installed for security and information purpose

Operation of the dunal discharge will involve routine maintenance to ensure the integrity and security of the discharge site and vegetation/weed management. Adverse weather events will be managed via operational protocols including the storage of effluent at the Stuarts Point WWTP, development of triggers for the ceasing of discharges and inspections required prior to recommencing discharge to the dunal discharge area.

Preliminary three-dimensional hydrodynamic modelling was undertaken to predict the flushing rates of the Macleay Arm system and assess the potential for poor water quality from the discharge into the groundwater that flows into the Macleay Arm (GHD, 2020). The study predicted that the groundwater discharge to the Macleay Arm and Tasman Sea would be rapidly diluted such that water quality objectives would be achieved within tens of metres from the inflow.

The discharge dilution criteria were reviewed and the marine and estuarine mixing modelling work was subsequently revised in 2024, following discussions with the NSW EPA on acceptable dilution criteria (GHD, 2024b). The mixing modelling was further refined in 2025 (GHD, 2025).

Based on the revised groundwater quality predictions, the maximum dilution goal required to meet the acceptable water quality criteria was determined to be 107 dilutions, based on the worst-case parameter being Total Nitrogen. The dunal discharge dilution criteria are summarised in **Table 2-5**.

Table 2-5: Dilution requirements for edge of mixing zone (MZ) (GHD, 2025)

Parameter	Groundwater quality	Ambient	MZ Criteria	Dilution Required at MZ edge	Trigger value type
Total nitrogen (mg/L)	5.80	0.25	0.30	107	Physical and chemical stressor
Total phosphorous (mg/L)	0.58	0.05	0.08	20	Physical and chemical stressor
Ammonia (mg/L)	0.02	0.10	0.90	No dilution required	Toxicant (95% species protection)
Nitrate (mg/L)	5.87	0.15	2.40	2.5	Toxicant (95% species protection)
Salinity (PSU)	1.00	22.9	17.88	4.4	Physical and chemical stressor

The marine and estuarine mixing modelling suggests that when groundwater flow with elevated nutrient loads reaches either the Macleay Arm or the Tasman Sea, it will significantly mix with surrounding waters. It is anticipated that within 150m from where the groundwater enters the estuarine or oceanic waters, the water quality would meet acceptable standards during typical discharges conditions. This increases to up to approximately 2km during peak holiday period.

Access to the dunal discharge area would be deterred through the installation of rural style wire fencing to the perimeter of the dunal discharge area. Signage would be placed at regular intervals along the fencing advising that treated effluent was irrigated within the area, and therefore entry to the area and contact with any water on the surface should be avoided.

2.3.7 Decommission of existing and redundant OSMS

Existing on-site sewage management systems (OSMS) infrastructure for all properties within the scheme area would be decommissioned following installation of the operational infrastructure.

The redundant infrastructure decommissioning would include:

- pump-out onsite sewage management systems (e.g., septic tanks) and transport offsite to the South Kempsey WWTP via tanker truck
- decommission existing onsite wastewater treatment systems to below ground level, puncture the treatment system and fill with rubble
- reinstate the disturbed area with topsoil or other material as agreed with the property owner
- land application areas would be decommissioned and abandoned in place.

2.4 Project staging

The anticipated staging and timing of the project is summarised in **Table 2-6**.

Table 2-6: Project staging and indicative timing

Stage	Indicative timing
Planning and approvals process	In progress
Construction	Two years
Operations	50 years
Decommissioning	Council anticipates ongoing operation of the SPSS through ongoing maintenance and replacement and/ or upgrade of project elements as required to facilitate continued operation.

3. Regional and environmental setting

3.1 Regional context

The project is located across Stuarts Point, Grassy Head and Fishermans Reach, approximately eight kilometres north-west of South West Rocks on the NSW Mid North Coast. These communities are located adjacent to the Macleay Arm which forms the northern part of the Macleay River estuary. The Macleay River, along with the Macleay Arm and Spencer Creek, separate the SPSS project communities from South West Rocks. **Figure 1-1** shows the regional context for the project.

Stuarts Point, Grassy Head and Fishermans Reach are located within the Kempsey Surrounds (SA2) region. This also includes Point Plomer, Crescent Head, Hat Head, Smithtown, Gladstone, Clybucca, Yarrahapinni, South West Rocks, Willawarrin, Bellbrook, Comar and other smaller surrounding suburbs. The region has an estimated population of 9,472 (Australian Bureau of Statistics, 2023). The social demographic of the Kempsey Surrounds region can be described as predominantly rural with a mix of coastal urban areas.

The Kempsey Surrounds (SA2) region is home to the Thunggutti / Dunghutti Aboriginal people. The historical occurrence of the Thunggutti / Dunghutti Aboriginal People extends outside of the Kempsey Surrounds (SA2) boundary as they have lived in the Macleay region for millennia, from the saltwater coastal areas in the east to the freshwater country upstream and the mountain country to the west (Kempsey Shire Council, 2023). Aboriginal and Torres Strait Islander Peoples comprise approximately 8.1% of the total population of the Kempsey Surrounds (SA2) region (Australian Bureau of Statistics, 2023).

The predominant land uses within the Kempsey Surrounds region include nature conservation, other minimal use areas (such as ancillary land uses including stock routes, residual native cover or rehabilitation land), grazing native vegetation, grazing modified pastures and production native forests (Australian Bureau of Statistics, 2023).

The Macleay River is the major surface water system in the region which meanders in a southeast direction through the mountainous terrains in the west of the region before reaching the township of Kempsey where it begins to flow in a northeast direction and eventually discharges to the Macleay River estuary.

3.2 Local and Site context

The project would service Stuarts Point, Grassy Head, Fishermans Reach located within the eastern, coastal section of the Kempsey LGA. The population demographics for each of the communities is (Australian Bureau of Statistics, 2021a, 2021b, 2021c):

- Stuarts Point: 766
- Grassy head: 85
- Fishermans Reach: 144.

The SPSS site is generally characterised as rural-residential and predominantly used for agricultural, residential or nature reserve purposes. The WWTP will be located within Stuarts Point, approximately 600m south of the residential area. The effluent disposal area would be located approximately 530m east of the residential area.

The SPSS site is also known as a high tourism area with two caravan parks (Grassy Head Holiday Park and Stuarts Point Caravan Park). The Stuarts Point Caravan Park borders the Macleay Arm. The Yarrahapinni Youth Centre, the Stuarts Point Convention Centre (Convention Centre), Stuarts Point Reserve and Joe Donanvon Sporting Complex are also located in Stuarts Point.

The area also has an active aquaculture industry, predominantly comprising oyster leases within the Macleay Arm to the southeast of Fishermans Reach, surrounding Shark Island, Whiskey Island and Little Shark Island and occurring throughout Anderson Inlet, Clybucca Creek and Spencers Creek.

Fishermans Reach contains three avocado farms, one now being one of the largest avocado producers on the Mid North Coast.

3.3 Environmental setting

A summary of the environmental setting for the site is provided in **Table 3-1**.

Table 3-1: Summary of environmental setting

Item	Description
Climate	The project area is located on the Mid North Coast of NSW which exhibits subtropical climate. As a coastal location, the SPSS site locality is exposed to strong winds, storms and salt accession from the sea (Ramboll, 2025). The nearest meteorological station that provides long-term climate statistics is the Bureau of Meteorology's (BOM) South West Rocks (Smoky Cape Lighthouse) station (059030), located approximately 15.2 km south from the project area. Data recorded from the BOM meteorological station indicates that temperatures are highest in February, with a mean maximum temperature of 27.1 °C. Temperatures are lowest in July, with a mean minimum temperature of 11.3 °C. Data recorded from the BOM meteorological station indicates that the average annual rainfall is 1497.9 mm, with the highest mean monthly rainfall occurring in March (198.5 mm) and the lowest mean monthly rainfall occurring in September (57.2 mm). The prevailing winds are from the north in summer and south in winter.
Topography	The SPSS site's landscape comprises low inner beach ridge plains with gentle to undulating slopes. The SPSS site has extremely low relief, ranging between one to nine metres AHD, but typically is less than three metres AHD. The terrain can be described as an inner barrier beach ridge plain consisting of mainly north-south trending linear dunes and swales approximately parallel to the modern coastline (Ramboll, 2025).
Vegetation	The proposed WWTP site has a fringe of remnant native vegetation on the western and eastern borders and passing through the centre of the lot approximately east to west. The location of the pressure sewer network is located partially within the Council-owned road reserve with a very low vegetation condition given it has previously been disturbed.
Areas of biodiversity value	Parts of the project area are mapped on the Biodiversity Values map (BV map) including parts of the residential land at Grassy Head, land on either side of Grassy Head Road between Stuarts Point and Grassy Head and land to the east of Fishermans Reach Road between Stuarts Point and Fishermans Reach on the banks of the Macleay Arm (Ramboll, 2025).
Geology	The SPSS site is predominantly underlain by Pleistocene-aged coastal barrier deposits. These generally comprise marine sand, indurated sand with potential for Holocene age estuarine deposits to the east in the southern half of the site generally comprises marine sand, silt, clay and gravel.

Item	Description
Soil landscapes	Specific site geology for the reticulation system and WWTP and the effluent disposal site are as follows: - the low-pressure sewer network and the WWTP site soil landscape is Stuarts Point, which consists of Aeric Podosols (podzols) with shelly Cumulic Anthroposols (Prairie Soils) on midden mounds, which have high erodibility and permeability. - the effluent disposal site soil landscape is Goolawah variant c, which on the site consists of weakly developed Aeric Podosols (Podzols) on stable dunes, which have high erodibility and permeability.
Acid sulfate soils	The SSPS site is mostly located within an area of low probability of acid sulfate soil (ASS) occurrence with a high probability of ASS occurrence to the east of the SSPS within the footprint of the Macleay Arm
Hydrogeology	Fractured or fissured, extensive aquifers of low to moderate productivity are reported at the site. Groundwater at the site is anticipated to be present in the coastal sediments between, approximately 3 to 4m depth, with flows generally in an easterly direction although tidal variation and atmospheric conditions can locally alter flow.
Users of groundwater	Review of existing registered groundwater bores identifies over 200 registered bores within the site footprint and over 100 bores within a 1 km radius. Total depths ranged from approximately 2 to 80 mbgl, with available water levels information indicating water depths between 2 and 50 mbgl. Generally, wells installed in the area are listed for domestic, irrigation and water supply use, with some also registered for monitoring, mining/exploration or research. From the limited salinity information available groundwater is fresh with salinity (reported as parts per million) from 0 to 500 ppm (Ramboll, 2025).
Groundwater dependent ecosystems	Review of regional scale mapping of groundwater dependent ecosystems (GDEs) indicates aquatic GDEs are not present at the site or surrounds. There is a low to high probability for the presence of terrestrial GDEs within the site boundaries.
Rivers and waterways	The Macleay Arm is located immediately adjacent to the east of the SSPS site, which flows into the Macleay River to the southeast and ultimately into the Pacific Ocean. Spencers Creek, Andersons Inlet, Clybucca Creek and South West Rocks Creek are tributaries of the Macleay Arm and the Macleay River to the southeast of the SSPS site. Creeks to the west of the SSPS site include Boringalla Creek and Kings Creek, located approximately 1 km west of the SSPS site at its closest point (Kings Creek), with smaller ephemeral tributaries and water ways. Kings Creek flows into Boringalla Creek which then flows into Clybucca Creek.

3.4 Sensitive human receptors

The key components of the project are located within the township of Stuarts Point. Sensitive human receptors within the vicinity of the WWTP and treated effluent dunal discharge area include:

- Residential properties
- Convention Centre
- Stuarts Point Public School
- Stuarts Point Pre-School
- Stuarts Point Caravan Park
- Grassy Head Holiday Park
- Recreational users of the Macleay Arm and South Pacific Ocean
- Recreational users of the beach and dunal areas.

4. Community and stakeholder engagement

4.1 Engagement overview

Consultation and engagement with affected parties, key stakeholders, and the broader community has been an integral part of the development of the project. The provision of centralised sewerage services has been discussed with the local community over an extended period. Council has recognised the need for centralised wastewater treatment in the area as a long-standing issue and has been refining the scope of the project for several years.

A consultation strategy was developed by Council to guide the consultation process associated with the planning, development and construction of the SPSS project. Outcomes of Council's community consultation activities are summarised in the reports *Stuarts Point Sewerage Scheme Ongoing Engagement Summary Report 2024* and *Stuarts Point Sewerage Scheme Ongoing Engagement Summary Report 2025* by Kempsey Shire Council.

Specific community and stakeholder engagement has been undertaken as part of the EIS relevant to the HIA has been carried out as part of the:

- EIS Scoping phase
- during the EIS
- technical studies for the EIS, specifically the SIA.

Further engagement on the project is to occur as:

- part of the public exhibition of the EIS
- ongoing community engagement throughout construction and operation of the project.

Details of the engagement approach and findings relevant to the HIA are provided in the following key reports:

- SSPS Consultation Report to Inform the EIS
- SPSS Scoping Report (Ramboll, 2023).
- SPSS EIS report (Ramboll, 2025)
- SPSS SIA report (APP Consulting, 2025),

A summary of the community and stakeholder engagement approach and findings relevant to the HIA is summarised below.

4.2 Engagement approach

The overall objective of consultation activities undertaken for the SPSS project were to support and inform the proposed development of the SPSS project in accordance with the *Undertaking Engagement Guidelines for State Significant Projects* (Department of Planning, Industry and Environment, 2022).

The engagement approach adopted for consultation utilises the five-point framework developed by the International Association for Public Participation (IAP2). This includes:

- Inform
- Consult
- Involve
- Collaborate
- Empower.

The proposed levels of public participation adopted in the consultation activities associated with the SPSS project include 'inform', 'consult' and 'involve'.

The identified stakeholders, their interest in the project and the proposed level of engagement in accordance with the IPA2 Public Participation Spectrum is outlined in **Table 4-1**.

Table 4-1: Identified stakeholders and proposed level of engagement

Stakeholder groups	Interest in the project	Level of influence / impact	Level of engagement
Directly affected private landholders to be connected into and serviced by the SPSS	Amenity impacts associated with the construction phase Cost of sewer rates during ongoing operation Environmental impacts Public spending	High influence / medium impact	Involve
Directly affected business owners and operators to be connected into and serviced by the SPSS	Amenity impacts associated with the construction phase Cost of sewer rates during ongoing operation Impacts to business operating hours	High influence / medium impact	Involve
Kempsey Shire Council LGA ratepayers (outside of SPSS scheme boundary)	Cost of sewer rates during ongoing operation Public spending	Medium influence / Medium impact	Inform
Oyster lease owners in local waterways	Water quality impacts	High influence / medium impact	Involve
Aboriginal community members and groups	Impacts to cultural heritage	High influence / Medium impact	Involve
Visitors/ tourists	Amenity impacts associated with the construction works including access	Low influence / Low impact	Inform
Elected representatives	Ensure project is benefiting their community	High influence / Medium impact	Involve
State Government agencies	Compliance	Medium influence / Medium impact	Consult

The state government agencies of relevance to the project include the following:

- Department of Planning, Housing and Industry (the Department)
- Department of Climate Change, Energy, the Environment and Water (DCCEEW), in particular:
 - DCCEEW – Conservation Programs, Heritage and Regulation (DCCEEW CPHR)
 - DCCEEW – Water (DCCEEW Water)
- Department of Primary Industries – Fisheries (DPI Fisheries)
- Department of Primary Industries – Agriculture (DPI Agriculture)
- NSW Environment Protection Authority (NSW EPA)
- NSW Health (North Coast Local Health District)
- National Parks and Wildlife Services (NPWS)
- Transport for NSW (TfNSW)

- NSW Crown Lands
- Heritage NSW
- Water NSW
- NSW State Emergency Services (NSW SES)
- Fire and Rescue NSW (FRNSW)
- NSW Rural Fire Services (NSW RFS).

4.3 Engagement tools and activities

A summary of the engagement tools and activities undertaken during the scoping phase and EIS phase is provided in **Table 4-2**.

