Notice of Meeting

Water and Sewer Advisory Committee Meeting

A Water and Sewer Advisory Committee Meeting of Byron Shire Council will be held as follows:

Venue	**Conference Room, Station Street, Mullumbimby**
Date	**Thursday, 19 June 2025**
Time	**11:30 AM**

Phil Holloway
Director Infrastructure Services

I2025/867
Distributed 12/06/25

BYRON SHIRE COUNCIL

CONFLICT OF INTERESTS

What is a "Conflict of Interests" - A conflict of interests can be of two types:

Pecuniary - an interest that a person has in a matter because of a reasonable likelihood or expectation of appreciable financial gain or loss to the person or another person with whom the person is associated.

Non-pecuniary – a private or personal interest that a Council official has that does not amount to a pecuniary interest as defined in the Code of Conduct for Councillors (eg. A friendship, membership of an association, society or trade union or involvement or interest in an activity and may include an interest of a financial nature).

Remoteness – a person does not have a pecuniary interest in a matter if the interest is so remote or insignificant that it could not reasonably be regarded as likely to influence any decision the person might make in relation to a matter or if the interest is of a kind specified in the Code of Conduct for Councillors.

Who has a Pecuniary Interest? - a person has a pecuniary interest in a matter if the pecuniary interest is the interest of the person, or another person with whom the person is associated (see below).

Relatives, Partners - a person is taken to have a pecuniary interest in a matter if:

- The person's spouse or de facto partner or a relative of the person has a pecuniary interest in the matter, or
- The person, or a nominee, partners or employer of the person, is a member of a company or other body that has a pecuniary interest in the matter.

N.B. "Relative", in relation to a person means any of the following:

(a) the parent, grandparent, brother, sister, uncle, aunt, nephew, niece, lineal descends or adopted child of the person or of the person's spouse;

(b) the spouse or de facto partners of the person or of a person referred to in paragraph (a)

No Interest in the Matter - however, a person is not taken to have a pecuniary interest in a matter:

- If the person is unaware of the relevant pecuniary interest of the spouse, de facto partner, relative or company or other body, or
- Just because the person is a member of, or is employed by, the Council.
- Just because the person is a member of, or a delegate of the Council to, a company or other body that has a pecuniary interest in the matter provided that the person has no beneficial interest in any shares of the company or body.

Disclosure and participation in meetings

- A Councillor or a member of a Council Committee who has a pecuniary interest in any matter with which the Council is concerned and who is present at a meeting of the Council or Committee at which the matter is being considered must disclose the nature of the interest to the meeting as soon as practicable.
- The Councillor or member must not be present at, or in sight of, the meeting of the Council or Committee:

    (a) at any time during which the matter is being considered or discussed by the Council or Committee, or

(b) at any time during which the Council or Committee is voting on any question in relation to the matter.

No Knowledge - a person does not breach this Clause if the person did not know and could not reasonably be expected to have known that the matter under consideration at the meeting was a matter in which he or she had a pecuniary interest.

Non-pecuniary Interests - Must be disclosed in meetings.

There are a broad range of options available for managing conflicts & the option chosen will depend on an assessment of the circumstances of the matter, the nature of the interest and the significance of the issue being dealt with. Non-pecuniary conflicts of interests must be dealt with in at least one of the following ways:

- It may be appropriate that no action be taken where the potential for conflict is minimal. However, Councillors should consider providing an explanation of why they consider a conflict does not exist.
- Limit involvement if practical (eg. Participate in discussion but not in decision making or vice-versa). Care needs to be taken when exercising this option.
- Remove the source of the conflict (eg. Relinquishing or divesting the personal interest that creates the conflict)
- Have no involvement by absenting yourself from and not taking part in any debate or voting on the issue as of the provisions in the Code of Conduct (particularly if you have a significant non-pecuniary interest)

Committee members are reminded that they should declare and manage all conflicts of interest in respect of any matter on this Agenda, in accordance with the Code of Conduct.

RECORDING OF VOTING ON PLANNING MATTERS

Clause 375A of the Local Government Act 1993 – Recording of voting on planning matters

(1) In this section, **planning decision** means a decision made in the exercise of a function of a council under the Environmental Planning and Assessment Act 1979:

(a) including a decision relating to a development application, an environmental planning instrument, a development control plan or a development contribution plan under that Act, but
(b) not including the making of an order under that Act.

(2) The general manager is required to keep a register containing, for each planning decision made at a meeting of the council or a council committee, the names of the councillors who supported the decision and the names of any councillors who opposed (or are taken to have opposed) the decision.

(3) For the purpose of maintaining the register, a division is required to be called whenever a motion for a planning decision is put at a meeting of the council or a council committee.

(4) Each decision recorded in the register is to be described in the register or identified in a manner that enables the description to be obtained from another publicly available document and is to include the information required by the regulations.

(5) This section extends to a meeting that is closed to the public.

OATH AND AFFIRMATION FOR COUNCILLORS

Councillors are reminded of the oath of office or affirmation of office made at or before their first meeting of the council in accordance with Clause 233A of the Local Government Act 1993. This includes undertaking the duties of the office of councillor in the best interests of the people of Byron Shire and the Byron Shire Council and faithfully and impartially carrying out the functions, powers, authorities and discretions vested under the Act or any other Act to the best of one's ability and judgment.

BYRON SHIRE COUNCIL

BUSINESS OF MEETING

MINUTES FROM PREVIOUS MEETINGS

Report No. 3.1 Adoption of Minutes from Previous Meeting

Directorate: Infrastructure Services

File No: I2025/869

RECOMMENDATION:

That the minutes of the Water and Sewer Advisory Committee Meeting held on 17 April 2025 be confirmed.

Attachments:

1 Minutes 17/04/2025 Water and Sewer Advisory Committee, I2025/491 , page 9

Report

The attachment to this report provides the minutes of the Water and Sewer Advisory Committee Meeting of 17 April 2025 .

Report to Council

5 The minutes were reported to Council on 22 May 2025.

Comments

In accordance with the Committee Recommendations, Council resolved the following:

Report No. 14.2	**Report of the Water and Sewer Advisory Committee Meeting held on 17 April 2025**
File No:	I2025/631

25-192 **Resolved** that Council notes the minutes of the Water and Sewer Advisory Committee Meeting held on 17 April 2025. (Swain/Lyon)

25-193 **Resolved** that Council adopts the following Committee Recommendations:

Report No. 4.1 Integrated Planning and Reporting
File No: I2025/481

Committee Recommendation 4.1.1

That the Water and Sewer Advisory Committee:

1. Notes Council's Integrated Planning and Reporting Framework;

2. Notes Council's priorities as identified by Councillors for the 2025 – 2029 and Delivery Program. (Swain/Lyon)

25-194 **Resolved** that Council adopts the following Committee Recommendations:

Report No. 4.2 Mullumbimby water supply strategy - High-level project plan
File No: I2025/395

Committee Recommendation 4.2.1

1. That the Water and Sewer Advisory Committee notes the proposed project design

2. That the Committee provides feedback to staff on how to improve the project design, in alignment with:

   a) The aim of the project i.e. provide evidence-based recommendations for

Council to decide on a long-term water supply strategy for Mullumbimby

b) The need to provide best-value to ratepayers via sustainable and efficient water services provision

3. That Council keeps the WSAC informed of subsequent changes to the project design, including between WSAC meetings.

4. That Council considers in the project the investigations previously sought by the WSAC, and recorded in its Minutes for the meeting of 19 July 2024.

(Swain/Lyon)

Minutes of Meeting

Water and Sewer Advisory Committee Meeting

Venue	**Conference Room, Station Street, Mullumbimby**
Date	**Thursday, 17 April 2025**
Time	**11:30 AM**

BYRON SHIRE COUNCIL

BYRON SHIRE COUNCIL

WATER AND SEWER ADVISORY COMMITTEE MEETING MINUTES 17 APRIL 2025

Minutes of the Water and Sewer Advisory Committee Meeting held on Thursday, 17 April 2025

File No: I2025/491

PRESENT:

Councillors:	Cr S Ndiaye (Mayor)	Zoom
	Cr M Lyon	Zoom
	Cr E Hauge (Chair)	Present
Staff:	Christopher Soulsby (Acting Director Infrastructure Services)	Present
	Cameron Clark (Manager Utilities)	Present
	Pablo Orams (Integrated Water Management Officer)	Present
	Rachel Derbyshire (Project Liaison Officer)	Present
	Amber Evans Crane Corporate Planning & Improvement Officer)	Present
	Chloe Woods (Minute taker)	Present
Community	Duncan Dey	Present
	Ben Fawcett	Present
	Taisa Baars	Present

The Water and Sewer Advisory Committee voted Cr Hauge as Chair.

Cr Hauge (Chair) opened the meeting at 11:33 am and acknowledged that the meeting was being held on Bundjalung Country.

BYRON SHIRE COUNCIL

WATER AND SEWER ADVISORY COMMITTEE MEETING MINUTES 17 APRIL 2025

ATTENDANCE VIA AUDIO-VISUAL LINK:

Cr S Ndiaye (Mayor) and Cr Lyon attended via Zoom Link.

APOLOGIES:

An apology was received from Phillip Holloway (Director Infrastructure Services).

DECLARATIONS OF INTEREST – PECUNIARY AND NON-PECUNIARY

Ben Fawcett declared a non-pecuniary interest in Report 4.2. The nature of the interest being that Ben Fawcett's residence is less than 1km from Lavertys Gap Weir and 500m from the water treatment plant. Ben Fawcett elected to remain in the Meeting and will participate in discussion and the vote.

MINUTES FROM PREVIOUS MEETINGS

Report No. 3.1 **Adoption of minutes from Previous Meeting**
File No: I2025/480

Moved:

That the minutes of the Water and Sewer Advisory Committee Meeting held on 19 July 2024 be confirmed.

(Ndiaye/Fawcett)

Note: The minutes of the meeting held on 19 July 2024 were noted, and the Committee Recommendations adopted by Council, at the Ordinary Meeting held on 15 August 2024.

BYRON SHIRE COUNCIL

WATER AND SEWER ADVISORY COMMITTEE MEETING MINUTES 17 APRIL 2025

STAFF REPORTS - CORPORATE AND COMMUNITY SERVICES

Report No. 4.1 **Integrated Planning and Reporting**
File No: I2025/481

Committee Recommendation:

That the Water and Sewer Advisory Committee:

1. Notes Council's Integrated Planning and Reporting Framework;

2. Notes Council's priorities as identified by Councillors for the 2025 – 2029 and Delivery Program (Fawcett/Baars)

The recommendation was put to the vote and declared carried.

Cr Hauge left the meeting at 12:28 pm and returned to the meeting at 12:28 pm.

STAFF REPORTS - INFRASTRUCTURE SERVICES

Report No. 4.2 **Mullumbimby water supply strategy - High-level project plan**
File No: I2025/395

Committee Recommendation:

1. That the Water and Sewer Advisory Committee notes the proposed project design

2. That the Committee provides feedback to staff on how to improve the project design, in alignment with: -

a) The aim of the project i.e. provide evidence-based recommendations for Council to decide on a long-term water supply strategy for Mullumbimby

b) The need to provide best-value to ratepayers via sustainable and efficient water services provision

3. That Council keep the WSAC informed of subsequent changes to the project design, including between WSAC meetings.

4. That Council consider in the project the investigations previously sought by the WSAC, and recorded in its Minutes for the meeting of 19 July 2024.

(Dey/Hauge)

The recommendation was put to the vote and declared carried.

Rachel Derbyshire left the meeting at 12:45pm and did not return.

Report No. 4.3 **Byron STP Wetlands Monitoring Report**
File No: I2025/470

Committee Recommendation:

That the committee note the report. (Lyon/Hauge)

The recommendation was put to the vote and declared carried.