Table 4-2: Summary of engagement activities undertaken

Method	Consultation goal	Activities undertaken
Community survey	Undertaken on the occupants that form the scheme boundary to capture community opinions, feedback and insights around the SPSS project.	<u>EIS phase</u> Survey of community opinions undertaken in November/December 2023 Targeted interviews with business and interest groups
Letter to property owners	Issued to mailboxes and PO boxes in the Stuarts Point, Fishermans Reach and Grassy Head post code to provide project information and community session information.	<u>EIS phase:</u> Letters to affected private land holders, business owners and operators and rate payers in November 2023
Project webpage	The project web page is established to be the hub for all documents and updates relevant to the SPSS project and represents the most up to date repository of project information.	The project web page is the hub for all documents and updates for the SPSS project and has included: Previous community updates Frequently asked questions Anticipated project timeline Information on the community information sessions Information on the community survey Pressure sewer scheme homeowner's manual Maps of the scheme and effluent disposal area Project history
Newsletters	Issued to mailboxes and PO boxes in the Stuarts Point, Fishermans Reach and Grassy Head post code and available on Council's website to provide project information.	<u>Scoping phase:</u> Newsletters provided in May 2021, May 2022, December 2022 and January 2023
Newspaper advertisement and media	To raise awareness around community information sessions.	<u>Scoping phase:</u> Newspaper articles published May 2021 and June 2022 Media statement published December 2022

Method	Consultation goal	Activities undertaken
		Interview and subsequent news piece published December 2022 <u>EIS phase:</u> Newspaper article published in November 2023
Social media	To raise awareness around community information sessions and to serve as an alternative platform for virtual community information sessions.	<u>EIS phase:</u> Social media post published in November 2023
Community information sessions	To facilitate discussion between project team members and the broader community on the SPSS project. The option for virtual information sessions was made available for those unable to attend face to face. The community information sessions provided community with a range of project information materials and allowed for the development of frequently asked questions to be posted on the project webpage. Hard copy surveys were also available to be completed at the sessions or they could be returned to Stuarts Point library at any time.	<u>EIS phase:</u> Community information session / virtual session held in November 2023, April 2024, July 2024, November 2024, and April 2025
Community groups	Community groups were engaged to understand local interests regarding the SPSS project. Consultation with community groups was undertaken a part of the SIA and ACHAR.	<u>Scoping phase:</u> Kempsey Local Aboriginal Land Council (LALC) contracted to conduct preliminary cultural heritage assessments in November 2021 and May 2022 <u>EIS phase:</u> Participation of Registered Aboriginal Groups (RAPs) in the Aboriginal Cultural Heritage Assessment (ACHAR) Stuarts Point and District Community Organisation (SPADCO) briefings via meetings and regular updates
State government agencies	Consultation with state government agencies was undertaken via email and letter correspondence and in some cases via virtual meeting to inform government agencies on the	Direct emails / letters requesting feedback sent December 2023 and April 2024 Follow up meetings

Method	Consultation goal	Activities undertaken
	SPSS project and invite them to comment on and/or provide feedback on the SPSS project and EIS methodology.	

4.4 Key engagement outcomes

The key outcomes from the community and stakeholder engagement relevant to this HIA are summarised below. This is focused on engagement outcomes relevant to the following key modifiable determinants of health:

- air quality
- noise and vibration
- food
- water (excluding wastewater)
- wastewater
- land and soil
- storage, handling and disposal of hazard materials
- built environment
- infrastructure and services
- transport
- socio-economic determinants of health

The key engagement insights as present in the AAP (2025) SIA report are summarised below:

- support for modern sewerage infrastructure: Support for the project was expressed by several community organisations and local industry groups. This was largely related to improvements in water quality, safeguarding public health and improved health, housing and employment opportunities
- affordability concerns: Community members and stakeholders raised concerns regarding additional costs to rate payers to support the construction and operation of the project.
- environmental benefits: Improved environmental outcomes were a central theme in community and stakeholder groups supporting the project
- cultural values and caring for Country: The Kempsey Local Aboriginal Land Council (LALC) viewed the investment in the project as supporting cultural heritage protection of ecological health and Aboriginal land aspirations for sustainable economic development.
- transparency and procedural fairness: Community members raised a strong desire for ongoing, clear and timely communication
- community cohesion and change: Some community members expressed views about how benefits and burdens would be distributed, including the impact on community character. Representatives of the oyster growers identified the project as an opportunity to unlock new opportunities for economic activity, tourism and housing development.

A more specific summary of the key positive and negative aspects identified from the engagement activities is provided in **Table 4-3**.

Table 4-3: Summary of positive and negative aspects identified from community and stakeholder engagement

Key Modifiable health determination	Key community / stakeholder engagement findings	
	Positive	Negative
Air quality	Reduce current odour issues	Concern about odours from the scheme

Key Modifiable health determination	Key community / stakeholder engagement findings	
	Positive	Negative
Noise and vibration	None identified	Concern about noise from the scheme during construction and operation
Food	Improve conditions for local oyster growers	None identified
Water and wastewater	Halt groundwater contamination from septic tanks Address public health issues related to septic systems that arise when flooding occurs	Water quality, groundwater and waterways Flooding No provision for agricultural reuse of treated water Potential environmental impacts as the discharge area is of high biodiversity
Land and soil	None identified	Biodiversity impact (flora and fauna) Impacts from vehicles accessing dunes Potential structural changes to the dunes Potential impact on the dunes if dunal discharge rises
Built environment	None identified	Construction impacts Landscape character and visual amenity
Infrastructure and services	Modern sewerage system that sets community up for the future	How the scheme will work Access to properties (for scheme participants)
Socio-economic determinants of health	Support new development and population growth Help better service the visitor population to support the local tourism industry Improve property values	Ongoing costs of sewage service Allowance for new development and population The number of houses impacted by flooding does not justify the expenditure required for the project.

5. Scoping

The screening step in the HIA process relates to determining whether a HIA is appropriate or required and to inform the scoping of the HIA if it is to proceed. This includes conducting an initial assessment of the health impacts associated with the proposed Project. Initial assessment of health impacts has been undertaken through various stages of planning works for the project and consolidated in the SPSS Scoping Report (Ramboll, 2023). Based on the Scoping Report the SEARs, as informed by input from NSW Health, confirmed that a HIA is required as part of the EIS for the project.

Guidance on the scoping for a HIA is provided in NSW Health (2007), enHealth (2017) and Western Australian Department of Health (2010). The scoping step is undertaken to plan and design the HIA. enHealth (2017) states that the scoping should be undertaken to identify only those impacts that have significant potential to occur. This is to be informed by a preliminary health risk assessment and consultation with stakeholders and the community.

The scoping step includes:

- identifying the potential health impacts that need to be addressed and prioritising their importance
- setting boundaries for the HIA, including timescale, geographical area and population that could be affected
- identifying the stakeholders that need to be involved
- agreeing on details and processes for the issues to be assessed and determine the appropriate levels of effort.

5.1 Identifying health impacts to be addressed

As outlined in **Section 1.4** and **Section 1.5** the HIA framework focusses on the assessment of modifiable determinants of health. The modifiable determinations of health relevant to the project, potential impacts and the importance to this HIA are summarised in **Table 5-1**.

This includes consideration of the key health issues identified in the EIS scoping report (Ramboll, 2023) and as identified from the stakeholder and community consultation, as discussed in **Section 4**. The prioritisation of modifiable health determinants for this HIA is identified and has been informed by the preliminary impact / risk assessments presented in the EIS scoping report (Ramboll, 2023).

This HIA focusses on health determinants related water and wastewater contaminants as these are key issues identified through the stakeholder / community consultation are not specifically addressed through other technical studies.

Table 5-1: Scoping: Identification and prioritisation of modifiable determinants of health

Modifiable determinant of health	Level of assessment determined in EIS Scoping	Potential impacts relevant to HIA	EIS assessment approach and relevant technical study	Priority for this HIA
Air quality (including odour)	Detailed	Removal of potential odour sources associated with onsite effluent management systems (i.e. septic system) Potential odour generation and air quality impacts from the operation of the WWTP, ventilation stacks and sewerage pumping stations, and proposed effluent disposal site	Air quality and dust management generally assessed in accordance with relevant guidelines and policies Conduct odour assessment for the WWTP, including odour emission modelling. Astute (2025) Stuarts Point Waste Water Treatment Plant – Odour Assessment	High
Noise and vibration	Detailed	Noise and vibration impact during construction from the operation of equipment, machinery and road traffic Noise and vibration for the Macleay Arm under boring for the effluent transfer pipeline during construction. Noise impacts from WWTP operation	Conduct noise and vibration impacted assessment, including desktop assessment, ambient and background noise monitoring, noise predictions for construction and operation RAPT Consulting (2025) Acoustic Assessment – Stuarts Point Sewerage Scheme	Medium

Modifiable determinant of health	Level of assessment determined in EIS Scoping	Potential impacts relevant to HIA	EIS assessment approach and relevant technical study	Priority for this HIA
Water (excluding wastewater)	Detailed	Mobilisation of sediments from ground disturbing activities which could enter waterways via runoff Water pollution due to spills of oil, fuel and chemicals during construction and operation Changes to surface water regimes leading to increased localised flooding Interception of groundwater and impacts to the quality / quantity or recharge during construction. Improved water quality conditions for the Priority Oyster Aquaculture Area (POAA)	Desktop water impacts assessment as part of EIS GHD (2025) Stuarts Point WWTP Marine and Estuarine Mixing Modelling Beca Hunter H2O (2025) Technical memo – Revised Stuarts Point WWTP Design Guidance Memo More detailed assessment of human health risks undertaken as part of HIA	High
Wastewater	Detailed	Water quality impacts from overflow of sewerage management systems during flooding. Water quality impacts from discharge of treated wastewater into the groundwater due to flooding, damage or blockage. Potential human health risk through contact with effluent disposal site	Desktop water impacts assessment as part of EIS GHD (2025) Stuarts Point WWTP Marine and Estuarine Mixing Modelling Beca Hunter H2O (2025) Stuarts Point Sewer Scheme: Stuarts Point WWTP Design Guidance Report	High

Modifiable determinant of health	Level of assessment determined in EIS Scoping	Potential impacts relevant to HIA	EIS assessment approach and relevant technical study	Priority for this HIA
			More detailed assessment of human health risks undertaken as part of HIA	
Land and soil	Standard	Disturbance of contaminated land during construction Contamination of soils / land during construction from poor management of oils, fuels and chemicals Impacts on soils (sands) in the dunal system during operation	Desktop reviews with limited sampling, Preliminary Site Investigation (PSI) for land contamination (Ramboll, 2025)	Medium
Storage, handling and disposal of hazardous materials and wastes	Standard	Potential risk of contamination from the storage and handling of dangerous goods during construction and operation Pollution of land and water resulting from poor management of wastes Decreased amenity resulting from poor management of wastes Disposal of wastes contributing to landfill Contamination of land and waterways from the disposal of effluent wastes	Desktop assessment of waste impacts assessment prepared as part of the EIS A preliminary risk screening in accordance with <i>State Environmental Planning Policy (Resilience and Hazards) 2021</i> is included in the EIS that considers the storage and transport of dangerous goods associated with the project	Low

Modifiable determinant of health	Level of assessment determined in EIS Scoping	Potential impacts relevant to HIA	EIS assessment approach and relevant technical study	Priority for this HIA
Built environment, infrastructure and services, transport	Standard	Increased heavy vehicle traffic during construction Construction of proposed effluent disposal site may require four wheel drive access to the site along the beach through Grassy Head Holiday Park The WWTP and some projects elements will be constructed above ground with potential to be visible from public viewpoints and private property	Traffic and transport impacted assessment prepared as part of the EIS Desktop assessment of potential viewpoints undertaken as part of the EIS	Low
Socio-economic determinants of health	Standard	Provide employment opportunities Project key infrastructure Facilitation of future development Facilitation of increased tourism	Conduct a social impact assessment including comprehensive assessment and evaluation of soil impacts against baseline conditions. AAP Consulting (2025) Social Impact Assessment Stuarts Point Sewerage Scheme	Low

5.2 Boundaries for HIA

The boundaries for the scope of the HIA are summarised in **Table 5-2**. The HIA is focussed on the geographic area directly associated with the footprint and operations of the project. The HIA does not directly consider ancillary activities associated with the SPSS beyond the defined geographic area of the project. The primary focus of the HIA is on the operational phases of the project as this is considered most relevant to potential long-term health impacts. The construction phase and decommissioning of existing OSMS has not been directly considered in the HIA. This is because these works are short-term and are to be undertaken using appropriate environmental management measures, as summarised in **Section 8**.

Table 5-2: Summary of the boundaries for this HIA

Aspect	Within scope of HIA	Outside scope HIA
Geographical area	Outer boundary of the land the would be used for SPSS infrastructure within sewerage collection system, WWTP and effluent transfer and disposal Beach, Pacific Ocean and MacLeay Arm in the vicinity of the dunal discharge Other areas that have been impacted by poor water quality due to flooding of OSMS, including the oyster lease areas	Ancillary activities indirectly associated with the SPSS beyond the outer boundary of the footprints for the infrastructure components Broader Kempsey LGA area beyond Stuarts Point, Grassy Head and Fishermans Reach
SPSS components	Low pressure sewerage collection system Activities within the footprint of the WWTP Effluent transfer and disposal	Property connection systems Decommission of existing and redundant OSMS Off-site sludge / biosolids disposal, land application and/or management Off-site re-use of effluent
Project phases	Operation of SPSS	Construction of SPSS, including decommission of existing and redundant OSMS Decommission of SPSS components during life of project
Time scale	50 years of operation	>50 years of operation.
Population that could be affected	Communities of Stuarts Point, Grassy Head and Fishermans Reach, including tourists	Communities in the broader Kempsey LGA area beyond Stuarts Point, Grassy Head and Fishermans Reach

5.3 Stakeholder involvement

This HIA has been prepared following the completion of the EIS scoping report (Ramboll, 2023), stakeholder consultation undertaken as part of the SEARs and stakeholder / community consultation undertaken by Council to inform the EIS. The outcomes from this stakeholder / community consultation, as summarised in **Section 4**, have been considered in preparation of this HIA.

The HIA has been undertaken in conjunction with other technical studies prepared for the EIS. Relevant technical specialists for these other studies have been involved in the preparation of the HIA as required.

Further stakeholder feedback on the HIA will be obtained through engagement activities to be undertaken as part of consultation on the overall EIS.

5.4 Appropriate level of effort

NSW Health (2007) provides guidance on choosing the appropriate level of assessment for a HIA based on the scale of the proposal, size of potential impacts and level of resources and capacity available. NSW Health 2007 provides four levels of HIAs as summarised in **Table 5-3**.

This HIA is an 'intermediate' HIA as the scoping has identified that need to assess more than three impacts in detail, as support for the other technical studies.

Table 5-3: Description of the four levels of HIA (adapted from NSW Health, 2007)

Desk based	Rapid	Intermediate	Comprehensive
No more than three impacts, assessed in less detail	No more than three impacts, assessed in more detail	Three to ten impacts, assessed in detail	All potential impacts assessed in detail.
Provides a broad overview of potential health impacts.	Provides a more detailed overview of potential health impacts.	Provides a more thorough assessment of potential health impacts and more detail on specific predicted impacts	Provides a comprehensive assessment of potential health impacts.
Is an 'off the shelf' exercise' based on collecting and analysis existing accessible data	Involves collecting and analysing existing data with limited input from experts and key stakeholders	Involves collecting and analysing existing data as well as gathering new qualitative data from stakeholders and key informants.	Involves collecting and analysing data from multiple sources (qualitative and quantitative)

6. Profiling

The profiling step in the HIA process relates to developing a clear understanding of the population potentially affected by the project, including demographic, socio-economic status, health status and vulnerable populations.

The SIA report (AAP, 2025) includes a social baseline assessment relevant to the project. This considered a Primary Study Area (PSA) including Stuarts Point, Grassy Head and Fishermans Reach. Key findings from the social baseline assessment are summarised in **Table 6-1**.