FOR INFORMATION ONLY

Report No. 6.1 **Infrastructure Services Utilities Monthly Status Report December 2024 - February 2025**
File No: I2025/434

Cr Lyon left the meeting 12:53 pm and did not return.
Quorum was lost at 12:53pm and the Chair, Cr Hauge, subsequently declared the meeting closed.

There being no further business the meeting concluded at 12:54 pm.

STAFF REPORTS - INFRASTRUCTURE SERVICES

Report No. 4.1 The Case for Implementing Digital Water Meters

Directorate: Infrastructure Services

Report Author: Pablo Orams, Integrated Water Management Officer

File No: I2025/855

Summary:

This report aims to brief the WSAC on the investigations done by Council staff to assess the potential benefits and feasibility of adopting Digital Water Metering (DWM) across the Shire's water supply network. It also provides key recommendations and a tentative plan/budget for its implementation. Staff hopes to gain feedback from the WSAC to identify further opportunities and/or challenges related to this proposal.

RECOMMENDATION:

That the Water and Sewer Advisory Committee: -

1. **Notes the report and attached supporting documentation.**
2. **Provides staff with feedback regarding:**
   a) **The appetite of Council and the community to adopt Digital Water Metering;**
   b) **The information presented in this report (e.g. the benefits of DWM, recommendations for implementation, etc); and**
   c) **Any knowledge gaps that staff may need to explore before presenting a project proposal to Council.**

Attachments:

1 Report 16/10/2024 Executive Team Meeting (Operational) Digital Water Metering Pilot - Outcomes and Recommendations, I2024/1130 , page 26
2 Conceptual diagram - Digital Water Metering system governance and architecture, E2024/93422 , page 58
3 WSAA Digital Metering State of Play Summary Report, E2024/84547 , page 59
4 Water Directorate 2021 Digital Metering Guidelines, E2024/84550 , page 66
5 Report 04/12/2024 Executive Team Meeting (Operational) Preliminary implemetation plan - Digital water metering, I2024/1436 , page 116
6 Digital Water Metering Project - Proposed 30-year budget - 28 May 2025, E2025/57655 , page 124

Report

1. Purpose

To brief the WSAC on the investigations done by Council staff to assess the potential benefits and feasibility of adopting Digital Water Metering (DWM) across the Shire's water supply network. This report includes a tentative implementation plan and budget, funding strategy and other recommendations. Staff hopes to gain feedback from the WSAC to refine this project plan moving forward.

2. Background

Driven by the dry weather conditions leading up to 2019, Byron Shire Council conducted a DWM pilot project between 2020 and 2023. It involved the installation of 355 digital meters in East Mullumbimby (residential connections) and 31 in Byron Bay Recycled Water Scheme (municipal and commercial connections), testing the viability of a full-scale rollout, and the capabilities of the technology to address water security challenges, improve customer engagement and drive efficiencies in water services operations and planning.

The pilot provided valuable insights that highlight the strong potential of DWM, as well as the capabilities and resources required by Council to implement, operate and maintain a DWM system. The full pilot report is available in **Attachment 1**, and has served as the basis to design a roadmap for the adoption of DMW in Byron Shire.

3. What is DWM, and why is it important

DWM involves collecting and analysing near real-time water consumption data through a combination of automated remote reading devices (i.e. digital water meters), telecommunication networks, and data management and analytics software. **Attachment 2** provides a conceptual diagram that outlines the key elements of a DWM system and how it may integrate with Council's management systems.

The potential benefits of this technology are extensive, driving efficiencies across the potable water service supply chain. A good way to understand these benefits is to first look at the limitations of the traditional water consumption monitoring method based on analogue water meters. This is the approach currently used by Byron Shire Council, as well as most Councils and water utilities globally.

Figure 1 – A typical analogue water meter used in Byron Shire (left) and a digital water meter used during Council's DWM pilot project (Right).

3.1. Analogue water metering (and its limitations)

In Byron Shire, a property connected to the water supply network will typically have an analogue water meter installed at the property boundary, between the water supply main and the property's internal water plumbing. The meters are designed to record the volume of water (e.g. kilolitres) flowing into such property.

Water consumption data is collected by manually opening the meter's casing and visually reading its dials. Meter reads are typically done by a contractor once every three months (at a cost of over $80,000/year), in alignment with the standard quarterly water billing cycle.

Collected data is then stored and handled by Council's Water Billing team using a combination of Excel spreadsheets and other dedicated software (e.g. Authority). This data serves as the "point of truth" from which Council derives water bills, and inform operational, planning and investment decisions to improve water service delivery (e.g. demand management, infrastructure upgrades, etc.).

Despite the importance of water consumption data for Council, there are two fundamental limitations with obtaining it via an analogue water metering system: low **data resolution** and limited **data accessibility**.

Data resolution is only as good as how often meter reads are done over a period. The quarterly meter reading cycle (i.e. four data points per year) means that Council can only know the total water consumed over three months (see **Figure 2 below**), but has no visibility over how consumption changes within this time.

This is particularly problematic when dealing with issues such as water leaks, as these are very difficult to identify and quantify using a quarterly meter read. Leaks can go unnoticed for years, and their impact on water bills can be substantial. In some cases, leaks have been known to waste over $250 of drinking water per day. The same goes for instances of water theft, irregular water connections, faulty water meters, etc.

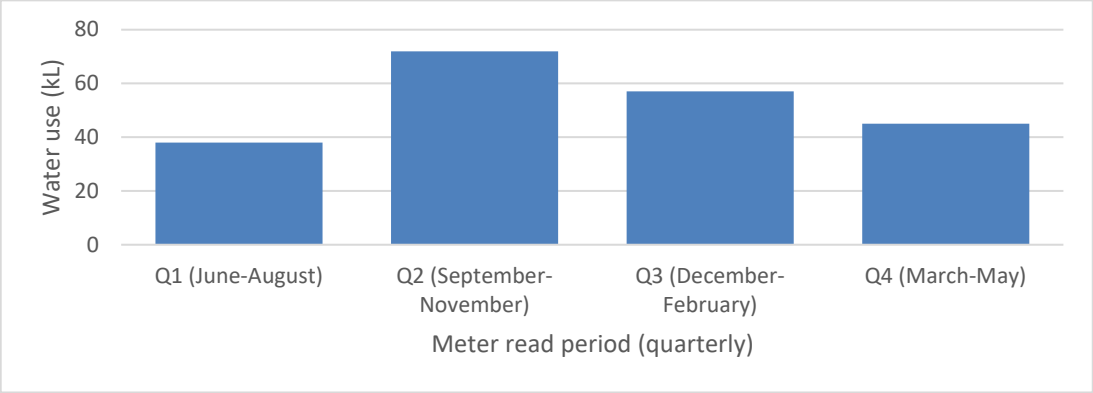


Figure 2 – Hypothetical example of a typical residential property's water consumption data obtained via quarterly meter reads. This level of data resolution does not allow for the prompt identification of water leaks and another water use anomalies.

Similarly, **data accessibility** is limited by the manual nature of data collection, handling and quality control. During the quarterly meter reading process, it typically takes three weeks from the moment a meter is read to when the data is available in Council's system (i.e. Authority). This lag time, combined with the low resolution of the data, means that Council staff and water users typically rely on outdated water consumption data to inform decisions.

3.2. The benefits of DWM

Contrarywise to analogue water metering, DWM can collect water flow data as frequently as every 15-to-60 minutes (high resolution), an allow for near real-time access to it via a dedicated user interface software (high accessibility). **Figure 3** below provides an example how this data may be displayed.

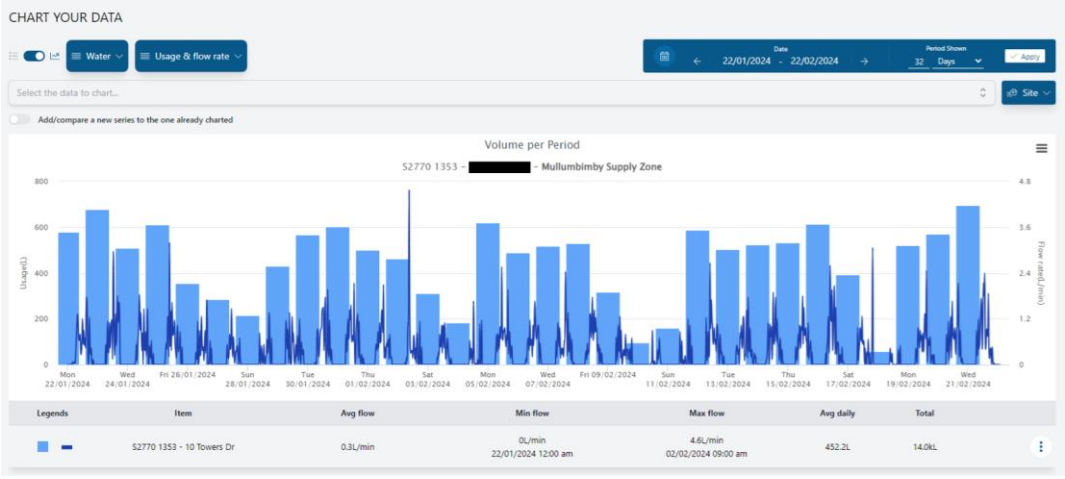


Figure 3 – Example of digital meter data in the UtiliOS SaaS user portal. The light blue bars show daily total consumption. The dark blue line shows flow rate in 30min intervals.

Analytics can be applied to this data to discover and interpret water use patterns/anomalies, and streamline decision-making. For example, a DWM system can be set up to identify water leaks based on water flow patterns (e.g. a constant water flow during the night may be an indication of a leak) and notify Council staff and/or property owners immediately.

More broadly, DWM can drive efficiencies across Council's water services supply chain, delivering benefits for customers, Council and the environment, as summarised in the table below:

Benefits of DWM…	
…for customers	Improves water literacy and awareness
	Prompt detection and notification of water leaks
	Improves customer user experience
	Supports behaviour change
…for Council	Reduces non-revenue water
	Reduces cost of bulk water purchases, and improves water billing revenue
	Detects irregular water uses (e.g. water theft)
	Improves understanding of water demand
	Supports demand management efforts (e.g. during droughts)
	Improves operational efficiency and asset performance
	Improves water monitoring and modelling capabilities (e.g. water balance monitoring) at different scales
	Reduces low-value labour requirements associated with analogue water meter (manual meter reads, data handling, administration, etc).
	Defer water system capacity upgrades
	Reduces occupational health & safety risks
	Improves billing accuracy and streamlines billing processes
	Enhances transparency and engagement with stakeholders (e.g. customer disputes)
	Supports compliance efforts (e.g. liquid trade waste, water restrictions)
…for the environment	Reduces of water losses
	Reduces water demand
	Improves energy efficiency of water services, reducing GHG emissions
	Improves resilience to climate uncertainty
	Enhances collaboration across the water sector institutions

From the perspective of Council's Community Strategic Plan, DWM has the potential support many of its objectives. This has been articulated in **Section 5** of **Attachment 1.**

3.3. DWM in Australia

Councils and water utilities across Australia are increasingly moving towards the adoption of DWM.

As observed by the Water Services Association of Australia (WSAA) in their 2022 *Digital Metering State of Play Summary Report* (see **Attachment 3**)**,** 61% of utilities and councils

participating in the study are trialling digital metering, and 23% are rolling out the technology. Some examples include:

- City of Gold Coast - QLD
- Goulburn Valley Water - VIC
- SAWater - SA
- South East Water - VIC
- Sydney Water - NSW
- Toowoomba Regional Council - QLD
- Unity Water - QLD
- Water Corporation - WA

A more recent example is Rous County Council (RCC), which since 2024 has rolled out DWM for the majority of its 2,000+ direct water customers. Using the “My Rous” app, customers have access to timely data from their meters, and customisable updates and alerts about water usage and leakage detection. BSC has been engaging closely with RCC to learn from this experience and explore opportunities for synergies between both organisations.

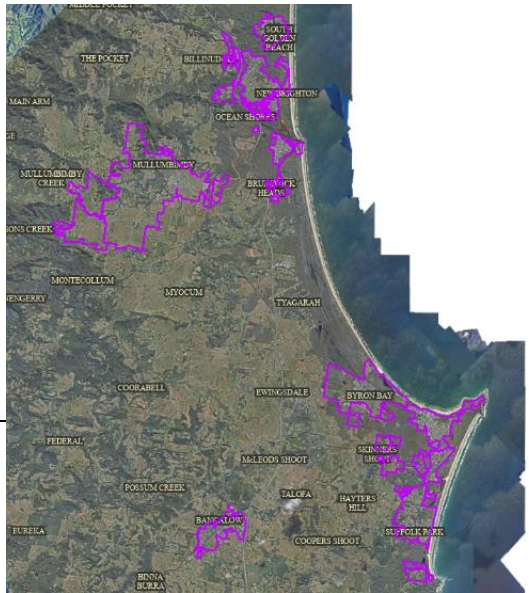
Progress has also been achieved in understanding the business case behind DWM, and providing water utilities and councils with guidance to advance it. For example, the NSW Water Directorate released its 2021 *Digital Metering Guidelines* (see **Attachment 4**), which provides a framework to assess and understand the costs and benefits of DWM.

4. How could it be implemented, and what is required

Key recommendations for a Shire-wide rollout of a DWM system are summarized in this section. These are informed by the lessons learnt from Council’s DWM pilot project (see **Attachment 1**), consultation across various Council departments (including Finance and the Executive Team - see **Attachment 5**), ongoing discussions with RCC and information obtained from potential DWM service providers.

4.1. A staged rollout

Byron Shire’s water supply network is inherently complex and fragmented across a large area. It comprises over rateable 13,000 water connections distributed across 20 water supply catchments (see **Figure 4**) of varying size and on-ground characteristics.



It is recommended that DWM installations tackle one water supply catchment at a time, ensuring

consistency and efficiency in the installation process and community engagement efforts. Also, once a supply catchment has been implemented, the full benefits of DWM can be immediately applied to that area.

A five-year timeframe (four water supply catchments per year) is being proposed (see **Section 4.2.** below).

Figure 1 – Byron Shire's 20 water supply catchments

4.2. Implementation plan and budget

Staff proposes a multi-stage implementation plan spanning 30 years. Capital and operational costs (i.e. Capex and Opex) have been estimated for each project stage. The costs presented below have been updated from previous estimates (shown in **Attachments 1** and **5**) as staff's understanding of the nuances of DWM progresses. A working spreadsheet with the most recent costing estimates is available in **Attachment 6**.

i. **Stage 1 – Planning, consultation and due diligence (Year 0):** This is aimed at ensuring Council's readiness to move into the implementation stage, reviewing the project plan and budget, and undergoing the necessary consultation and approval processes.

ii. **Stage 2 – System implementation (Years 1 to 5):** This stage involves the full-scale transition of Council's water supply network to a DWM System, tackling 4 water supply catchments per year.

iii. **Stage 3 – Ongoing system operation, maintenance and expansion (Years 6 to 30):** This involves the ongoing management of a stablished DWM system, including its expansion in alignment with future development.

Cost (Net Present Value)	**Stage 1** *Planning, consultation, due diligence* (Year 0)	**Stage 2** *Implementation* (Year 1 - 5)	**Stage 3** *Ongoing operation, maintenance, expansion* (Year 6 - 30)
Capex	$0.3 MM	$6.9 MM	$11.2 MM
Opex	-	$2.3 MM	$17.4 MM
Total	**$0.3 MM**	**$9.2 MM**	**$28.5 MM**

4.3. Human resources

Implementing a DWM System represents a fundamental change in how Council will govern water use consumption monitoring and related processes (e.g. water billing, leak detection, operations, planning, etc.).

There would be a shift from the current manual collection and handling of low-resolution water consumption data, to an on-demand, high-resolution and data-rich system with comprehensive analytics capabilities. While this will greatly reduce resources invested in low value-add manual tasks, it will increase resourcing requirements for system administration, cross-departmental coordination and high-value decision making.

It is also expected that interactions with customers will increase as DWM unveils leaks and other issues shortly after they happen, rather than being identified (if at all) through quarterly manual meter reads.

Additional roles (subject to further consideration and organisational requirements) are proposed to cater for these changes, and have been included in the cost estimates presented in **Section 4.2**. These roles include:

i. **DWM Rollout Project Manager (1 FTE for 5 years, Grade 11, Skill step 3)**. This will be a fixed-term contract to oversee project implementation.

ii. **DWM System Coordinator position (1 FTE, Grade 6, Skill step 3)** within Utilities' Systems Planning Team. This position will be responsible for coordinating the on-going operation and maintenance of the system, including technical support to the various departments using it.

iii. **Support officer - Water Billing and Revenue (1 FTE, Grade 5, Skill step 3)**. This position will increase the capacity of the Water Billing and Revenue team to manage increased requirements for system administration and customer interactions.

5. Other considerations

5.1. Community acceptance and expectations

During Council's DMW pilot project, community consultation results showed basic understanding of DWM, with benefits recognised for leak detection but concerns over costs, electro-magnetic radiation from the devices, and data privacy. Residents were interested in a detailed business case and the possibility of having an opt-in/opt-out option. There was minimal resistance to digital meter installations. Recommendations for a full-scale rollout include dedicating sufficient resources for a communication and community engagement strategy, considering an opt-in/out policy and assessing viability of providing direct water use data access to customers.

5.2. "Smart" or "Digital" water meters

During the pilot project, Council initially used the term "smart water meters". This seems to suggest that the devices have "smart" capabilities such as a smartphones or laptops. This is partly true from the perspective of their connectivity capabilities (e.g. send the information they collect to a 'cloud' or server to be processed), but differently to smartphones and other smart devices, they don't have computing or artificial intelligence capabilities to process data and/or perform complex tasks and decisions on their own.

To avoid any confusion regarding the capabilities and role of these devices, staff recommends Council adopts the term "digital water meters" instead. This issue should be further assessed when developing a communications plan for a full-scale rollout of the technology.

6. Final comments

DWM is an innovative technology for water consumption monitoring that can offers extensive benefits for rate payers, Council decision-making capabilities and the environment.

Council staff have undertaken extensive investigations, including a DWM pilot, providing valuable insights, lessons learnt and recommendations to progress the adoption of DWM.

Adopting DWM represents a paradigm shift in the management of water services, and will require careful planning, change management and resourcing.

There is wide-spread support from staff across Council departments, including the Executive Team, and the Australian water sector is progressively moving towards the mainstreaming of DWM.

Staff commit to continue with the development of this proposal, and engage closely with the WSAC and Council to ensure it is adequately considered.

Strategic Considerations

Community Strategic Plan and Operational Plan

CSP Objective	CSP Strategy	DP Action	Code	OP Activity
5: Connected Infrastructure	5.5: Provide continuous and sustainable water and sewerage management	5.5.1: Water supply - Provide a continuous water supply that is maintained in accordance with NSW Health guidelines	5.5.1.1	Continue to maintain Council's water and sewer assets

Recent Resolutions

Not Applicable

Legal/Statutory/Policy Considerations

Not Applicable

Financial Considerations

Various possible funding options have been identified following consultation with relevant Council staff. A high-level funding strategy for each stage of the project is provided below.

It is important to note that defining the mix and magnitude of these options will require further work and consultation with Council's Financial Services department.

Potential funding stream	**Stage 1** *Planning, consultation, due diligence* (Year 0)	**Stage 2** *Implementation* (Year 1 - 5)	**Stage 3** *Ongoing operation, maintenance, expansion* (Year 6 - 30)
Council's Water Fund	X		
Government grants (if available)	X	X	
Loan borrowing		X	
Cost savings / revenue increases		X	X
Developer contributions		X	X
Water access charge increase			X

Loan borrowing is likely to be the main source of funding for system implementation. Council's borrowing capacity for this project is to be defined in alignment with Council's 30-year long term financial plan.

Government funding may be available. In the past, the Australian and NSW governments have offered co-funding programs to regional water utilities and Councils to undertake projects to improve water security outcomes. These include the *Water Smart Australia program*[1] and the *Safe and Secure Water program*[2]. However, these are not currently available. Council will need to actively engage with government counterparts (e.g. DCCEEW) to identify any future funding opportunities.

Cost savings / revenue increases are a result of the efficiency gained as DWM implementation progresses. These can be used to subsidise the implementation of digital meters, and may include:

- the wind-down of manual meter reading costs, mechanical meter replacements and the current water billing system (MVRS).
- Reduction of non-revenue water (e.g. leakage), hence reducing bulk water costs paid to RCC.
- Increased water billing revenue
- Other efficiency gains such as reducing staff time spent on low-value manual tasks (e.g. data handling) or reactive maintenance of assets (e.g. water main bursts that could have been predicted if digital pressure monitoring devices were in place).

As described in **Section 3.2**, there are many other benefits to DWM that could translate into cost efficiencies. Quantifying them monetarily would require advance economic analysis. Ongoing engagement with Council's Financial Services department will be required to better understand and untap these subsidies.

[1] Water Smart Australia - DCCEEW
[2] Safe and Secure Water program | NSW Government Water

Developer contributions could also subsidise the project. By driving water supply efficiencies through DWM (e.g. reducing non-revenue water), water systems asset renewals and capacity upgrades will be deferred. DWM benefits will translate to higher levels of service to ratepayers. Council may decide to pass some of the costs to achieve these gains to developers, as value-for-money to the community is increased. Additionally, the cost of supplying and installing DWM for new developments will be passed on to developers, similarly to what is currently done with analogue water meters.

Water access charge increase will be required to sustain the DWM system into the future. It is considered this will happen only once the system is fully stablished (from Year 6 onwards) and ratepayer benefit from the increased levels of service DWM can offer.

Rough estimates indicate that an **average annual charge increase between $18 and $40** per rateable water connection could be sufficient to cover remaining project cost. This is after project subsidies via cost savings and developer contributions have been realised, and will depend on the level of external funding and loan borrowing obtained.

BYRON SHIRE COUNCIL

Report No. 4.1 Digital Water Metering Pilot - Outcomes and Recommendations

Directorate: Infrastructure Services

Report Author: Pablo Orams, Integrated Water Management Officer

File No: I2024/1130

Executive summary:

Driven by the dry weather conditions leading up to 2019, Byron Shire Council conducted a Digital Water Metering pilot project between 2020 and 2023. It involved the installation of 355 digital meters in East Mullumbimby (residential connections) and 31 in Byron Bay Recycled Water Scheme (municipal and commercial connections), testing the viability of a full-scale rollout, and the capabilities of the technology to address water security challenges, improve customer engagement and drive efficiencies in water services operations and planning.

Digital Water Metering involves collecting and analysing near real-time water consumption data through automated remote reading devices. The benefits of this technology are extensive, driving efficiencies across the potable water supply chain (see **Section 1.1**).

Attachment 9 provides a conceptual diagram that explains how Digital Water Metering works, and how it could integrate into Council's systems and processes (e.g. water billing, operations, planning, etc.)