Table 6-1: Summary of social baseline assessment

Category	Comments
Community plans and strategic planning policy	Several state and local government strategic plans, relevant to the project area, have been developed, including: - North-Coast Regional Plan 2041 (NSW Planning and Environment, 2017) - Kempsey Shire Council's Local Strategic Planning Statement (LSPS) 2020 – 2040: Future Macleay-Growth & Character (KSC, 2020) - Kempsey Local Growth Management Strategy 2041 2042 Community Strategic Plan for Kempsey Shire - Macleay Valley Community Infrastructure Strategy – 20-year plan. Key themes in these strategic plans include: - steady residential and population growth expectations - a need for new and upgraded infrastructure to meet the needs of the growing population, this specifically includes the needs for improved sewerage services - a desire to support population growth which maintaining the unique characteristics of the area - goals related to environmental protection, including managing water and waste such to restore and maintain the quality of waterways.
People	- the total population of the PSA is 993 - the median age is between 55 and 59 years - over 61% of residents are over 50 years old - approximately 7.5% of the population identify as Aboriginal and/or Torres Strait Islander - most people (90%) only speak English at home. - Nine percent of residents require assistance for core activities
Households and families	- in Fishermans Reach 51% of households are single/lone persons, in Stuarts Point this is 38% - over half the families living in the PSA were couple families with no children - both Stuarts Point and Fishermans Reach have 23% of one parent families
Employment and income	- the PSA has relatively high unemployment rates (approximately 10%) compared to the NSW average (4.6%) - the dominant industries for employment are agriculture, forestry and fishing, health care and social assistance, accommodation and food service and retail trade. - the primary mode of transport to work is by car
Housing and mobility	over 90% of dwelling structures are separate houses

Category	Comments
	- the average number of people per household ranges from 1.9 to 2.2. - the PSA has 16 dwellings in caravan/residential parks or camping grounds 27% of households are rented 62% of households are owned outright or with a mortgage
Education	- education attainment levels in the PSA are comparable to those in the rest of NSW 14% of residents have a bachelors degree or higher
Index of Relative Socio-economic Disadvantage (IRSD)	- the IRSD score for the PSA has been determined. A low score indicates a relatively greater disadvantage a high score indicates a relative lack of disadvantage. - the decile IRSD scores for the PSA were determined to be 1 to 2. Based on this the area has a relatively low disadvantage.
Population growth	- the Kempsey Shire population forecast indicates significant growth from 31,666 in 2024 to 35,310 by 2036 (11.5% increase) - in the Stuarts Point and District area the population is expected to from 1,594 in 2024 to 1,706 by 2036 (7% increase) - the area attracts younger couples and families as well as a notable 'sea-change' trend, with older adults, empty nesters and retirees moving to the region. - the demographic shift is impacting housing demands and spurring development projects to accommodate the growing and changing population
Vulnerabilities	- aging population: High median age of residents may pose challenges for healthcare and social services provision - unemployment and income disparities: Relatively high unemployment rate in the PSA and lower median household incomes indicate financial constraints for residents - housing affordability and rental stress: Significant percentage of households experience rental stress. Risk of financial strain, housing instability and social exclusion among vulnerable renters. - transport accessibility: Reliance on cars as the primary mode of transport to work indicates potential limitations in transport accessibility.
Opportunities	- indigenous population: A higher proportion of Aboriginal and/or Torres Strait Island residents presents opportunity for culturally sensitive programs and initiatives to address specific needs and promote inclusivity. - education attainment: Comparable education attainment levels to the rest of NSW suggest potential for education initiatives to enhance resident's social mobility and economic empowerment - dwelling characteristics: High rate of unoccupied dwellings and the prevalence of rental properties provide opportunities to promote housing diversity and affordability - social networks: Strong social networks with community can be leveraged to foster collaboration, support and resilience
Tourism	- the PSA is known as a high tourism area - there are two caravan parks: Grassy Head Holiday Park and Stuarts Point Caravan Park.

7. Assessment

7.1 Assessment approach

The assessment step in the HIA process involves evaluation of the health impacts associated with the project. This includes evaluation of the likelihood of the impact, direction of the impact (i.e. positive or negative) and magnitude of the impact.

The assessment step has been informed by prior steps in the HIA process, specifically the community and stakeholder engagement (**Section 4**), scoping step (**Section 5**) and profiling step (**Section 6**).

Per the guidance in NSW Health (2017) and enHealth (2017) the assessment step is focussed on the four health determinants identified as requiring a detailed assessment as follows:

- air quality (including odour)
- noise and vibration
- water (excluding wastewater)
- wastewater.

The following health determinants were identified as requiring a standard assessment:

- land and soil
- storage, handling and disposal of hazardous materials and wastes
- built environment, infrastructure and services, transport
- socio-economic determinants of health.

These latter health determinants have not been specifically assessed further in this HIA. They are addressed as part of the overall EIS report and/or SIA report.

As identified in the scoping step (**Section 5**) this HIA is focussed on longer-term health impacts associated with the project. As such the assessment step considers the operational phase of the SPSS only. The construction phase of the SPSS is out of scope for assessment in this HIA.

The assessment of health impacts has been undertaken for each of the four health determinants separately. This considers health impacts associated with the following key components of the SPSS:

- low pressure sewerage collection system
- activities within the footprint of the WWTP
- effluent transfer and disposal.

For each of the health determinants the following is presented as part of the assessment:

- overview of baseline conditions
- evidence, information and assessment method to inform health impact assessment, including consideration of:
 - outcomes from community and stakeholder engagement
 - findings from technical studies
 - information from other similar sewerage scheme projects (e.g. from other EISs and operational environmental protection licence reporting)
 - further technical assessment conducted specifically for this HIA
- characterisation of predicted health impacts and their significance.

The predicted health impacts (negative and positive) have been characterised using a qualitative impact assessment rating framework, which includes ratings for:

- likelihood of impact (i.e. frequency/probability of impact occurring)
- consequence of impact (i.e. magnitude of the impact if it occurs)
- overall impact (i.e. based on the likelihood and consequence ratings).

This has been based on the qualitative risk/impact assessment approach in the Australian / New Zealand Standard – Risk management guidelines (AS/NZS ISO 3100:2018) and NHMRC (2006) Australian guidelines for water recycling: Managing health and environmental risks.

The descriptors used to rate likelihood and consequence are detailed in **Table 7-1**. The overall impact rating matrix is detailed in **Table 7-2**. The descriptors and rating matrix are based on those provided in NHMRC (2006).

Table 7-1: Descriptors of likelihood and consequence

Descriptor	Description
Likelihood of impact	
Rare	May occur only in exceptional circumstances. May occur once in 100 years
Unlikely	Could occur within 20 years or in unusual circumstances
Possible	Might occur or should be expected to occur within a 5-to-10-year period
Likely	Will probably occur within a 1-to-5-year period
Almost certain	Is expected to occur with a probability of multiple occurrences within a year
Consequence of impact	
Insignificant	Insignificant impact or not detectable
Minor	Minor impact for small population
Moderate	Minor impact for large population
Major	Major impact for small population
Catastrophic	Major impact for large population

Table 7-2: Overall impact rating matrix

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Rare	Low	Low	Low	High	High
Unlikely	Low	Low	Moderate	High	Very high
Possible	Low	Moderate	High	Very high	Very high
Likely	Low	Moderate	High	Very high	Very high
Almost certain	Low	Moderate	High	Very high	Very high

7.2 Air quality and odour

The potential air quality impacts identified in the scoping step of the HIA are:

- removal of potential odour sources associated with onsite effluent management systems (i.e. septic system)
- potential odour generation and air quality impacts from the operation of the WWTP, ventilation stacks and sewerage pumping stations, and proposed effluent disposal site.

These potential impacts are the focus of the health impact assessment presented below.

7.2.1 Baseline condition

Stuarts Point is currently unsewered with private residents and other properties managing sewage through individual on-site sewage management systems (OSMS) (e.g. septic tanks and absorption trenches). It is estimated that there are more than 500 OSMS in operation within the Stuarts Point area. Given the age of the residential dwellings in Stuarts Point, it is anticipated that the majority of these are old systems (i.e. > 20 years old).

The installation and operation of OSMS are regulated through the NSW Office of Local Government. Property owners are responsible for ensuring OSMS are properly maintained so are not to cause harm of the environment. This includes maintenance to reduce odours. In Stuarts Point, KSC are responsible for regulatory inspections of OSMSs to ensure that they are being appropriately operated and maintained.

Despite the regulatory controls around operation and maintenance of OSMS it is well known that the systems can generate offensive odours. Any such odours generate are likely to be within sensitive areas of the community (e.g. within residential areas, caravan parks). Odours are likely to be exacerbated during periods of high rainfall and flooding events, when septic systems may overflow.

Ramboll are not aware of any specific odour assessment studies that have been undertaken to establish a current baseline of odours from the existing OSMS. However, community and stakeholder engagement, undertaken specifically for the EIS and via past studies since 1995, have consistently identified community concerns related to offensive odours from OSMS. The community survey undertaken as part of the engagement for the EIS identified that 31% of respondents considered reduction in current odour issues as being the most beneficial aspect of the SPSS. Eighteen percent of respondents identified air quality and odour as an area of most concern related to the SPSS.

Based on the currently available information Ramboll consider that health impacts related to offensive odours related to the existing OSMS occurs frequently and impacts a significant proportion of the community. The SPSS includes decommissioning of the majority of the existing OSMS which will remove associated odour generation in a significant proportion of the Stuarts Point area.

7.2.2 Assessment method

7.2.2.1 Technical study – Astute (2025) Odour Assessment.

Astute (2025) conducted an odour assessment related to the SPSS project which has been used as the primary basis for the health impact assessment for air quality – odour.

The Astute (2025) odour assessment was undertaken to determine the potential odour risks related to operation of the SPSS, specifically in relation to the operation of the WWTP. In addition to the WWTP, there is potential for odours related to:

- low pressure sewerage collection, including underground pipes, venting pipes and pumping station
- treated effluent transfer and dunal discharge

These have not been subject to odour modelling or detailed assessment in the Astute (2025) odour assessment. However, it includes a qualitative appraisal of odour risks from those project elements.

The scope of the odour assessment of the WWTP conducted by Astute (2024) included:

- review of information regarding the design of the SPSS components
- modelling meteorology in the area
- estimating odour emissions using literature values
- performing dispersion modelling
- analysing model results against relevant assessment criteria.

Astute (2025) conducted the odour assessment having regard to the following key guidance documents:

- NSW EPA (2006) *Technical Note: Assessment and management of odour from stationary sources in NSW*
- NSW EPA (2022) *Approved methods for the modelling and assessment of air pollutants in New South Wales*
- OEH (2011) *Generic guidance and optimum model settings for the CALPUFF modelling system for inclusion into the 'Approved methods for the modelling and assessment of air pollutants in NSW, Australia'.*

Assessment criteria

Astute (2025) considered the odour impact assessment criteria from NSW EPA (2006) and as reference in NSW EPA (2022), as reproduced in **Table 7-3**. The 2 odour unit (ou) criterion was conservatively adopted by Astute (2024) for the odour assessment.

Table 7-3: Odour impact assessment criteria (from NSW, 2006)

Population of affected community	Impact assessment criterion for complex mixtures of odorous air pollutants (ou)
Urban ($\geq \sim 2000$) and/or schools and hospitals	2.0
~ 500	3.0
~ 125	4.0
~ 30	5.0
~ 10	6.0
Single rural residence ($\leq \sim 2$)	7.0

Modelling methodology

Astute (2025) used the NOOBS approach detailed in OEH (2011) for meteorological and emissions modelling. The following specific models were used:

- TAPM (Version 4): A three dimensional meteorological and air pollution mode
- CALMET: A meteorological pre-processor
- CALPUFF: A US EPA regulatory non-steady state puff dispersion model.

The modelling considered meteorological data from the Bureau of Meteorology (BOM) Kempsey Airport station. Specifically, data for 2017 which used, this was considered the most representative year across ten years of data (2012 – 2021). The most dominant wind directions were determined to be from the north-east and south-west.

Emission estimates

Odour emissions from the proposed SPSS components were undertaken using the Stuarts Point specific meteorological data and odour emission rates from similar facilities / schemes.

Specifically, Astute (2025) made use of a Sydney Water Database on odour emission rates. Astute (2025) modelled odour emissions from key odour generating sources, as summarised in **Table 7-4**, this was based on the following key assumptions:

WWTP

- inlet works and associated wells are covered and have zero leakage to the atmosphere
- volume of air at the inlet works and treated by the odour control unit (via a biofilter) is approximately 104 m³ with six air changes per hour for a volumetric flow of 0.17 m³/sec
- sludge dewatering area is modelled as a volume source for one belt filter press
- all other sources modelled as constant source areas.

Table 7-4: Summary of odour emission rates - WWTP (adapted from Astute, 2025)

Process unit	Odour emission rate (ou/s)	Emission rate source
Odour control unit (inlet works)	86.7	Sydney Water maximum
Intermittently Decanted Extended Aeration (IDEA) flow splitter	107	75 th percentile Sydney Water database
IDEA 1	116	
IDEA 2	116	
Sludge tank 1	247	90 th percentile Sydney Water Database for sludge lagoon
Sludge tank 2	247	
Sludge tank 3	247	
Balance tank	291	90 th percentile Sydney Water Database for IDEA reactor – anoxic zone
Biosolids storage area	2,130	75 th percentile Sydney Water database for IDAL sludge
Sludge dewatering (belt filter press)	500	Typical industry value for this source
Total	4,088	

Odour emission modelling was used to predict the odour concentrations at sensitive receptors in proximity of the SPSS components. In relation to the WWTP odour emissions were modelled in relation to 14 sensitive receptors in the vicinity of the WWTP, as shown on **Table 7-4**. The results showed that the predicted 99th 1-second odour concentrations at the sensitive receptors ranged from 0.6 to 1.3. These are all below the adopted assessment criterion of 2 ou.

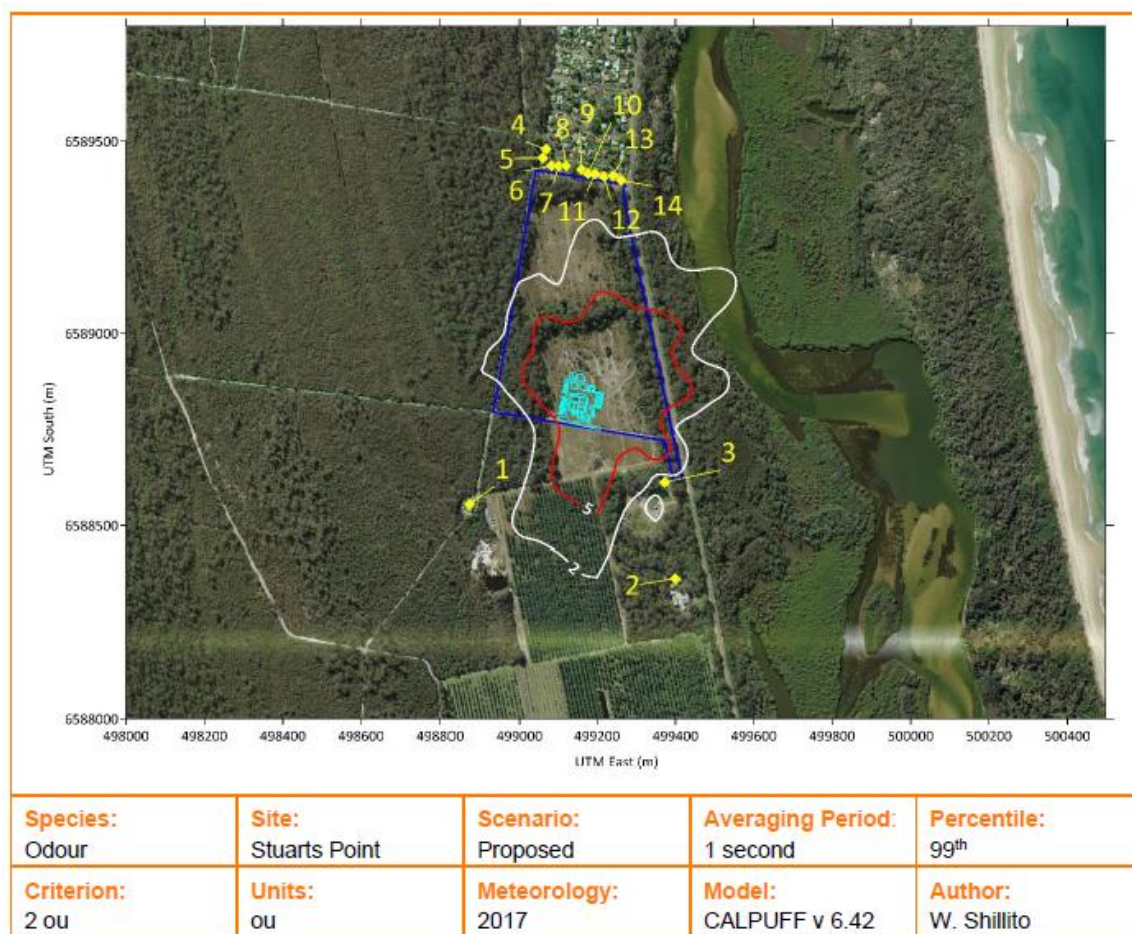


Figure 7-1: Predicted 99th 1 second odour concentrations - emissions from proposed WWTP (from Astute, 2025)

Conclusions

Based on the odour modelling undertaken, and key assumptions made, Astute (2025) concluded that the odour risk to sensitive receptors is low, based on normal operation of the WWTP.

Qualitative odour assessment – Sewerage network and dunal discharge

The Astute (2025) odour assessment did not model the odour risks beyond the WWTP, specifically in relation to:

- Low pressure sewerage collection, including underground pipes, venting pipes and pumping station
- Treated effluent transfer and dunal discharge .

A qualitative appraisal for odour risk related to these aspects of the SPSS identified that risks related to odour are expected to be low based on the odour management controls that are to be included, the distance to sensitive receptors, and experience at other similar sites.

7.2.3 Characterisation of health impacts – Air quality and odour

The health impacts for air quality (odour) have been characterised as presented in **Table 7-5**.

Positive impacts have been rated as high in relation to the reduction of odours from the removal / decommissioning of existing OSMSs. The positive impacts are expected to impact on a significant proportion of the population in Stuarts Point.

Negative odour impacts associated with the operation of the project have been rated as low. This is supported by the findings from the Astute (2025) odour assessment study. The negative odour impacts may impact on a small proportion of residents and other sensitive receptors within the vicinity of the WWTP, dunal discharge and associated pressure network infrastructure. In relation to the dunal discharges some negative odour impacts may be experienced by recreational users in the vicinity of the discharge site.