The pilot provided valuable insights that highlight the strong potential of Digital Water Metering, as well as the gaps in Council's capabilities to adopt and operate a Digital Water Metering system. Outcomes were assessed against the performance metrics defined by the pilot's working group in 2020 (see **Attachment 3**) and are summarised below together with high-level recommendations for undertaking a full-scale rollout:

- **Metric 1: Community acceptance / expectations**
  Community consultation results showed basic understanding of digital water meters, with benefits recognised for leak detection but concerns over costs, electro-magnetic radiation from the devices, and data privacy. Residents sought a detailed business case and an opt-in/opt-out option. There was minimal resistance to digital meter installations. Recommendations for a full-scale rollout include dedicating sufficient resources for a communication and community engagement strategy, considering an opt-in/out policy and assessing viability of providing direct water use data access to customers.

- **Metric 2: Ensure sufficient resources to carry out the work**
  Feedback from Council's Water Operations and Billing teams identified issues in internal consultation and coordination during the pilot, leading to inefficiencies and budget overruns. Effective in-house project leadership is recommended for the full-scale rollout.

  While the installation of digital meters was straightforward, inadequate record-keeping created confusion in data interpretation, impeding decision support. Establishing strong meter installation procedures is crucial for the full-scale rollout.

  By 2023, 16% of devices faced issues such as offline status or malfunctioning due to various factors, including damage and server problems. The pilot used outdated, low-cost devices; future selections should prioritise quality over cost.

  Data was transmitted to a vendor-operated cloud database via Telstra's NB-IoT (Narrowband Internet of Things) network, with Byron Bay coverage being excellent. Initial data analysis using an in-house Excel system was inefficient, but a trial of a third-party data portal (e.g. UtiliOS SaaS) showed superior analytics and visualisation capabilities.

  The pilot did not test integration with Council's existing systems (e.g. billing). This is a critical area for the full-scale rollout. Additionally, cybersecurity concerns were noted due to third-party data management. It is essential to assess data management providers for cybersecurity during tendering.

  Good planning, capacity building, and governance are essential for leveraging the potential of Digital Water Metering.

- **Metric 3: Cost of full-scale rollout**
  The estimated cost of a full-scale rollout (approx. 13,070 connections) is summarised below, including capital / upfront expenditure and ongoing annual costs and benefits. It shows a clear business case in support of Digital Water Metering (i.e. benefit-cost ratio > 1). See **Attachment 7** for more details.

	Total	Per water connection
Capital / upfront costs	$6,091,567	$ 466
Ongoing annual costs	$ 746,909 / year	$ 57 / year
Ongoing annual benefits*	$ 873,904 / year	$ 67 / year
Net annual benefit-cost*	$ 126,994 / year	$ 10 / year
Benefit-cost ratio*	1.17	

  * Only includes benefits which could be quantified monetarily based on available information.
  Note: This budget has not considered inflation.

- **Metric 4: Understanding the analytics options**
  Digital water meters provide flow rate and volume data every 30 minutes, improving decision support over quarterly manual reads. The UtiliOS SaaS data portal maximises value by automating analysis and management. Key features include network monitoring, leak detection, high usage identification, anomaly detection, usage comparison, meter status tracking, alarms, geospatial visualisation, and data

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

exports. These tools can enhance water supply management if aligned with strategic goals, governance, and sufficient resources.

- **Metric 5: Readiness**
  Council's readiness for a full-scale rollout of digital meters involves several key perspectives. Integrating workflows and systems remains the major challenge, as the pilot did not integrate digital metering into Council systems due to inadequate consultation and coordination. Despite this, both the Water Billing and Utilities teams support digital metering for its efficiencies. Community scepticism requires improved communication of benefits, aligned with the Community Strategic Plan 2032 (see **Section 5**). The necessary telecommunications infrastructure is in place, and there is regional momentum for digital metering. Council's current water billing system is outdated and technical support for the technology is no longer available, posing a risk to Council's water billing integrity. Digital metering offers a robust alternative, but it will require staff resourcing and upskilling and strong leadership for its successful implementation.

- **Metric 6: Vendor risk**
  Vendor risk involves the capacity and performance of vendors in handling data and providing technical support. These risks should be assessed at the tendering stage with the IT department's input. Using NB-IoT for data transmission removes the need for vendor-operated telemetry infrastructure, allowing for easier vendor transitions. Contractual terms should ensure the transferability of historical data collected by digital meters to new vendors.

- **Other considerations: Health and safety**
  Digital water meters are as safe as traditional analogue meters, but concerns have arisen regarding electro-magnetic radiation. To address these, communications should be evidence-based, clarifying that digital meters transmit intermittently (once daily, early morning), use low power (less than 1G technology), and are located away from houses, significantly reducing radiation exposure. During the pilot, community members could opt out of installations. A clear Digital Water Metering uptake policy will be needed.

Recommendations for Full-Scale Implementation of Digital Water Metering

1. Staged Rollout

A gradual rollout is recommended due to:

- **Network Complexity:** Byron Shire's extensive and varied water supply network necessitates starting with simpler areas like Bangalow or Ocean Shores to streamline installation and community engagement.

- **Transition Management:** Phased implementation helps staff and the community adapt smoothly and allows for prioritising other capital investments.

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

2. Rollout Budget (see **Attachment 7**)

- **Cost Overview:** A total upfront expenditure of $6.1 million spread across 5 years. Ongoing annual costs increase gradually until reaching $747k /year in year 5 once system has been fully implemented.
- **Benefits:** Positive net benefits begin in year 6 ($127k /year), as the advantages of digital metering surpass ongoing costs.

	PLANNING	IMPLEMENTATION					ONGOING OPERATION				
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10+**
Capital costs	- 150,000	-1,382,993	-1,139,643	-1,139,643	-1,139,643	-1,139,643					
Ongoing costs		-213,800	-348,332	-480,355	-613,632	-746,909	-746,909	-746,909	-746,909	-746,909	-746,909
Total costs	**-150,000**	**-1,596,794**	**-1,487,976**	**-1,619,998**	**-1,753,275**	**-1,886,553**	**-746,909**	**-746,909**	**-746,909**	**-746,909**	**-746,909**
Ongoing benefits*		**174,781**	**349,562**	**524,342**	**699,123**	**873,904**	**873,904**	**873,904**	**873,904**	**873,904**	**873,904**
Net benefit-cost*	**-150,000**	**-1,422,013**	**-1,138,414**	**-1,095,656**	**-1,054,152**	**-1,012,649**	**126,994**	**126,994**	**126,994**	**126,994**	**126,994**

* Only includes benefits which could be quantified monetarily based on available information.
Note: This budget has not considered inflation.

- **Cost recovery:** Project upfront and ongoing costs may be recovered via rate increases, external funding and/or the monetisation of the project benefits over time. For example, a rate increase of $94/year/connection alone could achieve full cost-recovery in a 10-year timeframe. A comprehensive cost-recovery strategy needs to be developed in consultation with Council's Finance department.

3. High-Level Implementation Plan

- **Consultation and Approval:** Present the plan to Council's Executive Team and Water and Sewer Advisory Committee. Community consultation may be required to refine the project scope.
- **Planning and Procurement:** Appoint a full-time Project Manager for the rollout (5-year fixed contract) and a Digital Water Metering coordinator for the ongoing operation of the system (additional 0.6 FTE), and form a working group representing relevant Council departments. Develop a digital water meter policy and prepare detailed system specifications. Secure funding and follow procurement guidelines.
- **Delivery:** Manage the project in-house for better control, ensure high-quality meter installations, prioritise quality over cost, integrate systems effectively, and allocate resources for thorough communication and stakeholder engagement efforts.

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

RECOMMENDATION:

That the Executive Team:

1. Notes the outcomes of the Digital Water Metering Pilot

2. Considers the recommendation from staff to implement a Shire-wide Digital Water Metering System, based on:

a) The emergence of Digital Water Metering as best practice in the region.

b) The lessons learnt from the pilot project presented in this report.

c) The Benefit-Cost assessment for a Shire-wide implementation, as presented in Attachment 7 (E2024/92705).

d) It's potential to support Council's Strategic Community Plan objectives (see Section 5).

Attachments:

1 WSAA 2022 Digital Metering State of Play Summary Report, E2024/84547
2 Water Directorate 2021 Digital Metering Guidelines, E2024/84550
3 Report 20/05/2020 Executive Team Meeting (Operational) Smart Water Meter Reading Pilot Project Update, I2020/695
4 Report 25/05/2022 Your Say Detailed Project Report Smart Water Meter Pilot, E2022/48821
5 Smart Water Meter Pilot Project Community Survey, E2022/48831
6 Memo - Smart Water Meter Pilot Project - Request for Approval of Tender, E2020/70642
7 Digital Water Metering pilot – Budget estimations for a full-scale implementation, E2024/93415
8 2022 Community Engagement Strategy - Byron Shire Council, E2023/12961
9 Conceptual diagram - Digital Water Metering system governance and architecture, E2024/93422

BYRON SHIRE COUNCIL

REPORTS - INFRASTRUCTURE SERVICES 4.1

Report

Table of contents

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

1. Background

Byron Shire Council carried a Digital Water Metering pilot between 2020 and 2023. It involved the installation of digital meters in two study areas:

- East Mullumbimby – potable water connections (commercial and residential)
- Byron Bay – connections within the Byron Bay Urban Recycled Water Scheme – BBURWS (commercial and municipal).

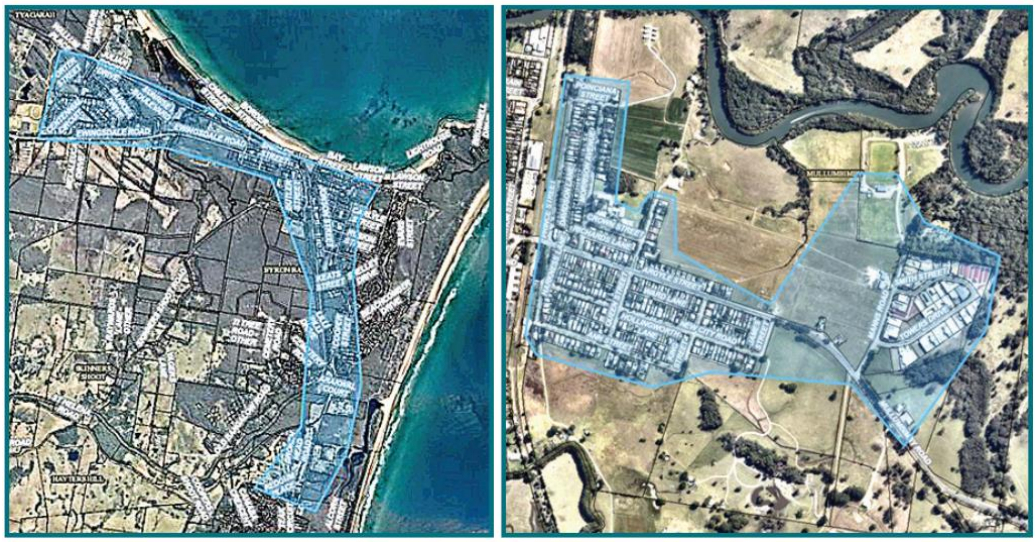


Figure 1 - Pilot study areas: Byron Bay Urban Recycled Water Scheme (left) and East Mullumbimby potable water supply catchment (right).

This pilot project was initially driven by the dry weather conditions experienced in the region during the years leading to 2019, which resulted in water restrictions and incidences of water theft, heightening the need for better understanding (and reducing) water consumption. With more extreme weather predicted in the future, population growth in the Byron Shire area and finite drinking water sources, water security is of key concern. Approaches such as Digital Water Metering can offer valuable decision-making capabilities in this context.

1.1. Why digital water meters?

Digital Water Metering is typically the collection and analysis of near real-time water consumption data obtained via automated remote reading devices. Digital Water Metering can help communities better manage their water supplies, respond to issues efficiently and avoid bill shock.

One of the main benefits of digital metering is the quick detection of leaks (normally 1-2 days after they first occur). This allows for immediate notification to customers, who would otherwise find out about a leak in their quarterly bill. In some cases, leaks can go

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

unnoticed in the quarterly bill and remain un-repaired for years (e.g. leaking washers may not be picked up as a significant increase in consumption in quarterly reports, but, overtime, can result in bill increases 100 times greater than the cost to repair the leak).

Even when customers know about a leak it can be hard to visualise its cost implications. Digital metering allows for half-hourly (or shorter) monitoring data resolution that can help Council and customers understand these implications promptly and transparently (e.g. “Monitoring results indicate you have a 45 litre per hour leak that will cost over $1,100 per year if not repaired”).

More broadly, Digital Water Metering can assist Council with:

- Improved accuracy of water billing.
- Reducing labour requirements associated with manual meter reads.
- Understanding detailed consumption patterns.
- Customer dispute management.
- Operations management and infrastructure planning.
- Integrating water and energy use metrics .
- Demand management (e.g. during drought periods).
- Commercial compliance (e.g. liquid trade waste).
- Bulk water balance monitoring and modelling.

From the perspective of Council’s Community Strategic Plan, Digital Water Metering has the potential support many of its objectives. This has been articulated in **Section 5**.

1.2. Digital Water Metering in Australia

Councils and utilities across Australia are increasingly moving towards the adoption of Digital Water Metering.

As observed by in 2022 by Water Services Association of Australia in their *Digital Metering State of Play Summary Report* (see **Attachment 1**), 61% of utilities and councils participating in the study are trialling digital metering, and 23% are rolling out the technology. Some examples include:

- City of Gold Coast - QLD
- Goulburn Valley Water - VIC
- SAWater - SA
- South East Water - VIC
- Sydney Water - NSW
- Toowoomba Regional Council - QLD
- Unity Water - QLD
- Water Corporation - WA

A more recent example is Rous County Council (RCC). Starting in February 2024, RCC is rolling out digital water meters for the majority of its 2,132 direct water customers. Using the “My Rous” app, customers will also gain access to timely data from their meters, and customisable updates and alerts about water usage and leakage detection.

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

Progress has also been achieved in understanding the business case behind Digital Water Metering, and providing utilities and councils with guidance to advance it. For example, the NSW Water Directorate released its 2021 *Digital Metering Guidelines* (see **Attachment 2**), which provides a framework to assess and understand the costs and benefits digital metering. **Section 3.3.3** of this report applies this framework to estimate the costs and benefits of implementing a Digital Water Metering system in Byron Shire.

2. Pilot objectives and performance tracking

The pilot was proposed to gauge the viability of a full-scale rollout of Digital Water Metering with regards to:

- **Cost** of a full-scale rollout.
- Required **governance** and **policy** changes to sustainably implement and manage a digital metering system.
- The **impact** on **stakeholders**, both internal (e.g. billing, IT, water operations, etc) and external (e.g. water customers, contractors, etc.).
- How and when the **public** would access digital metering data.

Additionally, in April 2020 an internal working group, endorse by the Council's Executive Team met and developed a set of performance metrics for the pilot (see table below and **Attachment 3**). These metrics are presented below. **Section 3** uses this framework to describe the pilot outcomes and draw recommendations to inform a full-scale roll out of Digital Water Metering.

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

Metric	What will be measured?	How will this be measured?
Community acceptance / expectations	Positive and Negative comments	Information collected from Project Page on have-your-say
Ensure sufficient resources to carry out the work (field work, administration, IT, rates)	- Qualitative assessment of resource available for customer services/rates staff - Quantitative assessment of field staff resource requirements	- feedback from other staff via regular meetings and feedback during trial - Cost measurement of field work (installations),
Cost of a full roll out	- Capital Cost - Ongoing Cost	To be provided by the successful pilot project contractor
Understanding the analytics options	- Qualitative assessment of analytics options	- feedback from other staff via regular meetings and feedback during trial
Readiness - **Customer service** - **Rates** - **IT** - **Utilities Operations**	- Qualitative assessment of analytics options - new procedures identified - policy changes identified	- feedback from other staff via regular meetings and feedback during trial
Vendor Risk	- What risks to Council in the case of poor vendor performance / cease of trading of the vendor	- Information provided by Tenderers - Financial Assessment of preferred tenderer

3. Pilot outcomes

3.1. A note on the COVID pandemic

The bulk of the pilot was delivered during 2020 – 2022, in the thick of the Covid pandemic. Project delivery was substantially impacted. This included supply chain issues delaying procurement of hardware, and restrictions (State borders, lock downs, social distancing, etc) hindering availability of contractors, in-the-field work and overall engagement across stakeholders.

The outcomes presented below should be assessed within this context.

3.2. "Smart" or "Digital" meters

The pilot initially used the term "smart water meters". This seems to suggest that the devices have "smart" capabilities such as a smartphones or laptops. This is partly true from the perspective of their connectivity capabilities (e.g. send the information they collect to a 'cloud' or server to be processed), but differently to smartphones and other smart devices, they don't have computing or artificial intelligence capabilities to process data and/or perform complex tasks and decisions on their own.

To avoid any confusion regarding the capabilities and role of these devices, the pilot project team recommends that Council refers to them as "digital water meters" instead. This issue should be further assessed when developing a communications plan for a full-scale rollout of the technology.

3.3. Pilot performance

In alignment with the Council-endorsed performance metrics framework (see **Section 2**), an account of the pilot outcomes is presented below. Lessons learnt and recommendations are incorporated within this framework.

3.3.1 Community acceptance / expectations

i. Results from Your Say (see Attachment 4)

776 people visited the pilot's *Your Say* page, with 70 people (9%) engaging actively with the resources and tools, particularly the project survey and Q&A.

63 people participated in the survey (see **Attachment 5**). Results indicated that:

- Survey data is predominantly from respondents who have a basic to fair understanding of digital water meter technology. Most participants saw some benefit, with the main one being early detection of leaks.
- The main concern was the cost of implementing the technology, followed by questions about the radiation produced by digital meters (and whether it represents a health risk), and privacy concerns associated with the data they collect and transmit.

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

- Residents indicated they would like to view the business case for the rollout and a full cost benefit analysis. Council priorities and budget considerations were of concern.
- An opt-in, opt-out program was favoured by some respondents and should be considered in the full-scale rollout to maximise community support.
- Further education and information about the health risk and privacy issues should occur as these issues were consistent throughout the survey.
- For a full-scale rollout, a media mix of mail-out, online and print formats should be considered. Presence in community gatherings such as farmers markets should also be considered.
- An early opt-in program could assist with further uptake of a full-scale rollout. Case studies could help to promote the benefits of the project.
- Further workshops should be conducted with willing participants who volunteered their contact details. This would assist with evaluation of the pilot and planning for a full-scale rollout.
- Community expectation of costs to residents is low. Any costs should be minimised as much as possible to increase uptake and gain social licence.

There were 13 contributions via the Q&A. Key issues discussed were:

- Monitoring data access to water users.
- Digital meter technical issues such as power supply, the range of data they monitor and the radiation they emit.
- Possible public health risks
- Whether users can opt out from having a digital meter
- Impacts of digital meter installation in the water service (e.g. interruptions).
- Privacy issues regarding data collected by digital meters.

Through the pilot implementation, staff learnt the following:

- Less than 5% of connections (approx. 13) in East Mullumbimby requested that the digital meters not be installed.
- Consultation showed that key concern was perceived risks to health from electro-magnetic waves/5G (although system runs on 4G)
- Ideally, customers involved in the pilot would have been involved in accessing data (e.g. via an app), to experience the benefits firsthand.

Mainstreaming digital metering in the Shire will require clear evidence-based messaging and a well-designed community engagement strategy. Key issues to be addressed involve understanding the benefit/cost balance and perceived health and privacy risks. Council should consider policies for providing residents access to their water consumption data, as well as providing an opt-out option for residents not wanting a digital meter.

3.3.2 Ensure sufficient resources to carry out the work

The original project budget was **$260,000** (see **Attachment 6**).

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

i. Fieldwork

Largely undertaken by contractors, totalling **$213,599** (based on Authority payment records), including:

- Council awarded a contract of $151,833 to WaterGroup for the supply of digital meter devices and data management services. An additional $21,665 were required to cover unexpected costs such the supply of NSW compliant plumbing fittings, replacements for faulty digital meters, etc.
- Meter installations were undertaken by two contractors (East Point Plumbing and Skilltech Consulting), totalling $40,100.

Feedback from Council's Water Operations and Billing teams indicate that there was a lack of adequate consultation and coordination during the planning and implementation stages. This led to inefficiencies and budget blowout during the rollout, including the purchase of digital meter unions that didn't align with NSW fitting standards, and issues with meter installation records.

Digital meter installations will require strong coordination and sound technical expertise. The Water Operations team is best placed to oversee the installation process. This should ensure alignment with relevant plumbing standards, Council's meter installation processes and related records management, the latter being of key importance for rates/billing purposes.

ii. ***Administration***

An external consultant was engaged as Project Manager to oversee pilot delivery. However, due to the impact of the COVID pandemic on project timeframes, and consequently on contractual arrangements, there was a leadership gap during project implementation. This hindered consultation and coordination across the various Council departments involved (Utilities, Water Billing, Customer Service, IT), created inefficiencies in project delivery (e.g. meter installation, records), and delayed project wrap-up and reporting. Feedback from the project team recommends that strong project leadership, that is preferably in-house, will be key for the success of a scaled-up rollout.

One of the key challenges arising from the above-mentioned leadership gap was the difficulty in accessing data on-demand. Data management was initially centralised through an in-house Excel spreadsheet only accessible by the Project Manager. Additionally, poorly managed meter installations records (e.g. mistakes on meter information, addresses, etc.) hindered data quality.

Consequently, the Water Billing team couldn't rely on digital meter data to inform water bills and notices (e.g. leaks) to customers. Digital meters have been read manually instead.

Similarly, the Water Operations team missed potential efficiencies related to water meter maintenance/replacement and leak identification, and Systems Planning team experienced difficulties in using the data to understand water demand patterns.

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

iii. Information Technology (IT)

Hardware installation

Council installed 355 digital meters in East Mullumbimby (residential and commercial potable water connections) and 31 digital meters in Byron Bay Recycled Water Scheme (commercial and municipal recycled water connections). Most meter installations happened between late 2020 and early 2021. Two device types were trialled:

- **HZ NuMeter**: a self-contained, ultrasonic digital meter with a fully integrated Internet of Things (IoT) type network communications module. These were installed at all 20mm connections (the standard residential connection).
- **Captis Data Logger**: a device that connects to an existing traditional meter to digitise analogue flow readings, and then transmit the via the IoT network. This was used on all connections bigger than 20mm (e.g. commercial users).

Figure 2 - The HZ NuMeter (left) and the Captis Data Logger (right)

While the installation and activation of the devices would normally be straight forward, the following issues where encountered:

- Due to a lack of adequate consultation/engagement with the water operations team, the selected HZ NuMeter didn't align with NSW standard water meter specifications. Consequently, new meter unions had to be sourced, and time and cost of meter installs increased considerably.
- Some installation records (meter numbers, location, etc.) were incorrect, creating confusion when accessing and interpreting monitoring data. This was due to lack of oversight and coordination, lack of technical knowledge when installing and setting up the devices or just human error. Also, some installation records were lost due to a faulty server hosted by the vendor.

BYRON SHIRE COUNCIL

Hardware reliability

By 2023, 16% of installed devices (60 meters) went offline, ceasing to transmit data or simply stopped working. Most of these (47 meters) were the HZ NuMeter. The immediate impact was the inability to manually read water consumption of 14 properties in East Mullumbimby, during the November 2023 water billing cycle, impacting the billing process.

The warranty on these devices was of 2 years and already expired, so the vendor wouldn't replace them.