Hazards associated with negative odour impacts relate to aesthetics and amenity. Nuisance and/or offensive odours can affect public amenity and the community's quality of life. Sensitivities to odours can vary across individuals in populations. Any negative impacts associated with the unlikely event of odours from the project are expected to be minor. The odours would not be expected to cause direct health effects on individuals but may cause some psychological or physiological effects for sensitive individuals.

Table 7-5: Health impact characterisation: Air quality (odour)

Health impact	Direction	Likelihood	Consequence (magnitude)	Overall impact assessment rating	Rationale / comments
Offensive odours related to OSMSs	Positive	Almost certain	Moderate	High	There are over 500 existing OSMS in the Stuarts Points area. Offensive odours related to the OSMS have been identified as a key area of concern by the local community. The SPSS project proposes to decommission the existing OSMSs. This will significantly reduce the odours generated from OSMSs and have a positive impact on the local community.
Offensive odours related to emissions from the operation of the WWTP	Negative	Possible	Insignificant	Low	A technical odour assessment study has been undertaken to model odour emissions from the proposed WWTP to sensitive receptors. The modelling identified that odours associated with operation of the WWTP would be within acceptable levels for the nearest sensitive receptors. There is some potential for elevated odours to be generated in unusual circumstances. However, these are unlikely to be sustained for extended periods of time and would likely only negatively impact on a small proportion of the population to closest proximity to the WWTP. This may include residents and other sensitive receptors.

Health impact	Direction	Likelihood	Consequence (magnitude)	Overall impact assessment rating	Rationale / comments
Offensive odours related to emissions from the pressure sewerage system network	Negative	Unlikely	Minor	Low	There is potential for some odours to be generated from the sewerage pressure system network including ventilation stacks and sewerage pumping stations. However, based on a qualitative appraisal from Beca Hunter H ₂ O it is considered that offensive odours are unlikely to occur as the SPSS is to be operated using odour management measures. There is some potential for elevated odours to be generated in unusual circumstances. However, these are unlikely to be sustained for extended periods of time and would likely only negatively impact on a small proportion of the population. This may include residents and other sensitive receptors.
Offensive odours related to effluent dunal discharge site	Negative	Unlikely	Minor	Low	There is potential for some odours to be generated from effluent at the dunal discharge point. However, based on a qualitative appraisal from Beca Hunter H ₂ O it is considered that offensive odours are unlikely to occur given treated effluent is to be discharge and from experience at other similar sites. However, if they do occur that are not expected to be sustained for extended periods of time and would likely only negatively impact on a small proportion of the population. This may include recreational users and residents in the vicinity of the dunal discharge site.

7.3 Noise and vibration

The potential air quality impacts identified in the scoping step of the HIA are:

- noise and vibration impact during construction from the operation of equipment, machinery and road traffic
- noise and vibration for the Macleay Arm under boring for the effluent transfer pipeline during construction
- noise impacts from WWTP operation.

The first two potential impacts are associated with the construction phase of the project. Impacts associated with construction are outside of the scope of this HIA. As such the focus of the health impact assessment presented below is on noise impacts related to the operation of the WWTP.

7.3.1 Baseline condition

Stuarts Point is currently unsewered with private residents and other properties managing sewage through individual OSMS. The OSMS are largely operated without mechanical means. Some noise may be generated by the operation of small pumps. Ramboll is not aware of any specific noise studies undertaken in Stuarts Point in relation to the operation of the OSMS. The SPSS project includes removal and decommissioning of the OSMS and construction / operational of a proposed WWTP, and associated infrastructure. The proposed infrastructure will be required to comply with relevant regulatory requirements related to noise.

The SPSS project is predominately located in a mix of residential, agricultural, commercial, recreational and conservation land uses. As such there is expected to be background noise in the area related to:

- local road and water traffic
- general community noise
- noise from sports ground during events
- noise from agricultural farming machinery and associated packaging facility
- ocean noise.

RAPT Consulting (2025) conducting an acoustic assessment for the SPSS project. This included noise monitoring to establish background and ambient noise prior to establishment of the SPSS, to inform baseline condition. The baseline noise monitoring was undertaken from 7 to 14 December 2023 at one location, being 7 Nineteenth Avenue, Stuarts Point. RAPT Consulting (2025) state that this location was selected to be indicative of the local ambient noise environment.

The background noise survey was conducted in consideration of procedure described in Australian Standard *AS 1055:2018 Acoustics – Description and Measurement of Environmental Noise* and the NSW EPA *Noise Policy for Industry* (NPfI).

The background noise monitoring was undertaken using a RION NL-43 noise logger with Type 2 Precision. It was programmed to accumulate environmental noise data continuously over sampling periods of 15 minutes for the one-week monitoring period.

The background noise survey established the following noise levels for day, evening and night:

- L_{A90} : Represents the noise level that is exceeded for 90 percent of the time over a relevant period of measurement. This has been used as that rating background level (RBL)
- L_{Aeq} : Represents the equivalent continuous noise level which would have the same acoustic energy over the measurement period as the varying noise actually measured. This has been used as an ambient noise level.

The background and ambient noise levels determined by RAPT Consulting (2025) are summarised in **Table 7-6**.

Table 7-6: Background and ambient noise monitoring results December 2023 - from RAPT Consulting (2025)

Rating background level, L_{A90} , dB(A)			Ambient noise levels, L_{Aeq} , dB(A)		
Day ¹	Evening ¹	Night ¹	Day ¹	Evening ¹	Night ¹
40	40	35	51	48	44

1. Day: 7:00 to 18:00 Monday to Saturday, 8:00 to 18:00 Sundays & Public Holidays
 Evening: 18:00 to 22:00 Monday to Sunday & Public Holidays
 Night: 22:00 to 7:00 Monday to Saturday and 22:00 to 8:00 Sundays & Public Holidays

Ramboll is not aware of any other background noise level monitoring / assessments that have been undertaken within the Stuarts Point area, i.e. beyond the RAPT Consulting (2025) study.

7.3.2 Assessment method

7.3.2.1 Technical study – RAPT Consulting (2025) Acoustic Assessment – Stuarts Point Sewerage Scheme

RAPT Consulting (2025) conducted an acoustic assessment related to the SPSS project which has been used as the primary basis for the health impact assessment for noise and vibration.

The acoustic assessment was undertaken to assess potential noise and vibration from the SPSS project and to recommend mitigation measures where required.

The scope of the acoustic assessment conducted by RAPT Consulting (2025) included:

- initial desktop review to identify noise sensitive receptors from aerial photography
- undertaken noise measurements to determine ambient and background noise levels
- Establish project noise goals for the construction and operation of the proposed project
- identify the likely principal noise sources during construction and operation and their associated noise levels.
- assessment of potential noise, vibration and sleep disturbance impacts associated with construction and operation aspects of the project.
- provide recommendations for feasible and reasonable noise and vibration mitigation and management measures, where noise or vibration objectives may be exceeded.

The acoustic assessment considered noise generation for both during construction and operation. The construction phase is outside of the scope for this HIA, as such the findings from the acoustic assessment relevant to operation as summarised below.

RAPT Consulting (2025) conducting the acoustic assessment having regard to the following key guidance documents:

- *Assessing Vibration: A technical guideline*, Department of Environment and Conservation (DEC), 2006
- British Standard BS7385.2 – 1993 *Evaluation and measurement of vibration in buildings, Part 2 – Guide to damage levels from ground borne vibration*
- *DIN 4150: Part 3-1999 Structural vibration – Effects of vibration on structures*
- *NSW Road Noise Policy (RNP)* Department of Environment, Climate Change and Water (DECCW), 2011
- *DECCW Interim construction noise guidelines (ICNG)*, July 2009
- *Noise Policy for Industry (NPfI)*, NSW Environment Protection Authority (EPA), 2017

Assessment criteria

In relation to operational aspects RAPT Consulting (2025) adopted noise assessment criteria based on guidance in the NSW EPA NPfl. This has included specify project specific amenity noise levels and noise trigger levels, as presented in **Table 7-7** and **Table 7-8**.

According to guidance in NPfl, project intrusiveness noise levels have been determined based on the rating background level (RBL), as determined from the background noise survey (see **Section 7.3.1**) plus 5 dB(A). Project amenity noise levels have been determined based on the NPfl recommended amenity noise levels for various receivers, with sub-urban residence adopted as a sensitive receiver.

Table 7-7 Project amenity noise levels - from RAPT Consulting (2025)

Type of receiver	Noise amenity area	Time of day	Recommended noise level, dB(A)	
			L _{Aeq,T} Period	L _{Aeq,T} 15 min
Residence	Sub-urban	Day	55 – 5 = 50	50 + 3 = 53
		Evening	45 – 5 = 40	40 + 3 = 43
		Night	40 – 5 = 35	35 + 3 = 38

Table 7-8: Project noise trigger levels - from RAPT Consulting (2025)

Type of receiver	Assessment period	Intrusiveness noise levels, L _{Aeq, 15 min} dB(A)	Amenity noise levels, L _{Aeq, 15 min} dB(A)	Project noise trigger levels, L _{Aeq, 15 min} dB(A)
Residential sub-urban	Day	45	53	45
	Evening	45	43	43
	Night	40	38	38

Modelling Methodology

RAPT Consulting (2025) conducting acoustic modelling to predict the effects of site operational noise. This was undertaken using Bruel and Kjaer's "Predictor" models. The predictor calculates environmental noise propagation according to ISO 9613-2 "Acoustics of sound during propagation outdoors". This predicts the sound pressure level under meteorological conditions favourable to propagation from sources of known sound emission. The modelling considered conditions for downwind propagation or equivalent under a well-developed moderate ground-based temperature inversion. Key assumptions in the model used by RAPT Consulting (2025) included:

- topographical information from NSW Government Spatial Services
- cleared areas were modelled considering a conservative ground factor of 0.5 to account for mixed surfaces
- all residential receivers were modelled at 1.5 metres above the ground surface.

The modelling considered noise sources associated with operation of the WWTP, as summarised in **Table 7-9**. Fact Sheet C of the NSW EPA NPfl provides characteristics for annoying noise. RAPT Consulting (2025) considered that the identified noise sources associated with operation of the WWTP are broadband in nature and not considered annoying per the NPfl guidance.

Table 7-9: Summary of noise source associated with operation of WWTP - from RAPT Consulting (2025), based on information provided by Beca Hunter H₂O

Structure	Equipment	Noise levels (dBA)
Raw water inlet pump station	Pumps	<55
Inlet works	Inlet ventilation fan	60
IDEA & Sludge tanks	Surface aerators	78(x3)
	Was pumps	59
	Sludge pumps	72
	Balance tank pumps	65(x2)
Foul water pump station	Pumps	<55
Chemical bund	Dosing pumps	TBC
Effluent storage pump station	Dune discharge pumps	72.5(x2)
	Emergency pumps	72.5(x2)
	Effluent reuse pumps	72.5(x2)
Biosolid storage facility	Centrifuge main driver	74
	Centrifuge back driver	72

Noise emission estimates

RAPT Consulting (2025) used the modelling to predict the propagation of noises for the WWTP operation sources, towards sensitive received. All items of the plant were modelled as a suite area source operation simultaneously. This was undertaken to simulate a reasonable worst-case scenario. The modelling was undertaken for noise sources for the WWTP, it was not undertaken for other aspects of the project more broadly, such as the dune discharge pumps.

The modelling results for the WWTP site are summarised on **Figure 7-2**. The modelling result indicate compliance with the project specific noise trigger levels during all situations for daytime, evening and night-time.

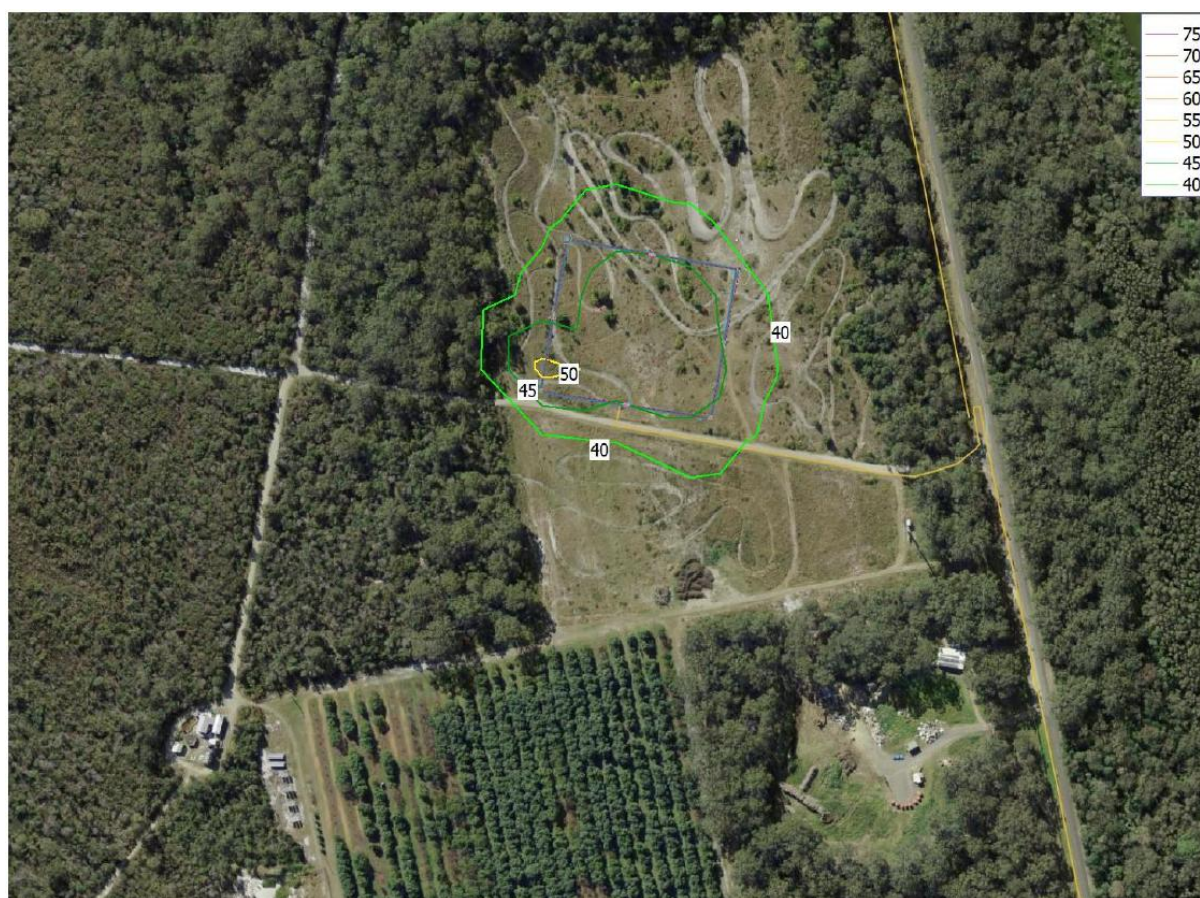


Figure 7-2: Predicted WWTP operational noise levels, dB(A) L_{eq} (15 mins) (Source: RAPT Consulting, 2025)

Conclusions

Based on the noise modelling from the operation of the WWTP, RAPT Consulting (2025) concluded that the results indicate the proposal is predicted to comply with established project noise trigger levels.

Whilst compliance is expected, RAPT Consulting (2025) recommended that an operational noise management plan to be prepared as part of the operations of the WWTP to deal with the unlikely occurrence of excessive noise emanating from operations.

The RAPT Consulting (2025) acoustic assessment did not include modelling or detailed assessment of the operational noise and vibration risks beyond the WWTP, specifically in relation to:

- low pressure sewerage collection, including underground pipes, venting pipes and pumping station
- treated effluent transfer and dunal discharge.

The noise impacts associated with these other operational components of the project are expected to be low. This is based on the technology used in their operation, the noise controls included as part of the design, proximity to sensitive receptors, and experience on other similar sites.

7.3.3 Characterisation of health impacts – noise and vibration

The health impact for noise and vibration have been characterised as presented in **Table 7-10**.

Positive impacts have been rated as low in relation to the insignificant reduction of noise from the removal / decommissioning of existing OSMs. Noise for the operation of the existing OSMs has

not been identified as a significant concern for the community. A reduction in noise is positive but the improvements in relation to health impacts are expected to be minimal.

Negative noise impacts associated with the operation of the proposed SPSS have been rated as low. This is supported by the findings from the RAPT Consulting (2025) acoustic assessment. Noises generated from the operation of the SPSS are expected to be within acceptable limits. If negative impacts are experienced this is likely to be within the range that may be considered nuisance or intrusive noise with potential impacts on amenity. The noises generated are unlikely to be in a range that would contribute to specific negative health impacts, such as impaired hearing. Any negative impacts would be expected to be limited to a relatively small proportion of the community.