To address the immediate billing issues, as well as better understanding the reliability the digital metering devices available in the market, the Utilities Team, in coordination with the Water Billing team, sourced small batch of new **L+G W350 meters**. These are equivalent to the HZ NuMeter, but understood to be of better quality. They've been installed and will be monitored to understand their robustness.

> ***IMPORTANT NOTE:*** Digital water meters are relatively new in the potable water services sector and lack well-understood deterioration patterns like those of traditional mechanical meters. They may suffer from accuracy issues that are particular to the digital metering technology. As the technology progresses, it is expected this knowledge gap will be filled. The National Measurement Institute of Australia (NMI) is currently revising their National Instrument Test Procedure for Utility Meters (NITP14), which guides how metering technologies are to be approved and verified for their use in a town water supply context.

More broadly, the introduction of a new system for meter reading introduces various points of potential failure, as described below:

Failure mode	Description
Pulse Unit Magnetic Probe	Pulse units (for >20mm and 20mm meters where an integrated digital meter is not used) connect to the water meter with a magnetic probe. Issues can arise from this connect due to condition installation, failure or they can be physically removed. It is possible they can record false 'high' readings due to vibration, but less likely.
Pulse unit cord damaged	Pulse units (for >20mm and 20mm meters where an integrated digital meter is not used) have a cord that connects the magnetic probe to the data logger/radio unit. This can be damaged.
Battery failure	Either due to age or water damage
Reception issues	To due to interference, submersion in water, buried, etc
Data management / server issues	Depending on the adopted software model
Inaccurate record keeping	Incorrect record keeping, say at installation, will prevent the correct meter reading information from being recorded

Data collection and storage

Digital meters use the Telstra's NB-IoT (Narrowband Internet of things) network to transmit monitoring data to WaterGroup's cloud-based database. NB-IoT is a new

BYRON SHIRE COUNCIL

wireless protocol globally standardised by the same industry group (3GPP) who standardised 3G and 4G. In Australia it is operated by Telcos such as Telstra using their existing mobile phone telecommunications infrastructure. The coverage at Byron Bay is excellent.

Data access and analysis

Council has accessed the data via two different methods. Initially, WaterGroup has sent the data to Council via email. Data processing was done via an in-house solution (Excel-based), as the pilot didn't have scope for entering a service contract for data portal (the industry standard). However, due to the need for manually extracting monitoring data from emails and the limitations of Excel as a data analytics and user-friendly visualisation tool, this approach proved to be ineffective to inform timely decision making (e.g. billing, reporting and addressing leaks, etc.).

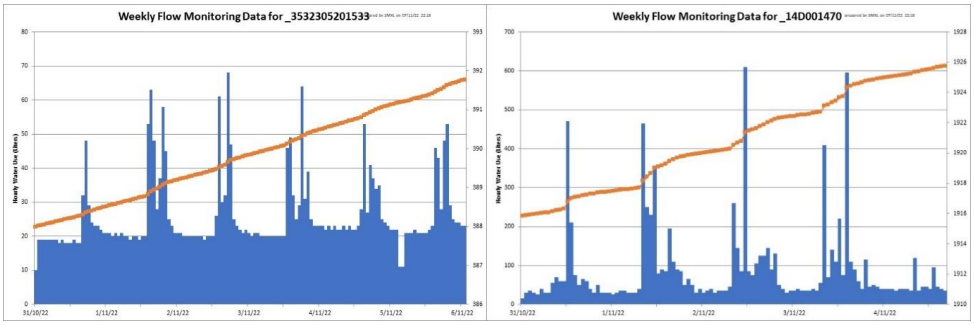


Figure 3 – Examples of meter data displayed via Council's in-house Excel data management solution. Data from a HZ NuMeter at a residential connection (left) and a Captis Data Logger at a commercial connection (right). Both are showing a constant base flow, characteristic of a leak.

Currently, through a short-term partnership with UtiliOS (a sister company of WaterGroup) Council is trialling the UtiliOS SaaS data portal. It features a series of analytical tools, alarms and reporting functions to support decision making. Staff testing the portal see great benefit in implementing this type of system, as long as the data behind it is of good quality and the integration of such system with Council's IT infrastructure is done adequately.

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

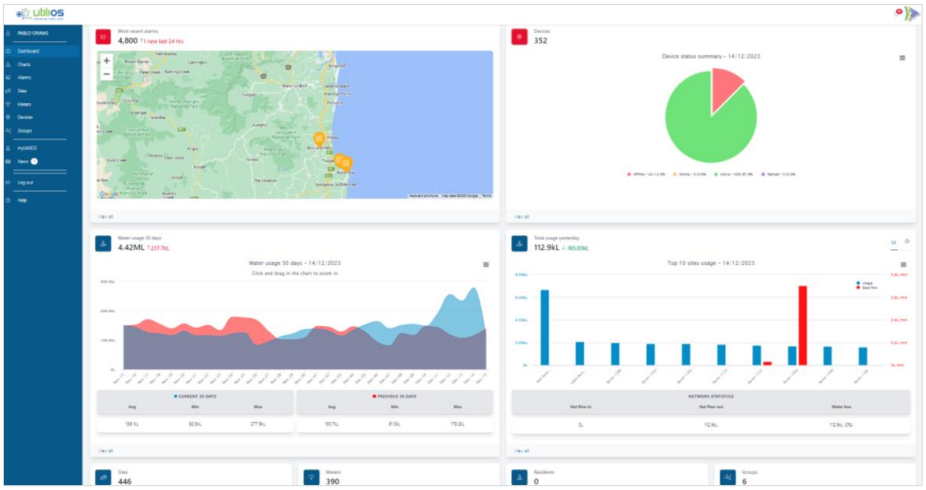


Figure 4 – The UtiliOS SaaS user portal

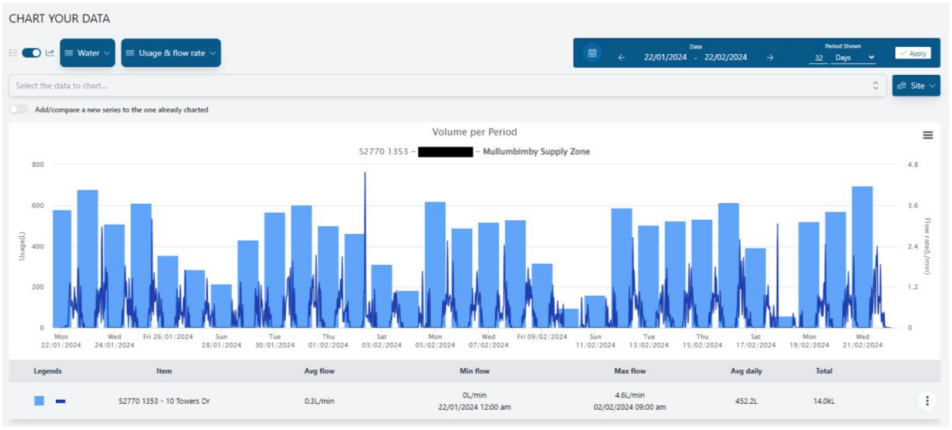


Figure 5 – Example of digital meter data in the UtiliOS SaaS user portal. The dark blue line shows flow rate in 30min intervals. The light blue bars show daily total consumption.

Workflows / systems integration

A substantial challenge experienced throughout the pilot was the integration of digital metering with relevant Council's processes (e.g. water billing, customer service, records management, etc.) and the IT systems that support them (e.g. Authority, Assetic, Geocortex, CM9, etc).

Effective integration is key to ensure Council and its customers benefit from digital metering. However, due to the lack of consultation and coordination across relevant Council departments and the data quality and accessibility limitations mentioned above, systems integration wasn't possible within the pilot's delivery.

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

Nevertheless, the pilot provided insights on the integration points that need to be considered. These include:

- Digital meter installations:

Digital water meter installation requires formal, repeatable procedures and is a data heavy activity. Installation records, including site photos must be kept and be available to staff to easily validate meter readings. Data should be collected via a robust electronic form process, with the contents of the installation forms automatically stored in the metering database and records management system. This includes forms/workflows for:

  - Installing an integrated digital water meter (e.g. for 20mm connections)
  - Installing an analogue water meter (not digital)
  - Installing a pulse unit on an analogue water meter
  - Removing a digital water meter or pulse unit from an existing connection
  - Replacing an integrated digital water meter
  - Replacing a pulse unit
  - Validating a digital water meter reading
  - Synchronising a pulse unit with the reading from the analogue water meter to which it is connected

Without these workflows in place and integrated data flows from one workflow to another and into the Digital Meter Database it will be difficult to manage the digital meter data into the long term (past the pilot period).

- Data Platform integration with Council systems

A suitable data platform would be able to allow for these points of integration:

  - Billing (Authority)
    - Update the Digital Metering Database with information from authority (read)
    - Provide billing data to Authority (write/via export/import)
    - Access account holder email/phone details for automatic notifications
  - Workflow (CRM/Authority)
    - Issue works request for validation / investigation
    - Meter replacement requests
  - E-forms (Assetic)
    - Record keeping of installations including photos and tabulated data
  - Records Management
    - Installation / Inspections records and leak detection records automatically uploaded to CM9
  - Asset Register (Assetic)
    - Read/write asset information related to digital metering installations
  - GIS
    - Read/write locational information
  - Email / SMS

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

- Utilise email / SMS systems to send automatic notifications.

With these integration points the platform will have the following features:

- Access to installation records as above
- Meter/pulse configuration can be updated easily (start reads, pulse factors, synchronisation reads)
- Connect to the water billing database for automatic notifications of leaks
- Provide outputs to Councils records management system of leak notifications
- Send automatic emails and SMSs to customers
- Dashboard reading anomalies such as:
  - Missing reads
  - Low reads
  - High reads (not leaks)
  - Leaks
  - Low battery
- Ability to manage data gaps in a meaningful way
- Accessible by different departments of Council

There are several software platforms available on the market, and they are gradually reducing in per device cost to use. Some of the commercially available platforms include a customer portal for customers to individually access the data related to their water meter. Practically the most essential need is for access to leak notifications, which can be through an automated process connected to the billing account holder's email or mobile phone number (i.e. the NAR record on the assessment).

- Billing

Robust billing process with digital meters rely on readily available data and verifiable installation records. The pilot process highlighted existing deficiency in workflow that will be problematic for a continued digital meter rollout. The billing workflow requirements for digital meters are higher than for manually read meters. The normal process for billing is:

1. Define a list of digital meters to be 'read' (this is equivalent to the "billing route" in Council's billing system
2. Provide the list to the Digital Meter Data Manager
3. Use the Digital Meter Data Platform to obtain a "quarterly reading" of the data
4. Provide the meter read back to the Billing staff
5. Upload for billing (manually or using a pre-defined format for bulk uploading)

BYRON SHIRE COUNCIL

Issues can arise in the following ways;

For data loggers

Water meters > 20mm were installed with a data logger, the data logger commissioning information requires:

a) the start read of the water meter,
b) the start read of the data logger (they don't all start with '0' pulses on the dial
c) The precise synchronisation time or when the data logger is attached to the water meter (even down to the minute)
d) the pulse rate of the water meter (how many Litres are measured for each pulse recorded on the data logger)
e) photographic evidence of all these steps so they can be confirmed/reviewed at a later date

Incorrect record keeping can result in the wrong values being reported. One issue with the current trial is that the pulse rate information is stored within the Vendor (Telstra) data platform, but the start water meter read and synchronisation times are not. This means that there is no single 'source of truth' for commissioning data and no simple way to show or validate the 'data chain'.

This means that if an error is discovered with the pulse rate conversion it is difficult to modify. It was requested that WaterGroup provide pulse totaliser values (not flow totaliser values) to rectify this issue, but this did not occur.

- Customer Service

Providing live data to customers to prevent bill shock, explain bills, notify of leaks or generally be able to provide more insightful advice was seen as a highly beneficial aspect of the pilot. While hard to quantify, digital meter data would help support customer interactions, and reduce the amount of time to advise those residents/rate payers about the issue of their complaint.

This would go long way in supporting customer facing staff, so long as the data is available for them to access.

Systems reliability and cybersecurity considerations

Feedback from Council's IT department has highlighted critical issues that were not explored during the pilot project, and that will need to be considered for a full-scale rollout.

The current water billing system uses a Multi-Vendor Reading System (MVRS) for the collection and storage of manual water meter readings. This is done using handheld devices that pre-date smartphones. Technical support options for MVRS are now scarce and maintaining this system is increasingly challenging.

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

The outdated MVRS technology has become a liability to Council. As per Council's 2022-23 financial statement, water bills accounted for 24% of the revenue obtained from user charges and fees. Water bills also involve handling property owners' private information. Ensuring the robustness of Council water billing system is of critical priority.

While digital metering coupled with a cloud-based data management system offers a powerful alternative to MVRS, the outsourcing of data management to a third-party raises cybersecurity concerns. The IT department has protocols in place to assess the robustness of data management service providers, and this will be a key step in the planning stages for a full-scale rollout of Digital Water Metering. It is recommended that this is assessed at the tendering stage.

Application of data for informing decision

Due to the above-mentioned issues with project coordination, meter installation records, data access and systems integration, the pilot fell short of using digital meter data to inform billing, operations and planning decisions. While implementing fit-for purpose IT systems is important, it is good planning, capacity building and governance arrangements that are key to sustain digital metering and benefit from its decision-making support potential.

3.3.3 Cost of full-scale rollout

The estimated cost of a full-scale rollout (approx. 13,070 connections) is summarised below, including capital / upfront expenditure and ongoing annual costs and benefits (a detailed budget model is presented in **Attachment 7**).

	Total	**Per water connection**
Capital / upfront costs	$6,091,567	$ 466
Ongoing annual costs	$ 746,909 / year	$ 57 / year
Ongoing annual benefits*	$ 873,904 / year	$ 67 / year
Net annual benefit-cost*	$ 126,994 / year	$ 10 / year
Benefit-cost ratio*	1.17	

* Only includes benefits which could be quantified monetarily based on available information.
Note: This budget has not considered inflation.

There is a clear business case for a full-scale rollout of digital meters (i.e. benefit-cost ratio > 1). There are additional benefits that would further improve the benefit-cost ratio of the project but were difficult to estimate monetarily. These include:

- Avoid risk of lost revenue due to MVRS system failure
- Operational and maintenance (O&M) gains.
- Energy savings across the water supply network due to improved O&M efficiency gains.
- Deferred infrastructure augmentations.
- Improved community engagement and information transparency.
- Drought response and demand management benefits, particularly during times of drought.
- Social corporate responsibility / reputational gains due to improved management.
- Alignment with latest industry trends to help tackle water security challenges.

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

- Regional synergies (e.g. with RCC) generated by improved data management and sharing, understanding of demand, enforcement of water restrictions, etc.

IMPORTANT NOTE: The above is a simple budget model that assumes immediate full-scale implementation, providing an overview of the full costs and benefits of digital water metering. However, there are practical considerations that suggest a staged rollout is more realistic. These considerations, as well as insights on cost recovery pathways are presented in **Section 4.1**.

3.3.4 Understanding the analytics options

The digital meters installed as part of the pilot provide flow rate and volume data at 30min intervals. At a basic level, particularly in comparison with the traditional quarterly meter manual reads, this data can offer powerful decision support to Council. However, the full potential of digital meter data is only unlocked via the aid of a software tool that can automate data analysis, facilitate access to such data and assist with prompting management actions.

Through testing the UtiliOS SaaS data portal, which is comparable to other software products available in the market, Council has gained understanding of the analytics options that could be used. Some examples include:

- **Network water balance**: By monitoring bulk water supply and comparing it with water consumption at metered connections, Council can better understand the efficiency of its water supply networks, including non-revenue water levels (e.g. system losses). This can also assist on hydraulic modelling and systems planning exercises.

- **Identification of potential leaks**: The software can be programmed to identify flow rate patterns characteristic of a leak (e.g. when there is continuous flow even during periods of low demand, or when minimum flows are consistently higher than cero).

- **Identification of high-water use**: Water use thresholds can be applied to identify potential cases of high-water consumption. This is a powerful tool to implement demand management actions.

- **Identification of irregularities / anomalies**: the application of flow rate, volume and time-based thresholds/rules can be used to identify potential unusual situations such as water theft, irregular connections, faulty meters, etc.

- **Comparing water usage**: This can be done across users (or group of users) and across timescales (e.g. consumption in this month compared to last month).

- **Digital meter status/history**: This includes time of meter install/activation, replacement or decommissioning, as well as meter status (online/active, offline, retired, battery level, etc.).

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

- **Alarms**: These can be set to automatically notify Council staff and/or customers when an issue arises, prompting management actions accordingly. Alarm settings can be customised to best fit the levels of service Council aims to deliver. Common alarms relate to possible leaks, high water usage and the status of digital meters. Alarms history is also recorded.

- **Geospatial capabilities**: The location of meters is recorded during the installation stage. This allows for the geospatial visualisation of the meters, as well as the other features related to them (e.g. alarms).

- **Data exports**: The software can create a diversity of exports that can be downloaded on-demand or scheduled as required.

While there is no lack of data analytics options within software products such as UtiliOS SaaS, these will only be of benefit to Council if a full-scale roll out is founded on sound strategic objectives, clear governance arrangements and sufficient human capacity.

3.3.5 Readiness

Council's readiness to undertake a full-scale rollout of digital meters can be understood through these perspectives:

- **The major hurdle will be the integration of workflows and systems.** The pilot fell short of integrating digital metering into Council systems. This is attributed to the lack of adequate consultation and coordination with the various Council teams involved. Strong consideration needs to be given to the robustness, flexibility and security of selected technologies and data management providers to provide a fit-for-purpose and sustainable solution to Council water metering needs.
- **Council staff wants to adopt the technology**. Both the Water Billing and Utilities teams (the key internal stakeholders) concurred that digital metering will create substantial efficiencies in their work and enable better results for Council and customers. In a full rollout scenario, human resourcing within these teams is sufficient to use digital meter data and perform day-to-day water billing and on-ground operation and maintenance (e.g. replacements) of meters. However, a gap remains at the project management / program coordination level (see next dot point below).
- **Community is sceptical about digital meters.** While the benefits of digital metering are somewhat understood by community members engaged during the pilot, Council will need to better communicate the benefit-cost balance of the technology. The strategic objectives identified in Council's Community Strategic Plan 2032 should serve as the framework to articulate how digital metering will support community objective.
- **Advanced management, coordination and consultation capacity is needed as a priority.** The cross-departmental, multidisciplinary and technically advanced nature of digital metering requires strong leadership. This is key for ensuring adequate implementation of digital metering system and running it sustainably into the future. The pilot showcased fundamental gaps in project management, program coordination and stakeholder consultation (particularly with internal stakeholders)

BYRON SHIRE COUNCIL

that resulted in various issues as described in this report. It is recommended that Council builds up internal capacity in this area.

- **The required telecommunications infrastructure is available**. Telstra's NB-IoT network is already established in the Byron Shire area, and offers good connectivity.
- **RCC is progressing digital metering.** Momentum behind digital metering is growing across Australia and in the region. Council has an opportunity to align with RCC and other neighbouring Council's (e.g. Ballina) to advance digital metering and better contribute to regional water security outcomes.
- **Council's current water billing system (MVRS) is outdated.** Digital metering offers a solution to this issue, and an opportunity to align with industry best practice.
- **Staff resourcing and upskilling is needed to maximise value to the community.** Transitioning from a system based on quarterly manual meter readings to one based on automatic and continuous meter data collection, storage and processing will reduce the need for manual/administrative tasks. It will shift the focus of Council staff towards interpreting data/metrics to support decision making and service delivery. Resourcing and upskilling of staff may be required to ensure the value to community from Digital Water Metering is maximised.

3.3.6 Vendor risk

There are risks associated with Vendors' capacity and performance in collecting, storing and safeguarding data (this is further explored in **Section 3.2.7**), and to provide technical support to the client. These risks would be best assessed at the tendering stage, in consultation with Council's IT department.

In the case of poor Vendor performance, the following considerations apply:

- By using the available NB-IoT as the transmission platform, there is the added benefit of not requiring Vendor owned/operated telemetry infrastructure. Instead, the communications towers are owned/operated by Telco providers and digital meters can be transitioned across vendors.
- Contractual arrangements should ensure that historical data collected by digital meters is owned by Council and can be transferred to another vendor.

3.3.7 Other considerations

i. Health and Safety

Digital meters are as safe as traditional analogue water meters. This means there will be the same issues associated with access to private property, animals, unsafe surfaces and so on. Council is well positioned to respond to any safety issues of this nature. However, digital meters have raised concerns from some community members about the safety of the device itself from an electro-magnetic radiation perspective.

It is important to enable shared understanding across stakeholders about this issue. Communications should be evidence-based, and the nature of digital meters be clearly explained. For example, stakeholders should be made aware that digital meters are:

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

a. Intermittent, generally transmitting for only minutes of each day. The NB-IoT meters installed by Byron Shire Council in the pilot study transmit once per day in the morning prior to 5 AM.
b. Low power, slightly higher than that of a garage door opener and much lower than even 1G mobile phone technology. This is further underscored by the fact that water digital meters operate on a battery, not mains power, and therefore rely on using low amounts of power to transmit data – otherwise the batteries would run out quickly.
c. Away from the house. Water meters are generally located on the street frontage. Electro-magnetic radiation decreases dramatically with distance.

These three factors show that digital water meters should be of much less concern to people who are concerned with e.g. electricity digital meters (which in themselves are also considered safe). Most people who were concerned about digital meters described the normal installation of electricity digital meters, being:

a. Continuously transmitting
b. High(er) power, being 4G or 5G and connected to mains power
c. Attached to the house, potentially nearly sleeping areas

Electricity digital meters are also safe, but highlighting how water meters are fundamentally different was an important talking point for some residents during the trial.

During the pilot, community members were permitted to request the device not be installed on their property. If continuing a digital meter rollout, Council will need to adopt a policy on the mandatory or voluntary nature of the uptake. Typical options are a) mandatory, b) opt out or c) opt in.

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

4. Recommendations for full-scale implementation

4.1. A staged rollout

Staff recommend that a full-scale implementation should happen in a staged manner. This is due to the following considerations:

- Byron Shire's **water supply network is inherently complex and fragmented** across a large area. There are 20 water supply catchments (see Figure 6) varying in area, number of connections and condition of on-ground assets. In some supply catchments (e.g. Byron Bay) access to water meter locations is challenging (e.g. behind fences, inside buildings, etc.). Following consultation with Council's Water Operations team, it is recommended that digital meter installations tackle one water supply catchment at a time, starting with the least complex (e.g. Bangalow or Ocean Shores). This will ensure consistency and efficiency in the installation process and community engagement efforts. Also, once a particular supply catchment has been implemented, the full benefits of digital metering can be immediately applied to that area (e.g. water balance monitoring and modelling).

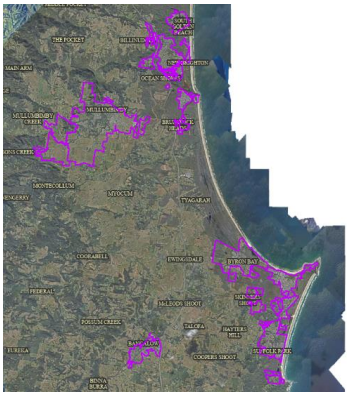


Figure 6 – Water supply catchments

- Transitioning to a digital metering system represents a **change in paradigm for Council's staff and management processes**. A staged implementation - one water supply catchment at a time - will ensure a smoother transition for both Council and the community.