Table 7-10: Health impact characterisation - Noise and vibration

Health impact	Direction	Likelihood	Consequence (magnitude)	Overall impact assessment rating	Rationale / comments
Intrusive noise impacts related to OSMSs	Positive	Likely	Insignificant	Low	Some noises can be generated from OSMSs, such as from pumps and gurgling sounds related blockages. Removing the OSMSs will reduce such noises. However, noises generated from the current OSMSs are generally expected to be minimal and any intrusive noise impacts localised to specific properties. The community and stakeholder consultation has not identified noise from existing OSMSs as an issue of concern. As such improvements in noise impacts related to OSMSs removal are expected to be insignificant and the overall positive impacts rated as low.
Intrusive noise impacts related to operation of the WWTP	Negative	Unlikely	Minor	Low	A technical acoustic assessment study has been undertaken to model noise emissions from the proposed WWTP to sensitive receptors. The modelling identified that noise associated with operation of the WWTP would be within acceptable levels. There is some potential for intrusive noise impacts in unusual circumstances. However, these are unlikely to be sustained for extended periods of time and would likely only negatively impact on a small proportion of the population in close proximity to the WWTP.
Intrusive noise impacts related to the pressure sewerage system network	Negative	Unlikely	Minor	Low	There is some potential for intrusive noises to be generated due to pumps incorporated as part of the system, e.g. pumping stations. However, it is unlikely that these will negatively impact on health, given the management controls in place and proximity to sensitive receptors.

Health impact	Direction	Likelihood	Consequence (magnitude)	Overall impact assessment rating	Rationale / comments
Intrusive noise impacts related to effluent dunal discharge site	Negative	Unlikely	Minor	Low	There is some potential for intrusive noises to be generated due to pumps incorporated as part of the system, e.g. small pumps at the dunal discharge. However, it is unlikely that these will negatively impact on health, given the management controls in place and proximity to sensitive receptors.

7.4 Water and wastewater

The potential water and wastewater impacts related to operation of the SPSS identified in the scoping step of the HIA are:

- water quality impacts from overflow of sewerage management systems during flooding
- water quality impacts from discharge of treated wastewater into the groundwater due to flooding, damage or blockage
- potential human health risk through contact with effluent disposal site
- water pollution due to spills of oil, fuel and chemicals
- improved water quality conditions for the Priority Oyster Aquaculture Area (POAA).

These are the focus of the health impact assessment presented below.

Other potential impacts identified in the scoping step were considered outside of the scope for detailed assessment in this HIA and are addressed as part of the EIS. This includes:

- mobilisation of sediments from ground disturbing activities which could enter waterways via runoff
- changes to surface water regimes leading to increased localised flooding
- interception of groundwater and impacts to the quality / quantity or recharge during construction.

7.4.1 Baseline condition

The SPSS is located within a low-lying coastal estuarine environment underlain by alluvial floodplain groundwater sources. The project site is within the MacLeay River catchment. Major tributaries of the Macleay River include Apsley River, Christmas Creek, Borigalla Creek, Clybucca Creek, Macleay Arm, Andersons Inlet, and Belmore River. The Macleay Arm is an estuarine environment directly adjacent to the proposed effluent dune discharge. The marine environment of the Pacific Ocean is located to the east of the proposed effluent dune discharge.

There is an established history of surface water and groundwater quality issues in the Stuarts Point area related to the presence and operation of the large number of OSMS. This includes numerous significant flood incidents in low lying areas of Stuarts Point, which have inundated OSMS and resulted in effluent discharges to surrounding surface waters and groundwater. Community and stakeholder engagement, undertaken specifically for the EIS and via past studies since 1995, have consistently identified community and stakeholder concerns related to water quality contamination related to OSMS / septic tanks. The community survey undertaken as part of the engagement for the EIS identified that 64% of respondents considered stopping groundwater contamination from septic tanks as being the most beneficial aspect of the SPSS. Issues being addressed related to the septic system that arising when flood occurs was also identified as a benefit by 51% of respondents. Water quality, groundwater and waterways was identified as a top concern by 69% of respondents.

Baseline water quality information is available for surface waters and groundwater within the project area. This includes baseline water quality investigations specifically undertaken for the EIS as well as historical investigation and monitoring programs commissioned by KSC.

The baseline water quality results have been compared to the following water quality guideline values to indicate potential human health risks:

- NHMRC (2011) *Australian Drinking Water Quality Guidelines*, Version 4 Updated June 2025.
- NHMRC (2008) *Guidelines for Managing Risks in Recreational Water*. 10 times drinking water quality value (health based) adopted for primary contact recreational exposures.

7.4.1.1 Macleay Arm

In relation to the Macleay Arm baseline water quality data is summarised in GHD (2020) SPSS WWTP marine mixing modelling report and GHD (2024) Stuarts Point and surrounds, stormwater and flooding study. This considers data from WMA Water (2009) Macleay River Estuary Processes Study, the Macleay EcoHealth Project 2015 – 2016 (Ryder et al, 2016) and data from monitoring undertaken by KSC between 2015 and 2019.

WMA Water (2009) presents water quality data for the Macleay Arm and the main arm of the Macleay Estuary from monitoring conducted between September 2006 and August 2007. GHD (2024) summarise that nutrient concentrations were reported to be as follows:

- total nitrogen: 0.25 to 0.30 mg/L
- nitrate: <0.015 mg/L
- ammonia: <0.015 mg/L
- total phosphorous: 0.03 to 0.045 mg/L.

From the information provided in GHD (2024) it is not clear if the concentrations reported are nitrate as N and ammonia as N. As such it has been assumed that the concentrations are nitrate as nitrate and ammonia as ammonia.

The concentrations of nitrate and ammonia reported are below the applicable drinking water (nitrate: 50 mg/L (as nitrate); ammonia: 0.5 mg/L (as ammonia) and primary contact recreational water quality guideline values (nitrate: 500 mg/L (as nitrate); ammonia: 0.5 mg/L (as ammonia)). Drinking water and recreational water quality guideline values are not available for total nitrogen and total phosphorous (or phosphate) in NHMRC (2011) and NHMRC (2008).

GHD (2020, 2024 and 2025)) provide a summary of ambient water quality sampling undertaken in the Macleay arm as part of the Macleay EcoHealth Project 2015 – 2016. This ambient water quality data was used as part of the WWTP marine mixing modelling report (GHD, 2020, 2025). Ambient water quality results were summarised by GHD (2020) in relation to six water samples collected between April 2015 and February 2016 for a location approximately 340m south of the proposed SPSS groundwater discharge site (Site ID NAMR2). The ambient water quality result for nutrients is summarised in **Table 7-11**. Drinking water and recreational water quality guideline values are not available for total nitrogen, total phosphorous and NO_x in NHMRC (2011) and NHMRC (2008). However, the NO_x concentrations reported are below the drinking water and recreational water quality guideline values for nitrate (i.e. 50 mg/L and 500 mg/L respectively) and nitrite (i.e. 3 mg/L and 30 mg/L respectively).

Table 7-11: Summary statistics for nutrients in MacLeay Arm from the MacLeay Ecohealth project 2015 – 2016 (Site ID NAMR2) (from summary data presented in GHD (2020))

Parameter	Minimum	20 th percentile	Median	80 th percentile	Maximum
Total nitrogen (TN) (mg/L)	0.15	0.16	0.25	0.31	1.4
Total phosphorous (TP) (mg/L)	0.021	0.029	0.052	0.079	0.080
Nitrate and nitrite (NO _x) (mg/L)	0.014	0.025	0.099	0.12	0.27

Monitoring undertaken by KSC between 2015 and 2019 included collection of water quality data for physio-chemical parameters at a sampling location in MacLeay Arm. The monitoring data has been summarised by GHD (2024, 2025) and reproduced in **Table 7-12**. The pH was generally within the Australian drinking water quality guideline value range of pH 6.5 – 8.5. The TDS is higher than the drinking water quality guideline value of 600 mg/L, but this is not considered relevant as the Macleay Arm is a marine environment and, as such, is not a source of drinking water.

Table 7-12: Physico-chemical water quality data for Macleay Arm (2015 and 2019) (from summary data presented in GHD (2024, 2025))

Parameter	5 th percentile	Average	95 th percentile
pH	7.04	7.97	8.98
Oxidation-reduction potential (ORP) (mV)	29	106	173
Electrical conductivity (EC) (µS/cm)	22,500	37,100	48,700
Dissolved oxygen (DO) (mg/L)	3.23	37.1	20.1
Total dissolved solids (TDS) (mg/L)	14,600	23,300	29,700

It is not known if any of the above sampling was undertaken during periods of flooding and associated discharges from OSMS. Ramboll is not aware of any reports that specifically related to surface water quality monitoring undertaken in response to known OSMS discharges events because of significant flooding events.

7.4.1.2 Groundwater

Baseline groundwater quality data relevant to the SPSS has been presented in two studies undertaken as part of the EIS:

- GHD (2024, 2025) *Groundwater and marine mixing modelling report*
- Ramboll (2024) *Hydrogeological assessment*.

As part of the groundwater marine mixing modelling GHD (2024) installed three groundwater monitoring wells in the vicinity of the proposed dunal discharge area. These were sampled in March 2024 to obtain baseline data of key water quality parameters at the dunal discharge area. The groundwater quality results are summarised in **Table 7-13**.

Concentrations of ammonia reported were below the drinking water and primary contact recreational water quality guideline value of 0.41 mg/L ammonia (as N) (aesthetics based). The pH was within the Australian drinking water quality guideline value range of pH 6.5 – 8.5.

Table 7-13: Baseline groundwater quality at the dunal discharge area - March 2024 (adapted from data presented in GHD (2024))

Parameter	Groundwater results		
	Minimum	Maximum	Average
Ammonia (as N) (mg/L)	0.15	0.29	0.22
Nitrate and nitrite (as N) (mg/L)	<0.05	<0.05	<0.05
Organic Nitrogen (as N) (mg/L)	0.35	1.11	0.65
Total Kjeldahl Nitrogen (as N) (mg/L)	0.50	1.4	0.87
Total Nitrogen (as N) (mg/L)	0.50	1.4	0.87
Phosphate total (as P) (mg/L)	0.05	0.17	0.11
Phosphorous reactive (as P) (mg/L)	<0.05	<0.05	<0.05
pH	7.56	7.78	7.64
Electrical conductivity (µS/cm)	341	660	533
Dissolved oxygen (mg/L)	1.21	2.33	1.79
Oxidation reduction protection (ORP) (mV)	-136	-65.4	-98.7

Ramboll (2024) completed a hydrogeological assessment for the SPSS project. As part of this Ramboll (2024) sampled groundwater from three groundwater monitoring wells (SP01, SP05 and GR01) from previous installed by GHD (2024) as part of the groundwater and stormwater study. Two of the monitoring wells (SP01 and SPO5) are located within Stuarts Point township and one of the wells (GR01) located in Grassy Head to the north of the proposed dunal discharge area. The groundwater results are summarised in **Table 7-14**.

Concentrations of nitrate and ammonia reported exceed the drinking water guideline value at one monitoring well location (SP05). The ammonia concentration at SPO5 also exceed the recreational water quality guideline value.

Table 7-14: Summary of baseline groundwater data for Stuarts Point and Grassy Heads in March 2024 (from Ramboll (2024) hydrogeological assessment)

Parameter	Water quality guideline values		Groundwater monitoring wells		
	Drinking water ¹	Primary contact recreation ²	SP01	SP05	GR01
Nitrite as N (mg/L)	0.91	9.1	<0.02	<0.02	<0.02
Nitrate as N (mg/L)	11.3	113	0.05	24	0.81
Ammonia as N (mg/L)	0.41 (aesthetics)	0.41 (aesthetics)	0.01	7.0	0.05
Total Nitrogen (mg/L)	-	-	1	32	0.8
Total phosphate (mg/L)	-	-	0.02	<0.01	<0.02

Parameter	Water quality guideline values		Groundwater monitoring wells		
	Drinking water ¹	Primary contact recreation ²	SP01	SP05	GR01
Arsenic (mg/L)	0.01	0.1	0.002	0.001	0.003
Cadmium (mg/L)	0.002	0.02	<0.0002	<0.0002	<0.0002
Chromium (mg/L)	0.05	0.5	0.005	0.001	<0.001
Copper (mg/L)	1 (aesthetics)	1 (aesthetics)	<0.001	0.003	<0.001
Lead (mg/L)	0.01	0.1	<0.001	<0.001	<0.001
Mercury (mg/L)	0.001	0.01	<0.0001	<0.0001	<0.0001
Nickel (mg/L)	0.02	0.2	0.001	0.011	0.001
Zinc (mg/L)	3	3	0.008	0.95	<0.005
Total PAH (mg/L)	-	-	<0.005	<0.001	<0.001
TRH C6 – C10 (mg/L)	-	-	<0.02	<0.02	<0.02
TRH C6 – C10 less BTEX (F1) (mg/L)	-	-	<0.02	<0.02	<0.02
TRH >C10 – C40 (mg/L)	-	-	<0.1	<0.1	<0.1
Biological oxygen demand (BOD) (mg/L)	-	-	<10	<5	<5
Chemical oxygen demand (COD) (mg/L)	-	-	100	<25	<25
pH	6.5 – 8.5	6.5 – 8.5	4.9	4.0	6.8
Electrical conductivity (µS/cm)	-	-	106	557	273
Dissolved oxygen (DO) (mg/L)	-	-	0.21	1.6	0.1
Redox Potential (mW)	-	-	-163	50.9	-134
Total dissolved solids (TDS) (mg/L)	600	600	96	377	180

Bold – Water quality guideline value exceeded

1. NHMRC (2011) Australian Drinking Water Quality Guidelines, Version 4 Updated June 2025.

2. NHMRC (2008) Guidelines for Managing Risks in Recreational Water. 10 times drinking water quality value (health based) adopted for primary contact recreational exposures.

7.4.1.3 Pacific Ocean

Ramboll is not aware of any baseline water quality data related to the Pacific Ocean and beach environment to the east of Stuarts Point, including the proposed dunal discharge area. It is understood that faecal coliform levels at beaches in the broader region are monitored as part of the Beachwatch Program, however there is no readily accessible information in relation to beaches in Stuarts Point.

7.4.2 Assessment method

The health impacts associated with water quality and wastewater quality has been focussed on expected water quality associated with the dunal discharge area. This has been undertaken based on:

- the marine mixing modelling technical study undertaken by GHD (2025) as part of the EIS
- the effluent pathogen risk management assessment undertaken by Beca (2025) in the Revised Stuarts Point WWTP Design Guidance Memo
- data from an existing comparable dunal discharge area in Kempsey Shire – South West Rocks Sewerage Treatment Plant.

7.4.2.1 Technical study – GHD (2025) SPSS WWTP Marine Mixing Modelling

GHD (2025) conducted a marine mixing modelling technical study for the SPSS project which has been used as the primary basis for the health impact assessment for water quality / wastewater. The technical study is presented in the following reports:

- GHD (2020) *Stuarts Point Sewerage Scheme WWTP Draft Marine Mixing Modelling*
- GHD (2024) *Technical Memorandum: Groundwater and marine/estuarine modelling update*
- GHD (2025) *Stuarts Point Sewerage Scheme WWTP Marine Mixing Modelling*

The GHD (2025) marine mixing modelling study was undertaken to predict the potential implications to water quality associated with the proposed groundwater dunal discharge from the SPSS project.

The primary objectives of the study were to:

- determine the natural rates of tidally driven water exchange between the Macleay Arm and the Pacific Ocean
- predict whether the flushing is sufficient to maintain water quality to acceptable standards once the proposed WWTP is operational.

The scope of the marine mixing study included:

- determination of the water quality objectives of contaminants of concern in the groundwater discharge
- establishment of dilution targets for groundwater once discharged into the Macleay Arm
- establishment of a hydrodynamic model of the lower Macleay River, Macleay Arm and nearshore coastal Pacific Ocean
- calculation of flushing rates for the Macleay Arm undertaken a range of conditions over a representative year
- simulation of the nutrient concentrations in the Macleay Arm over a representative calendar years and comparison between the existing and two future dunal discharge scenarios.
- assessment of any potential impacts to water quality.

GHD originally completed the marine mixing modelling study in 2020. It was then updated in 2024 and 2025 to account for changes in the predicted effluent discharge rates, and total nitrogen and phosphorous loads.

Assessment criteria

The final 2025 marine mixing modelling report considered changes to water quality for the following key water quality parameters:

- total nitrogen (TN)
- total phosphorous (TP).

Early versions of the mixing modelling also considered:

- ammonia (as N)
- nitrate
- nitrate and nitrite (NO_x)
- salinity.

GHD (2025) stated that the mixing modelling was focussed on TN and TP as the primary nutrient constituents, which can be assumed to behave in a relative conservative manner within groundwater. The other analytes (e.g. other nitrogen species) were not included in the final modelling as GHD (2025) considered that there are more likely to undergo substantive fate transformations during groundwater transport and discharge into Macleay Arm.

GHD (2024, 2025) did not specifically consider human health assessment criteria for the study. Rather, the assessment criteria adopted were the ANZECC (2000) physical and chemical stressor default trigger values and ANZG (2018) toxicant default guideline value. GHD (2025) also adopted a site-specific guideline value being the 80th percentile concentrations of from the Macleay Ecohealth Project. For this health impact assessment, we have also adopted the following assessment criteria:

- NHMRC (2008) *Guidelines for Managing Risks in Recreational Water*. 10 times drinking water quality value (health based) adopted for primary contact recreational exposures.

Table 7-15: Water quality assessment criteria adopted for the marine mixing model

Parameter	Assessment criteria (mg/L)	
	Human health -primary contact recreation ¹ (adopted by Ramboll)	Ecological – aquatic ecosystems (Adopted by GHD, 2025, 2024)
Total nitrogen (mg/L)		0.30 ²
Total phosphorous (mg/L)		0.08 ³
Ammonia (as N) (mg/L)	0.41 (aesthetics)	0.91 ⁴
Nitrate (as N) (mg/L)	113	1.1 ⁵

1. NHMRC (2008), 10 x Australian drinking water guideline value, no adjustment of aesthetics-based guideline values.
2. ANZG (2018) default guideline value – physical and chemical stressors southeast Australian estuaries
3. GHD (2025) site-specific guideline value, based on 80th percentile of ambient water quality in the Macleay Arm
4. ANZG (2018) default guideline value of toxicants – marine water 95% level of species protection
5. ANZG (2018) default guideline value for toxicants – freshwater 95% level of species protection

Modelling Methodology

The marine mixing modelling methodology included:

- 3D Hydrodynamic modelling using MIKE 3 Flexible Mesh (MIKE 3 FM) to simulate groundwater dilution to Macleay Arm
- determining flushing rates of the Macleay Arm through calculation of the e-folding flushing time. This is the duration for 63% of a water body's volume to exchange with adjacent ambient waters until 37% of the original volume remains.

Groundwater discharge was simulated in two components, being ambient groundwater flow and groundwater effluent plumes. Three different scenarios were modelled as follows:

- Scenario 1: Groundwater effluent from existing septic tanks
- Scenario 2: Groundwater effluent from dunal disposal site based on projected ultimate peak effluent dune disposal
- Scenario 3: Groundwater effluent from dunal disposal site based on projected 2047 off-peak effluent dune disposal

The modelling was undertaken based on (but not limited to) the following key assumptions:

- the aquifer is unconfined, homogeneous and isotropic
- groundwater flow is horizontal
- typical groundwater elevation of 1 m AHD
- a bottom datum of -1.5m AHD to represent the bed of the Macleay Arm.
- aquifer hydraulic conductivity of 0.1225 m/day
- groundwater flow towards the Macleay Arm is 0.196 m³/s
- the effluent discharge rate at the dunal discharge area is
 - Scenario 1: Current 2024 off-peak septic discharge of 273 kL/d
 - Scenario 2: Projected ultimate peak effluent dune disposal of 1,030 kL/d with 515 kL/d to each of Macleay Arm and the Pacific Ocean.
 - Scenario 3: 2047 off-peak effluent dune disposal of 693 kL/d with 346.5 kL/d to each of Macleay Arm and the Pacific Ocean.
- effluent is discharged to ground surface and all effluent infiltrates to the water table before discharge is assumed to split evenly to the Pacific Ocean and to Macleay Arm.
- the simulated length of the effluent discharge boundary into the marine and estuarine regions was configured to be equal to the north-south length of the proposal dune discharge site (approximately 1,300m).
- effluent chemistry from septic tanks assumed to be:
 - total nitrogen: 41.25 mg/L
 - total phosphorous: 9.37 mg/L
- effluent chemistry from effluent entering the dunal discharge system following treatment assumed to be:
 - Total nitrogen: 6 mg/L
 - Total phosphorous: 0.6 mg/L
- no losses or transformations of TN or TP were assumed to occur within the groundwater effluent plume from the dunal discharge
- groundwater discharge simulation spanning the entirety of 2012, as a representative one-year period. This included a total of ten marine flushing simulations for different tidal conditions, including neap/spring, flooding/ebbing and high/low tide. GHD (2024) selected 2012 as a representative year from modelling because:
 - three flood events occurred with riverine water levels greater than 1.5 mAHD.

- the highest river level recorded in 2012 was approximately 5.5 m, which is a good representation of a typical large flood event.
- 2012 is the second most recent year within the available water level record, which is closer in time to the available 2015-2016 ambient Macleay Arm water quality data.

Effluent dilution requirements

GHD (2025) calculated the level of dilution of the groundwater effluent that would be required to meet the nominated water quality guidelines values at the discharge locations. This was undertaken in the context of dilution required at the edge of the mixing zone (D_{MZ}) and was calculated according to the following equation:

$$D_{MZ} = C_{GW} - C_{AMB} / C_{TV} - C_{AMB}$$

Where:

D_{MZ} = Mixing zone

C_{GW} = Project groundwater effluent quality

C_{AMB} = Medial ambient surface water quality

C_{TV} = Adopted trigger values (water quality guideline values)

GHD (2025) calculated the effluent dilution requirements in related to aquatic ecosystem guideline values, as summarised in **Table 7-16**. As part of this HIA, Ramboll have calculated the dilution required to meet the human health guideline recreational water quality guideline value. There is no recreational water quality guideline values for TN and TP as such this has been undertaken assuming all of the TN could be in the form of ammonia or nitrate.

Table 7-16: Dilution requirements at edge of mixing zone

Parameter	Groundwater effluent quality	Ambient surface water concentration (median)	Assessment criteria (Mixing zone criteria)		Dilution required at mixing zone edge	
			Human health -primary contact recreation	Ecological	Human health	Ecological
Septic tank groundwater effluent						
Total nitrogen (mg/L)	41.25	0.25	0.41 (Ammonia as N) 113 (Nitrate as N)	0.30	256.3 ¹	788.5
Total phosphorous (mg/L)	9.37	0.05	-	0.08	-	345.3
Dunal discharge groundwater effluent						
Total nitrogen (mg/L)	6	0.25	0.41 (Ammonia as N) 113 (Nitrate as N)	0.30	35	110.6
Total phosphorous (mg/L)	0.6	0.05	-	0.08	-	20.3

1. Based on meeting the human health recreational water quality guideline value for ammonia, on the conservative assumption that all of the total nitrogen is in this form.

Modelling results

GHD (2025) evaluated flushing rates for 10 different simulations throughout the 2012 representative year. This was undertaken to calculate the e-folding flushing timescale for the control volumes of Stuarts Point and the Macleay Arm. The e-folding flushing timescales calculated are:

- Stuarts Point control volume: ~28 days during the flood event and 34 – 37 days for all other simulations
- Macleay Arm: ~10 days to ~28 days, which was influenced by tidal patterns.

This was used for the modelling simulations to predict the dispersion of effluent parameters in the Macleay Arm and Pacific Ocean. The dispersion modelling was undertaken for TN only as GHD (2025) identified that this was the nutrient that required the greatest dilution to meet the water quality guideline value at the edge of the mixing zone (see **Table 7-16**). The results from the dispersion modelling are summarised below in relation to outcomes at Macleay Arm and Pacific Ocean.

Macleay Arm

The modelling demonstrated significant reduction in TN loads to the Macleay Arm for the proposed dunal discharge compared to the existing septic tank seepage scenario. The results are summarised in **Table 7-17** and shown on **Figure 7-3** and **Figure 7-4**.

Table 7-17: Summary of TN dispersion modelling results for Macleay Arm (based on information in GHD, 2025)

Scenario	Predicted extent of TN 0.3 mg/L criteria exceedance in the Macleay Arm (per GHD, 2025)	Ramboll interpretation in relation to human health impacts
Scenario 1 – Existing septic tanks	Nearly the entire 10km length of MacLeay Arm. Median and maximum TN concentrations exceeded 1 mg/L at the poorly flushed, northern most reaches of the MacLeay Arm.	Predicted TN concentrations in Macleay Arm potentially exceeded relevant human health guideline values for ammonia, if it is assumed that all nitrogen is in that form. The ammonia recreational water quality guideline value potentially exceeded indicates is based on aesthetics.
Scenario 2 – Ultimate peak holiday effect dune disposal	Median extent confined to the upper ~2km of Macleay Arm, and was not predicted to exceed 0.4 mg/L. The maximum predicted concentrations were also predicted to be less than 0.4 mg/L, and extended approximately 5 km southward before reducing below 0.3 mg/L.	Predicted TN concentrations in Macleay Arm for both median and maximum are the relevant human health guideline values for ammonia and nitrate, if it is assumed that all nitrogen is in those forms respectively.
Scenario 3 – Off-peak dune disposal	The median TN concentration was not predicted to exceed 0.3 mg/L anywhere within the model domain. The dilution required to reduce the TN effluent concentration to below 0.3 mg/L occurred within ~30m. The maximum predicted concentrations were 0.3 – 0.35 mg/L and confined within ~150 m westward distance from the discharge boundary.	

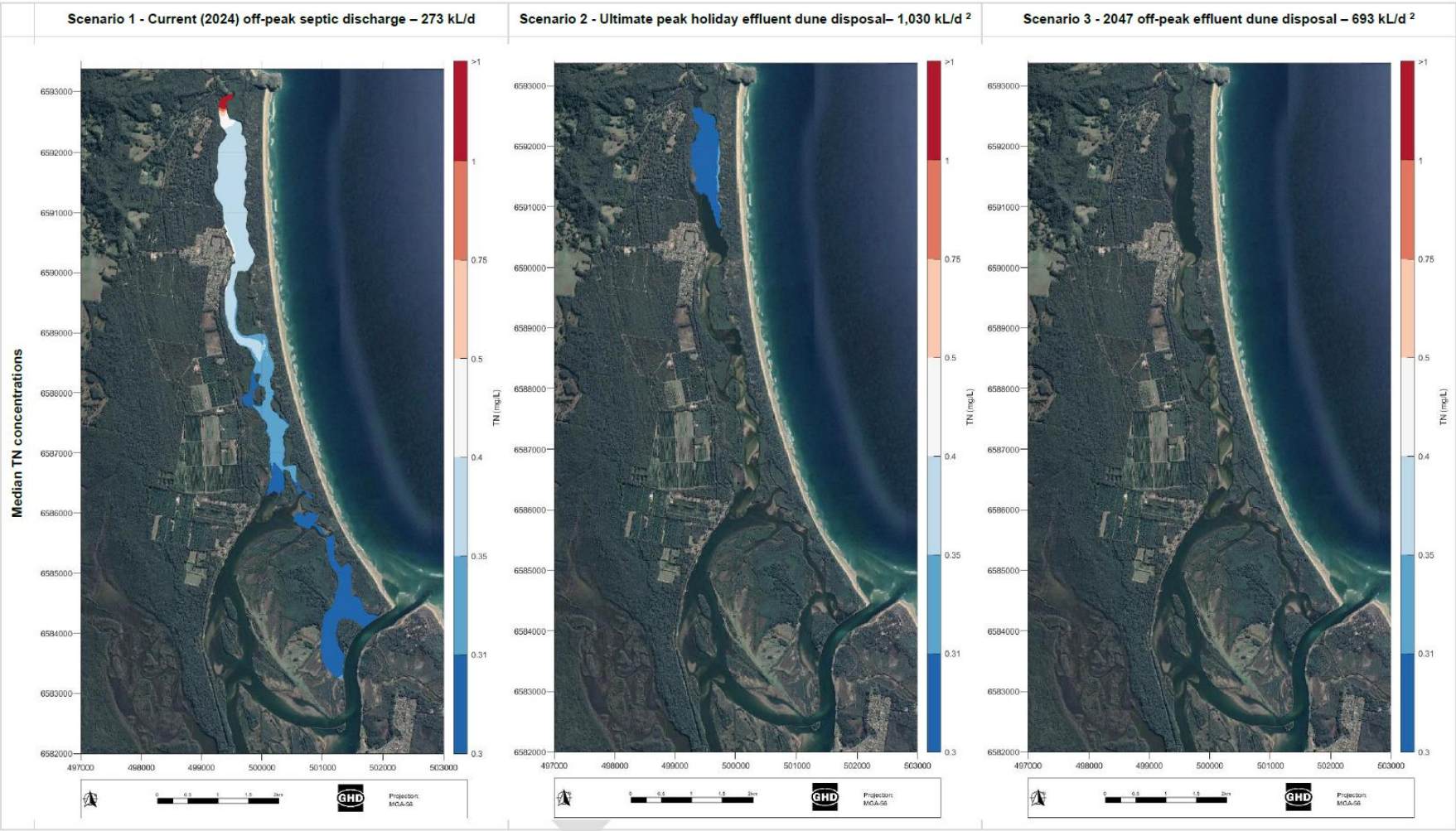


Figure 7-3: Spatial plots of statistical median predicted TN concentrations within Macleay Arm (from GHD, 2025)

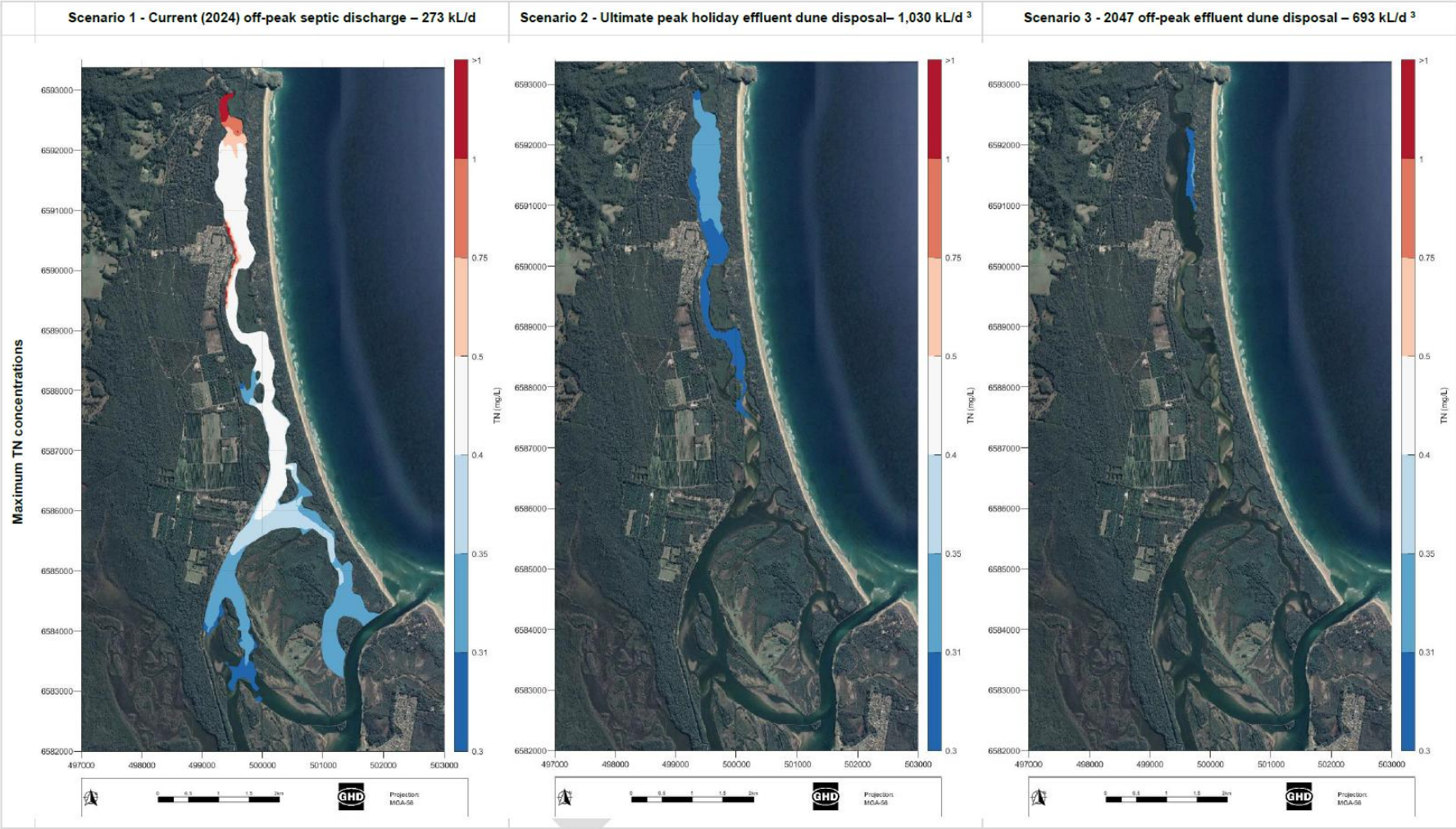


Figure 7-4: Spatial plots of statistical maximum predicted TN concentrations within Macleay Arm (from GHD, 2025)

Pacific Ocean

Scenarios 2 and 3 of the proposed dunal discharge strategy will likely result in groundwater effluent flows to the Pacific Ocean. As such GHD (2025) modelled discharge of TN in the Pacific Ocean. This was only undertaken based on the maximum TN concentration.

The modelling showed that the 0.3 mg/L guideline value was not exceeded within the Pacific Ocean, with the exception of a few localised modelling cells along the coast for the Scenario, as shown on **Figure 7-5**. The modelling showed that these exceedances occurred for less than 5% of the time the simulation. The predicted maximum concentrations in the Pacific Ocean were below the human health recreational water quality guidelines for ammonia and nitrate, if it is assumed that all the nitrogen is in those forms.

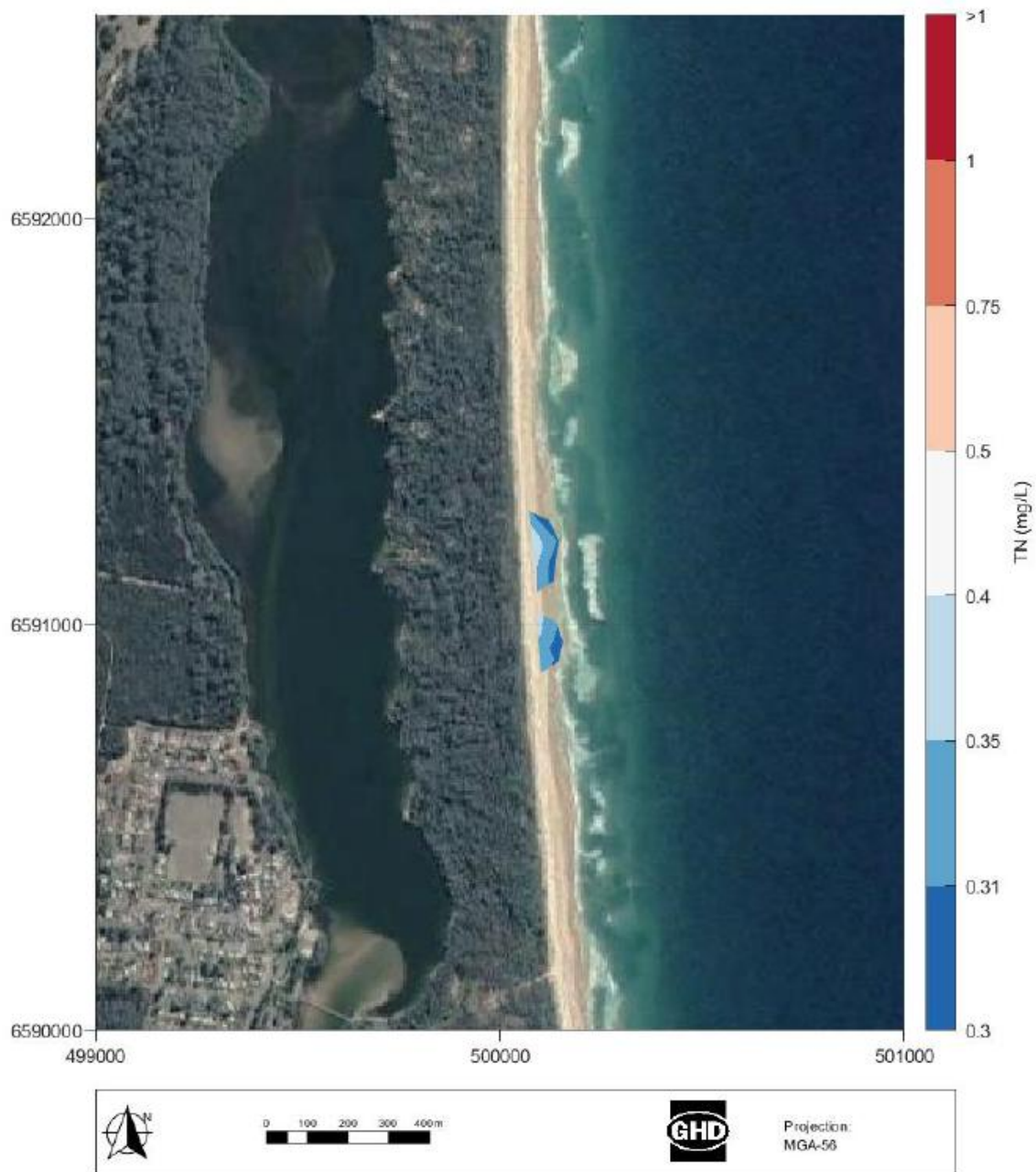


Figure 7-5: Spatial plot of the statistical maximum TN concentrations at the Pacific Ocean from Scenario 2 (from GHD, 2025)

Conclusions

Based on the marine mixing modelling undertaken, GHD (2025) made the following conclusions:

- the flushing rates of the Macleay Arm control volume are predicted to range between 10 to 28 days depending on tidal state and river flow events.
- the flushing rates of the Stuarts Point control volume were less influenced by tides and river flow events, and long flushing timescales of ~38 – 37 days were predicted.
- for the existing septic tank arrangement (Scenario 1), TN greater than 0.3 mg/L is predicted to extend across the entire 10km length of the Macleay Arm.
- significant TN reductions are predicted following the decommissioning of the septic tanks and replacement with the wastewater treatment and dunal discharge strategy. Maximum predicted TN under this arrangement was less 0.4 mg/L and extended only ~2km under the ultimate peak holiday flow rate (Scenario 2) and was localised to within 150m for the 2047 off-peak effluent dune disposal (Scenario 3).
- minimal impacts to the Pacific Ocean are predicted following establishment of the dunal discharge system, with only a few localised model cells along the coast predicted to exceed 0.3 mg/L TN under ultimate peak holiday flow rates. This was predicted to occur less than 5% of the time.

The modelling undertaken by GHD (2025) was based on meeting water quality guidelines protection of aquatic ecosystems. This was also only undertaken in the context of nutrients, as represented by TN and TP. Ramboll has interpreted the modelling results for nutrients in related to potential human health impact, based on applicable recreational water quality guideline values.

There are no such recreational water quality guideline values for TN. However, as a conservative approach the TN concentrations predicted in the Macleay Arm and Pacific Ocean have been compared to recreational water quality guideline values of ammonia and nitrate, on the assumption that all the nitrogen could be in these forms. The predicted TN concentrations were below the recreational water quality guideline values for ammonia and nitrate for all scenarios, as such are unlikely to negatively impact on human health.

7.4.2.2 Effluent pathogen risk management assessment – Beca Hunter H₂O Revised Stuarts Pont WWTP Design Guidance Memo

In 2025 Beca Hunter H₂O prepared a memo to present changes to the reference design for the Stuarts Point Wastewater Treatment Plant (SPWWTP). This specially outlined changes to the design to incorporate a tertiary treatment process. Amongst other aspects Beca Hunter H₂O (2025) identified that tertiary treatment was required to meet:

- pathogen reduction requirements taking into account the presence of oysters leases in the discharge environment and other community uses
- quality and pathogen reduction standards for onsite effluent reuse in accordance with *Australian Guidelines for Water Recycling* (AGWR) (NHMRC, 2006) and state legislation.

The revised design guidance memo (Beca Hunter H₂O, 2025) includes a section on effluent pathogen risk management. The approach taken and outcome is summarised below.

Oyster farms are located on the Macleay Arm Estuary, as shown on **Figure 7-6**.

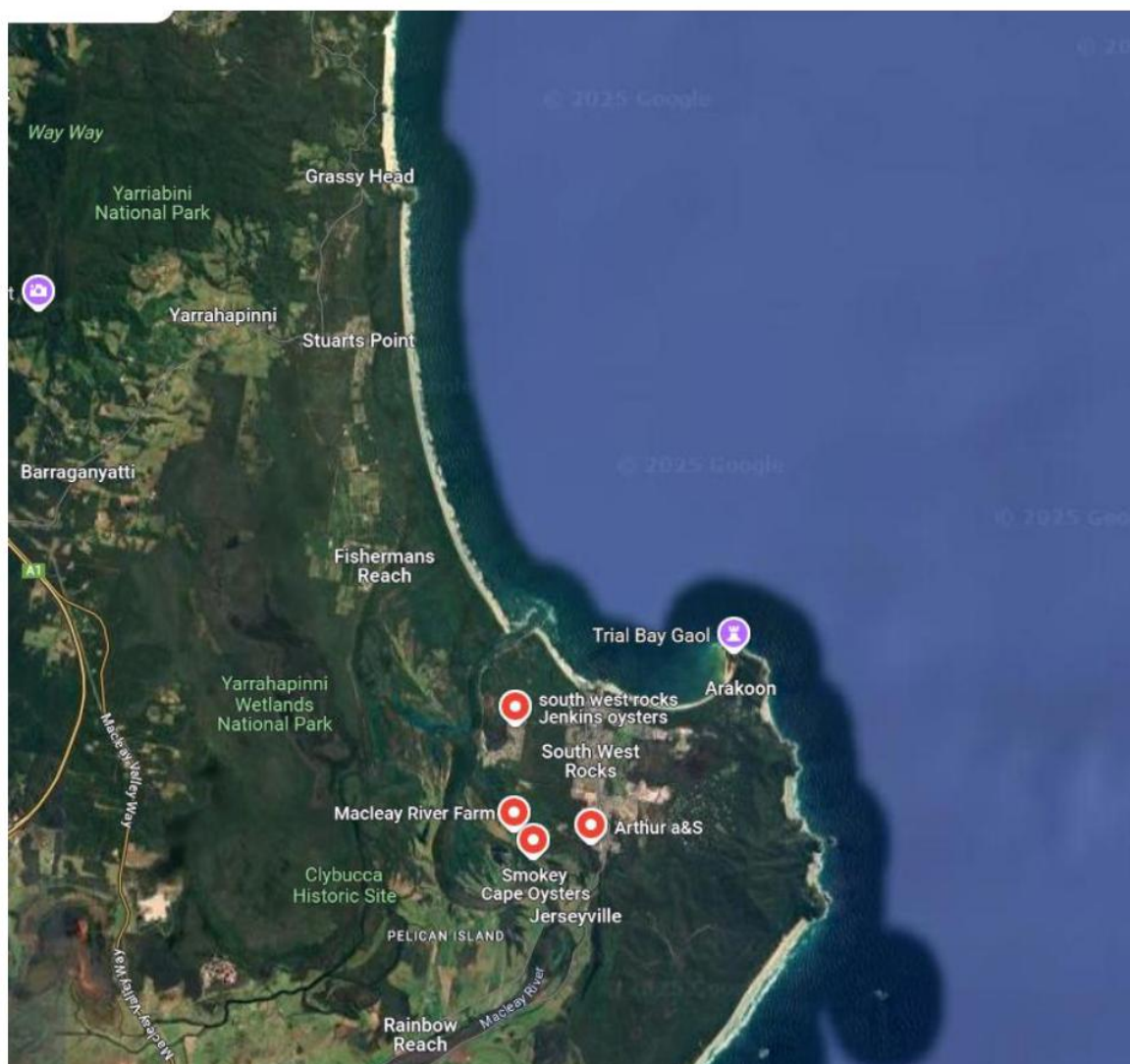


Figure 7-6: Location of oyster farms within the Macleay Arm catchment (from Beca Hunter H₂O, 2025)

The NSW Department of Primary Industries (NSW DPI, 2023) have published 'Health estuaries for health oysters – guidelines for development near waterways'. The guidelines include water quality guidelines for oyster production in aquaculture areas. In relation to pathogens, the water quality guideline is:

- faecal coliforms: 90th percentile of randomly collected samples do not exceed 43 MPN/100 ml or 21 MF/100 ml.

Additionally, the presence of viruses has been a focus in relation to the local oyster industry, specifically norovirus is a key concern for bioaccumulation.

In relation to the oyster farms Beca Hunter H₂O (2025) determine the pathogen removal requirements for the WWTP design based on the guidance in AGWR (NHMRC, 2006). The required Log Reduction Value (LRV) requirements determined by Beca Hunter H₂O (2025) are summarised in **Table 7-18**. Beca Hunter H₂O (2025) note that limited concern has been raised in relation to the presence of *Cryptosporidium*, as such no target was included for this pathogen. Concerns have been raised regarding the presence of faecal coliforms with the river system, to address this Beca Hunter H₂O (2025) have nominated a final 90th percentile effluent concentration of 20 cfu/ml based on the oyster production guidelines (NSW DPI, 2023).

Table 7-18: Assumed Log Reduction Value (LRV) requirements for the Stuarts Point WWTP overflow to Macleay Arm (from Beca Hunter H₂O, 2025)

Parameter	Rotavirus (Viruses)	Norovirus / Adenovirus (Virus)	Cryptosporidium (Protozoa)	Campylobacter (Bacteria)
Effluent LRV requirement	5.5	5.5	No target	No target

Beca Hunter H₂O (2025) also considered pathogen reduction requirements to manage the broader catchment risk. This was undertaken in consideration of the AGWR (NHMRC, 2006) and the NSW Recycled Water Management Systems Guidance Document (NSW DPI, 2015). The adopted LRV requirements for the Stuarts Point WWTP on-site reuse are summarised in **Table 7-19**.

Table 7-19: Adopted Log Reduction Value (LRV) targets for the treated effluent from Stuarts Point WWTP (from Beca Hunter H₂O, 2025)

Parameter	Rotavirus (Viruses)	Norovirus / Adenovirus (Virus)	Cryptosporidium (Protozoa)	Campylobacter (Bacteria)
Effluent LRV requirement	5.5	5.5	3.7	4.0

Based on the pathogen reduction requirements determined Beca Hunter H₂O (2025) have proposed tertiary treatment process to achieve the required pathogen log reductions. This is summarised in **Table 7-20**.

Table 7-20: Indicative log reduction for Stuarts Point WWTP with the proposed treatment processes (from Beca Hunter H₂O, 2025)

Treatment process	Indicative Log Reduction		
	Virus (Rotavirus, Norovirus, Adenovirus)	Protozoa (Cryptosporidium)	Bacterial (E.coli or Campylobacter)
LRV Requirement	5.5	3.7	4.0
Biological treatment	0.5	0.5	1.0
Shortfall of LRV	-5.0	-3.2	-3.0
Pressure media filtration	0.0	0.0	0.0
Ultraviolet (UV) disinfection	0.5	4.0	4.0
Chlorine disinfection	4.5	0.0	4.0
Effluent storage	0.0	0.0	0.0
Total	5.5	4.5	9.0

7.4.2.3 Comparable dunal discharge area – South West Rocks

As outlined in the SPSS effluent transfer and disposal design – Concept design report (GHD, 2023) the design on the dunal discharge area has been based around that of dunal discharge for the South West Rocks Sewerage Treatment Plant (STP). The South West Rocks STP has a currently operational dunal discharge area, also located within Kempsey Shire, and services a similar community and type of sewerage to that of Stuarts Points. As such information / data from the South West Rock STP dunal discharge has been evaluate in this section as an additional line of evidence related to the likely performance and health impacts for the proposed SPSS dunal discharge.

The South West Rocks STP operates under Environment Protection Licence (EPL) No. 2497. This required monitoring for a range of water quality parameters, including the dunal discharge point (EPL monitoring point 3). Discharge water quality monitoring data has been sourced from the Kempsey Shire Council website (<https://www.kempsey.nsw.gov.au/Residents/Waste-recycling/Environment-Protection-Authority-licence-reporting>).

Ramboll have collated and evaluated monitoring data from the 2024 calendar year for South West Rocks EPL monitoring point 3 (dunal discharge). This data is considered to be representative of the current effluent quality at the discharge point to the dune. The water quality monitoring results are summarised in **Table 7-21**. These have been compared to the following relevant human health water quality guideline values:

- NHMRC (2008) *Guidelines for Managing Risks in Recreational Water*. 10 times drinking water quality value (health based) adopted for primary contact recreational exposures.
- NHMRC (2019) *Guidance on Per and Polyfluoroalkyl (PFAS) in Recreational Water*.

Table 7-21: South West Rocks STP – Dunal discharge monitoring data - 2024 (EPL monitoring point 3)

Parameter	Assessment criteria	Minimum	Maximum	Mean	90 th percentile
	Primary contact recreation ¹				
pH	6.5 – 8.5 (aesthetics)	6.9	7.6	7.2	7.4
Electrical conductivity (µS/cm)	-	504	666	573	618
Alkalinity (mg CaCO ₃ /L)	-	7	168	56.2	75.4
Total suspended solids (TSS) (mg/L)	-	<2	20	3.8	3.9
Biological oxygen demand (mg/L)	-	<2	26	4.0	2.0
Ammonia (as N) (mg/L)	0.41 (aesthetics)	<0.02	28.4	2.4	0.7
Total nitrogen (mg/L)	-	1.6	32	5.5	4.6
Total phosphorous (mg/L)	-	0.27	5.0	1.0	1.3

Parameter	Assessment criteria	Minimum	Maximum	Mean	90 th percentile
	Primary contact recreation ¹				
Oil & grease (mg/L)	-	<2	<2	<2	<2
Potassium (mg/L)	-	12	22	16	21
Chloride (mg/L)	250 (aesthetics)	78	111	91	99
Arsenic (mg/L)	0.1	<0.012	<0.012	<0.012	<0.012
Thermotolerant coliforms (cfu/100 mL)	40	0	540	46	4.6
PFOS (µg/L)	2 ³	<0.02	<0.02	<0.02	<0.02
PFHxS (µg/L)	2 ³	<0.01	<0.01	<0.01	<0.01
PFOA (µg/L)	10 ³	<0.01	<0.01	<0.01	<0.01
PFPeA (µg/L)	10 ^{3, 4}	<0.02	0.097	0.028	0.032
PFHxA (µg/L)	10 ^{3, 4}	<0.01	0.11	0.02	0.044
PFHpA (µg/L)	10 ^{3, 4}	<0.01	0.02	0.011	0.01

Bold – Exceedance of water quality guideline value

1. NHMRC (2008), 10 × Australian drinking water guideline value, no adjustment of aesthetics-based guideline values
2. NHMRC (2008) Microbial water quality assessment (faecal pollution) recreational water, Category A.
3. NHMRC (2019) Guidance on per and polyfluoroalkyl substances (PFAS) in recreational water
4. Guideline value for PFOA adopted

Review of the 2024 South West Rocks dunal discharge monitoring results identified that the water quality parameters measured were below the applicable recreational water quality guideline value, where available, except for:

- ammonia as N for which the maximum, mean and 90th percentile concentrations exceed the aesthetics based recreational water quality guideline value in the treated effluent.
- thermotolerant coliforms for which the maximum exceeded the recreational water quality guideline value in the treated effluent.

These are evaluated further below in relation to how the findings may be relevant to health impacts for the proposed SPSS dunal discharge.

During 2024 a total of 12 (monthly) discharge samples were collected from the South West Rocks EPL monitoring point 4. Of these, two of the samples reported an ammonia concentration exceeding the recreational water quality guideline value in the treat effluent, at the point of discharge to the dune, see **Table 7-22**. The concentration reported in February 2024 (0.71 mg/L) was below the effluent quality assumed by GHD (2025) for the SPSS marine mixing modelling (6 mg/L total nitrogen). As such, based on the results from the GHD (2025) modelling, the 0.71 mg/L concentrations would not be expected to present an adverse health impact in the received water bodies if present in discharges at the proposed SPSS dunal discharge location. The maximum concentration (28.4 mg/L) recorded in October 2024, is greater than the effluent quality assumed for SPPS dunal discharge, as such may result in exceedance of the recreational

water quality guideline value in Macleay Arm and/or Pacific Ocean if this was to occur at the proposed SPSS dunal discharge.

Table 7-22: South West Rocks STP dune discharge 2024 - Exceedances of recreational water quality guideline values for ammonia

South West Rocks STP dunal discharge – Exceedances of ammonia recreational water quality guideline values - 2024		Effluent quality assumed for SPSS marine mixing modelling by GHD (2015)
Sampling round	Ammonia as N (mg/L)	Total Nitrogen (mg/L)
February 2024	0.71	6
October 2024	28.4	

In relation to thermotolerant coliforms the recreational water quality guideline value was only exceeded on one occasion (October 2024, 540 cfu/100 mL) at the South West Rocks dunal discharge point during 2024. All the other results for 2024 were ≤ 5 cfu / 100ml and predominately below detection limits. Should the maximum thermotolerant coliforms reading occur at the proposed SPSS dunal discharge there is some potential for the recreational water quality guideline value to be exceeded in the Macleay Arm and/or Pacific Ocean, however this would likely only occur during infrequently during atypical conditions.

Per and polyfluoroalkyl substances (PFAS), including PFPeA, PFHxA and PFHpA were detected in the treated effluent at South West Rocks during 2024. The concentrations detected are below the applicable recreational water quality guideline values. However, some PFAS are known to be bioaccumulative and can accumulate in aquatic foods for human consumption. To indicate the potential human health risks related to uptake of PFPeA, PFHxA and PFHpA into aquatic foods we have used published bioconcentration factors to predict the accumulated concentrations in biota, see **Table 7-23**.

The predicted concentrations have been compared to the relevant trigger points for aquatic foods published by Food Standards Australia and New Zealand (FSANZ, 2017). The predicted concentrations of the PFAS in aquatic biota were at least an order of magnitude below the FSANZ trigger point for PFOA. FSANZ (2017) have not derived trigger points for PFPeA, PFHxA and PFHpA, these PFAS are within the same perfluorocarboxylic acids (PFCAs) group as PFOA for which there is a FSANZ (2017) trigger point. As such the predicted concentrations of PFPeA, PFHxA and PFHpA in biota have been compared to the trigger points for PFOA, as they are broadly expected to have similar toxicities. This is consistent with the general approach adopted by Environment and Climate Change Canada in the Ecological State of the Science Report on short-chain and long-chain PFCAs and PFASs (ECCC, 2023). The predicted concentrations are below the PFOA trigger points, as such if these PFAS were present in discharges at the proposed SPSS dunal discharge that would be unlikely to result in concentrations in aquatic foods that would present an adverse health risks.

Table 7-23: Predicted concentration of PFAS in aquatic biota for human consumption – based on concentrations reported at South West Rocks STP treated effluent

PFAS	Maximum concentration in SWR STP effluent (µg/L)	Bioconcentration factor (BCF) (L/kg, ww) ¹		Predicted biota concentration (µg/kg)	
		Water to aquatic invertebrate / crustacean	Water to fish tissue	Invertebrate / crustacean	Fish
PFPeA	0.097	91	0.23	9	0.022
PFHxA	0.11	91	0.69	10	0.076
PFHpA	0.02	91	3.2	1.8	3.2
FSANZ trigger points (µg/kg) (PFOA)				520	41

1. Bioconcentration factors sourced from SERDP (2020)

7.4.3 Characterisation of health impacts – water and wastewater

The health impacts for water and wastewater have been characterised as presented in **Table 7-24**.

Positive impacts have been rated as very high in relation to reducing the potential for water quality impacts due to the removal / decommissioning of the large number of OSMSs. There is an established history of negative water quality impacts related to discharges from the OSMSs, in particular during significant flooding events. This has resulting in a range of chemical and biological contaminants entering local waterways. Improvements to water quality from the removal of the OSMS is expected to have a positive impact on a significant proportion of the local community and industries, including the oyster farming industry.

Negative water quality impacts associated with the operation of the proposed SPSS, specifically the dunal discharge, have been rated as low. This is supported by the findings from the GHD (2025) marine mixing model, the design of the tertiary treatment processes by Beca Hunter H2O and evaluation of water quality from a comparable existing dunal discharge (i.e. South West Rocks STP).

There is some potential for negative health impacts during atypical conditions. However, these are expected to be short-lived and limited to a relatively small extent of waterways. Some recreational users of the waterways may be impacted. The negative health impacts may be related to nutrients, specifically ammonia, and pathogens.

At the concentrations presented in the treated effluent, and predicted to be within the receiving waterways, ammonia may cause some aesthetics concerns for exposed individuals, but is not expected to be presented above the odour threshold (NHMRC, 2011). Exposure to ammonia in the water would not be expected to cause direct toxicological health impacts.

The pathogens associated with discharges of treated effluent may include bacteria, protozoa and viruses. At the concentrations estimated as potentially present in the receiving waterways during atypical events the health effects associated with exposure may include short-term gastrointestinal illness.

Table 7-24: Health impact characterisation – Water and wastewater

Health impact	Direction	Likelihood	Consequence (magnitude)	Overall impact assessment rating	Rationale / comments
Water quality impacts to recreational users of Macleay Arm and Pacific Ocean due to discharges from OSMSs	Positive	Almost certain	Major	Very high	There are over 500 existing OSMS in the Stuarts Point area. This is an established history of water quality contaminant events related to discharges from the OSMS, in particular during flooding events. Marine mixing modelling conducted by GHD (2025) indicated that discharges from the OSMS could result in nutrient impacts in the Macleay Arm of up to 10km. Pathogens are also expected to be released. Community and stakeholder groups have identified significant health concerns related to previous contamination events. The SPSS project proposed to decommission the existing OSMSs. This will significantly reduce the potential for water quality impacts and have a positive impact on the local community
Water quality impacts to consumers of aquatic foods and aquaculture (oysters) due to discharges from OSMSs	Positive	Almost certain	Major	Very high	As above the historical water quality impacts associated with the existing OSMS have posed risks to consumers of aquatic foods and the local oyster farming industry. The decommissioning of the OSMSs will significantly reduce the potential for water quality impacts.

Health impact	Direction	Likelihood	Consequence (magnitude)	Overall impact assessment rating	Rationale / comments
Water quality impacts to recreational users of Macleay Arm and Pacific Ocean due to discharges from the WWTP dunal discharge	Negative	Possible	Insignificant	Low	The SPSS project proposes to discharge tertiary treated effluent to the environment via a dunal discharge system. This is designed to allow treated effluent to discharge to Macleay Arm and Pacific Ocean via the dunal discharge infiltration process. The marine mixing modelling undertaken by GHD (2025) indicates that concentrations of nutrients in the Macleay Arm and Pacific Ocean are not expected to exceed relevant human health-based water quality guideline values. This is also supported by an evaluation of the performance of the existing South West Rocks STP dunal discharge. It is possible that nutrients and pathogens may occur above human health guideline values during atypical conditions. However, these such conditions are expected to be short lived, effect a relatively small extent of the water bodies and a small portion of the population impacted. As such the potential negative health impacts are considered to be low. It is also noted that the SPSS project and dunal discharge system is being designed with management controls to limit discharges during atypical conditions, such as high rainfall condition.
Water quality impacts to consumers of aquatic foods and aquaculture (oysters) due to discharges from WWTP dunal discharge	Negative	Possible	Insignificant	Low	As above releases to Macleay Arm and Pacific Ocean, via the proposed dunal discharge are not expected to result in water quality impacts to consumers of aquatic foods. This is supported by the marine mixing modelling and evaluation of water quality data from the comparable South West Rocks STP dunal discharge, including consideration of bioaccumulative contaminants. Negative impacts are possible, but as above are expected to be short-lived and consequences relatively insignificant.

Health impact	Direction	Likelihood	Consequence (magnitude)	Overall impact assessment rating	Rationale / comments
Potential human health risk associated with direct contact with effluent disposal site	Negative	Possible	Insignificant	Low	The proposed dunal discharge area includes management controls to prevent people coming into contact with treated effluent prior to infiltration into the dune. This is to be achieved through the use of fencing and signage. However, it is possible that some people could come in direct contact with the treated effluent. This may contain water quality parameters above human health guideline values, such as recreational water quality guideline value, however the exposures to any contaminants would be expected to be short-lived and unlikely to cause significant short-term health implications.

7.5 Summary of health impact characterisation

The assessment phase of the HIA has characterised positive and negative health impacts associated with operational aspects of the SPSS project, included related to:

- low pressure sewerage collection system
- activities within the footprint of the WWTP
- effluent transfer and disposal.

The detailed health impact characterisation has been undertaken for the following modifiable determinants of health:

- air quality (including odour)
- noise and vibration
- water (excluding wastewater)
- wastewater.

Positive health impacts were rated as high to very high for odour and water/wastewater related to removal/decommissioning of the existing OSMSs in Stuarts Point. The removal of the OSMSs is expected to have a significant positive impact on human health for most of the community. Positive impacts associated with noise were rated as low. This is because noise associated with the existing OSMSs has not been identified as an issue of concern, hence limited potential for improvement due to removal/decommissioning of the OSMSs.

For all the modifiable health determinants the negative health impacts were characterised as low in relation to operation of the proposed SPSS. This was based on the design of the system, expected management controls and findings from the various relevant technical studies. There is some potential for insignificant to minor health impacts for odour, noise and water quality in discrete areas during atypical conditions. However, these are expected to be short-lived and limited to a small proportion of the community. Negative health impacts during these atypical events are likely to be related to aesthetics / amenity concerns, and minor, short-term pathogenic responses, rather than significant long-term health impacts.

Overall, the proposed SPSS project is expected to result in significant positive health outcomes / benefits for the community. This is consistent with the findings from the other technical studies and overall EIS.

8. Management

As noted in **Section 7.5** this HIA has concluded that the project would result in positive health impacts due to the removal of odour and water/wastewater related to removal/decommissioning of the existing OSMSs in the scheme area. It has also concluded that the identified negative health impacts were characterised as low in relation to operation of the project. This was based on the design of the system, expected management controls and findings from the various relevant technical studies.

There is some potential for insignificant to minor health impacts for odour, noise and water quality during atypical conditions. However, these are expected to be short-lived and limited to a small proportion of the community, and are likely to be related to aesthetics / amenity concerns, and minor, short-term pathogenic responses, rather than significant long-term health impacts.

The detailed assessments of air quality and odour, noise and vibration, and water quality prepared to inform the EIS (and also this HIA) have identified a number of environmental mitigation and management measures (in addition to the environmental management inherent to the project) that would mitigate the relevant environmental impacts, but would also mitigate the associated health impacts. The management measures tabulated in Section 8 of the EIS would address the identified potential aesthetics / amenity concerns and further reduce the risk of health impacts. The HIA has not identified the need for any additional mitigation and management measures to address potential health impacts.

9. Conclusions

A Health Impact Assessment (HIA) has been prepared for the project. The HIA has been undertaken as a technical study to support the overall EIS for the project. The HIA has been undertaken in accordance with the NSW Health (2007) and enHealth (2017) health impact assessment to meet the requirements SEARs in relation to Health and Public Safety.

The HIA has assessed both positive and negative health impacts associated with the project. This has been based on the removal/decommissioning of the existing OSMSs and establishment of a new sewerage scheme including low pressure sewerage collect, WWTP and dunal discharge for tertiary treated effluent. The HIA focussed on operational aspects of the project, including the following key components of the project:

- low pressure sewerage collection system
- activities within the footprint of the WWTP
- effluent transfer and disposal

This HIA has conducted a detailed assessment of the following priority modifiable health determinants:

- air quality (including odour)
- noise and vibration
- waste (excluding wastewater)
- wastewater.

These priority health determinants were identified from the EIS scoping and extensive community and stakeholder engagement activities undertaken as part of the EIS and SIA.

Positive health impacts were rated as high to very high for odour and water/wastewater related to removal/decommissioning of the existing OSMSs in Stuarts Point. The removal of the OSMSs is expected to have a significant positive impact on human health for most of the community. Positive impacts associated with noise were rated as low. This is because noise associated with the existing OSMSs has not been identified as an issue of concern, hence limited potential for improvement due to removal/decommissioning of the OSMSs.

For all of the modifiable health determinants the negative health impacts were characterised as low in relation to operation of the proposed SPSS. This was based on the design of the system, expected management controls and findings from the various relevant technical studies. There is some potential for insignificant to minor health impacts for odour, noise and water quality during atypical conditions. However, these are expected to be short-lived and limited to a small proportion of the community. Any negative health impacts during these atypical events are likely to be related to aesthetics / amenity concerns, and minor, short-term pathogenic responses, rather than significant long-term health impacts.

The SPSS project has been designed to incorporate controls to manage the potential negative health impacts to acceptable levels and to meet relevant standards / guidelines. The design and management controls have been informed by the various technical studies undertaken as part of the EIS. The main EIS report provides further details on the management and monitoring controls for the project.

Overall, the project is expected to result in significant positive health outcomes / benefits for the community. This is consistent with the findings from the other technical studies and overall EIS.

10. Limitations

Ramboll Australia Pty Ltd prepared this report in accordance with the scope of work as outlined by Kempsey Shire Council and in accordance with our understanding and interpretation of current regulatory standards.

In performing its assignment, Ramboll must rely upon publicly available information, information provided by the client and information provided by third parties. Accordingly, the conclusions in this report are valid only to the extent that the information provided to Ramboll was accurate and complete. This report is not intended as legal advice, nor is it an exhaustive review of site conditions or facility compliance. Ramboll makes no representations or warranties, express or implied, about the conditions of the site.

Ramboll's scope of work for this assignment did not include collecting samples of any environmental media. As such, this report cannot rule out the existence of latent conditions, and is intended, consistent with normal standards of practice and care, to assist the client in identifying the risks of such conditions.

Site conditions may change over time. This report is based on conditions encountered at the Site at the time of the report and Ramboll disclaims responsibility for any changes that may have occurred after this time.

The conclusions presented in this report represent Ramboll's professional judgment based on information made available during the course of this assignment and are true and correct to the best of Ramboll's knowledge as at the date of the assessment.

Ramboll did not independently verify all of the written or oral information provided to Ramboll during the course of this investigation. While Ramboll has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided to Ramboll was itself complete and accurate.

This report does not purport to give legal advice. This advice can only be given by qualified legal advisors.

10.1 User Reliance

This report has been prepared exclusively for Kempsey Shire Council and may not be relied upon by any other person or entity without Ramboll's express written permission.

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