- It is likely there will be competing **capital investment priorities** (e.g. water and sewer infrastructure upgrades) which may limit Council's capacity to deliver digital metering at full-scale in one particular financial year.

4.2. Rollout budget and cost recovery pathways

The proposed approach involves rolling out the system over a 5-year implementation period, tackling four supply zones every year. A 10-year budget has been developed using these assumptions:

- Connections numbers are spread evenly across the 20 water supply zones (654 connections per zone), meaning 2,614 connections are transitioned to digital meters every year during the implementation.
- Digital meters have a lifespan of 10 years, with meter replacement costs equally distributed across that 10-year period (i.e. 1/10th of all active meters are replaced every year).

A budget spreadsheet is available in **Attachment 7**, and a summary is provided below. It involves a Planning stage (year 0). Project implementation is carried out over 5 years.

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

Cost and benefits stabilise from year 6 onwards, with the benefits outweighing the operation and maintenance costs.

	PLANNING	IMPLEMENTATION					ONGOING OPERATION				
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10+**
Capital costs	- 150,000	-1,382,993	-1,139,643	-1,139,643	-1,139,643	-1,139,643					
Ongoing costs		-213,800	-348,332	-480,355	-613,632	-746,909	-746,909	-746,909	-746,909	-746,909	-746,909
Total costs	**-150,000**	**-1,596,794**	**-1,487,976**	**-1,619,998**	**-1,753,275**	**-1,886,553**	**-746,909**	**-746,909**	**-746,909**	**-746,909**	**-746,909**
Ongoing benefits*		**174,781**	**349,562**	**524,342**	**699,123**	**873,904**	**873,904**	**873,904**	**873,904**	**873,904**	**873,904**
Net benefit-cost*	**-150,000**	**-1,422,013**	**-1,138,414**	**-1,095,656**	**-1,054,152**	**-1,012,649**	**126,994**	**126,994**	**126,994**	**126,994**	**126,994**

* Only includes benefits which could be quantified monetarily based on available information.
Note: This budget has not considered inflation.

The implementation of digital water metering will require substantial upfront investment, and represents a fundamental change in practice that can offer enhanced levels of service to the community. As such, it is possible that some costs will need to be passed on to rate payers / developers. The details on how costs will be recovered need to be investigated in consultation with Council's Finance department. Possible cost-recovery approaches to be considered include:

- **Rate increases:** Council may decide to pass on all capital and operational costs to rate payers. As an example, a Water Access charge increase of $94/year per connection would achieve full-cost recovery after 10 years.
- **External funding:** Council may be able to access State Government funding to cover a portion of the project's upfront costs. Similarly, with Rous County Council already operating a digital water metering system and having an interest in ensuring a consistent approach to water consumption monitoring across its constituent Councils, cost sharing opportunities may arise.
- **Long-term payback through project benefits only:** Based on the monetary benefits estimated in the budget, and assuming there are no external inputs (State Government funding, rate increases, etc.), it is possible that full cost recovery could be achieved in at least 50 years. It is unlikely however that Council would rely solely on this approach given the substantial upfront costs and uncertainty around the monetary value of project benefits.

IMPORTANT NOTE: A cost-recovery strategy needs to be further developed in consultation with Council's Finance department, and may involve a combination of the approaches presented above.

4.3. High-level implementation plan

4.3.1 Project consultation and approval process

The outcomes in this report will be the basis of a summary report to be presented to Council's Executive Team and the Water and Sewer Advisory Committee for feedback and direction. It will then be expected that a Community Consultation process will be required, in alignment with Council's Community Engagement Strategy (see **Attachment 8).**

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

Outcomes from this process will be used to refine the project scope for its final approval by Council.

4.3.2 Detailed Planning and Procurement

i. **Nominate a Digital Water Metering Rollout Project Manager**. This will be a 5-year fixed-term contract to oversee project implementation.

ii. **Create a Digital Water Metering System Coordinator position** within Utilities' Systems Planning Team (additional 0.6 FTE). This position will be responsible for coordinating the on-going operation and maintenance of the system, including technical support to the various departments using the system.

iii. **Establish a Digital Water Metering Working Group** with representatives from the following Council departments and teams:

a. Utilities – Systems Planning
b. Utilities – Operations
c. Water Billing and Revenue
d. Business Systems and Technology
e. Customer Service
f. Other departments required on an ad-hoc basis (e.g. Media Communications, Building Services, Community Enforcement, etc.)

IMPORTANT NOTE: Council should also involve a representative from RCC to ensure any opportunities for regional-level synergies/efficiencies are considered.

iv. **Develop a Digital Water Metering Policy** where all new connections are required to have digital water meters. This policy should align to other relevant policies (e.g. Water Supply Connection Policy) and could be extended to include:

a. Category 2 Trade Waste renewals (where a daily volumetric restriction is applied).
b. Change-of-use applications.
c. Mechanical meter replacement program
d. An opt-out option for customers. A manual meter read charge for customers opting out could be considered (e.g. RCC has implemented such charge).

IMPORTANT NOTE: Fees and Charges will need to be reviewed in alignment with this policy, including cost of supplying digital meters for new connections (these are more expensive than mechanical meters), or a fee for manual meter reads if a property owner decides to op-out from having a digital meter.

v. **Develop a specification for a digital metering system**, in collaboration with relevant Council departments, and following the recommendations presented in this report. **Attachment 9** provides a conceptual description of the system to help guide this process. The specification will include:

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

a. Roles and responsibilities across relevant Council departments.
b. Workflows (e.g. digital meter installations, meter removals, validation read, billing, customer engagement, integrations with key Council systems, etc.).
c. Specifications for the data base / data platform, including what information should it record and produce, and the cybersecurity requirements it should comply with.
d. Definition, prioritisation and specifications of all water supply catchments to be transitioned (e.g. catchment boundaries, number of connections, locations for bulk supply digital meters and pressure monitoring devices, etc.).

IMPORTANT NOTE: *The pilot highlighted the critical importance of having a clear, robust process to install digital meters. Diligent meter install records are key to ensure the quality of the data feeding the data portal, and the decision-support information it produces.*

vi. **Review the implementation budget, and secure required funds** to cover capital and on-going annual costs.

vii. **Undergo the procurement process** following Council's Procurement Guidelines. With expected upfront costs of $6.1 million over 5 years, Council is obliged to call tenders before entering a contract with a service provider/s.

4.3.3 Delivery

The scope of the delivery will be guided by what is prescribed in the services contract granted to the successful tenderer. Also, based on the lessons learnt from the pilot's delivery, staff recommends that the below guiding principles are considered:

i. Project coordination should be done in-house to ensure Council builds ownership over the Digital Water Metering system and its management.
ii. Digital meter install procedures need to be robust and managed diligently to ensure the quality of the data.
iii. Prioritise quality over cost when choosing a digital water meter device. The implementation budget has considered a conservative supply cost.
iv. The integration of workflows and systems is critical to the success of the Digital Water Metering system.
v. Communication and consultation efforts are of key importance and requires adequate resourcing.

5. Alignment with Council's Community Strategic Plan

Below is a description of how implementing a Digital Water Metering system in Byron Shire could support the objectives outlined in the Community Strategic Plan.

CSP Objective	CSP Strategy	How Digital Water Metering contributes to the CSP?
1. Effective Leadership *We have effective decision making and community leadership that is open and informed*	*1.1. Enhance trust and accountability through open and transparent leadership*	Collects high-resolution, near real-time water consumption data that supports robust, transparent and timely decision making by both Council and water users.
	1.2. Engage, inform, and involve community in decision making	
	1.3. Ethical and efficient management of resources	Offers an improved way of monitoring water demand and the performance of water supply systems, allowing Council to manage them more efficiently, and to deliver better value to the community.
	1.4. Enhance organisation capability through innovative practices and regional partnerships	Enhances Council's decision-making capabilities by leveraging industry-leading practices and technology, in alignment with ongoing regional trends to improve water resources management.
	1.5. Empower community leadership through collaboration, capacity building, and cultivating community driven initiatives	With improved access to water usage consumption (especially if a customer access portal is implemented as part of the rollout) the community will be empowered to make better decisions around their water consumption.
2. Inclusive Community *We have an inclusive & active community where diversity is embraced & everyone is valued*	It is challenging to draw a direct link between implementing a Digital Water Metering system and the strategies outlined under this CSP objective. However, by improving water usage data access, it will allow the community to participate more effectively in the management and stewardship of their water supplies, supporting Council in delivering better, fairer and more transparent value to ratepayers.	
3. Nurtured Environment *We nurture and enhance the natural environment*	*3.1. Partner to nurture and enhance biodiversity, ecosystems, and ecology*	Drives efficiency in water use and the management, operation and maintenance of water supply systems. This in turn reduce the reliance on fresh water sources.
	3.2. Deliver initiatives and education programs to encourage protection of the environment	Enables a detailed understanding of water demand behaviours across the community, allowing Council to design and deliver more effective education and behaviour change initiatives to drive sustainable water use behaviours.
	3.3. Protect the health of coastline, estuaries, waterways, and catchments	Drives efficiency in water use and the management, operation and maintenance of water supply systems. This in turn reduce the reliance on fresh water sources.
	3.4. Support and empower the community to adapt to, and mitigate the impact on climate change	Assists residents and businesses in tracking their daily water usage, and hence empowering them make better decisions around their water use behaviours.
	3.5. Minimise waste and encourage recycling and resource recovery practices	Drives water leak reduction, improved efficiency in water use and more effective operation and maintenance of water supply networks.
4. Ethical Growth *We manage growth and change responsibly*	*4.1. Manage responsible development through effective place and space planning*	By providing high-resolution water consumption and water system performance data, it supports improved

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

		modelling of future system capacity – a key element in development planning.
	4.4. Foster sustainable visitation and manage the impacts of tourism on the Shire	Allows better understanding water demand over time and across water user types (e.g. hospitality businesses), helping to identify seasonal trends, target high-water user, and inform more effective operation and maintenance of water systems during high-demand seasons.
	4.5. Support a resilient community that can adapt and respond to change	Assists residents and businesses in tracking their daily water usage, and hence empowering them make better decisions around their water use behaviours.
5. Connected Infrastructure *We have connected infrastructure, transport & facilities that are safe, accessible & reliable*	*5.3. Ensure infrastructure meets future needs and invest in emerging technologies*	It is an emerging technology that is rapidly becoming best practice in the water industry. It offers powerful monitoring capabilities and decision-making support to Council. It drives efficiencies in water use and the operation/maintenance of water supply systems, delaying the need for infrastructure upgrades, and informing improved modelling of future system capacity.
	5.5. Provide continuous and sustainable water and sewerage management	All the benefits mentioned above contribute to this CSP strategy. In short, Digital Water Metering offers improved performance monitoring capabilities and efficiency gains across the water supply network. It allows Council and the broader community to make informed decisions on how to best manage precious water supplies.

BYRON SHIRE COUNCIL
REPORTS - INFRASTRUCTURE SERVICES 4.1

6. Legal/Statutory/Policy Considerations

Digital meters, like any water meter, must comply with the National Measurement (NMI) Instrument requirements. Water meters must be approved and verified before they can be used for water billing purposes. As digital water meter technology is emergent, there is a lack of well-defined deterioration patterns and understanding of inaccuracies over time. it may not be possible to assume that all certified products will perform equally across their lifespan, and it is not fully understood if this would represent a legal risk for water service providers, as the accuracy of digital meters could be challenged. However, adoption of digital water meters is growing despite of this gap.

7. Financial Considerations

A full-scale implementation budget has been presented in **Section 4.2**.

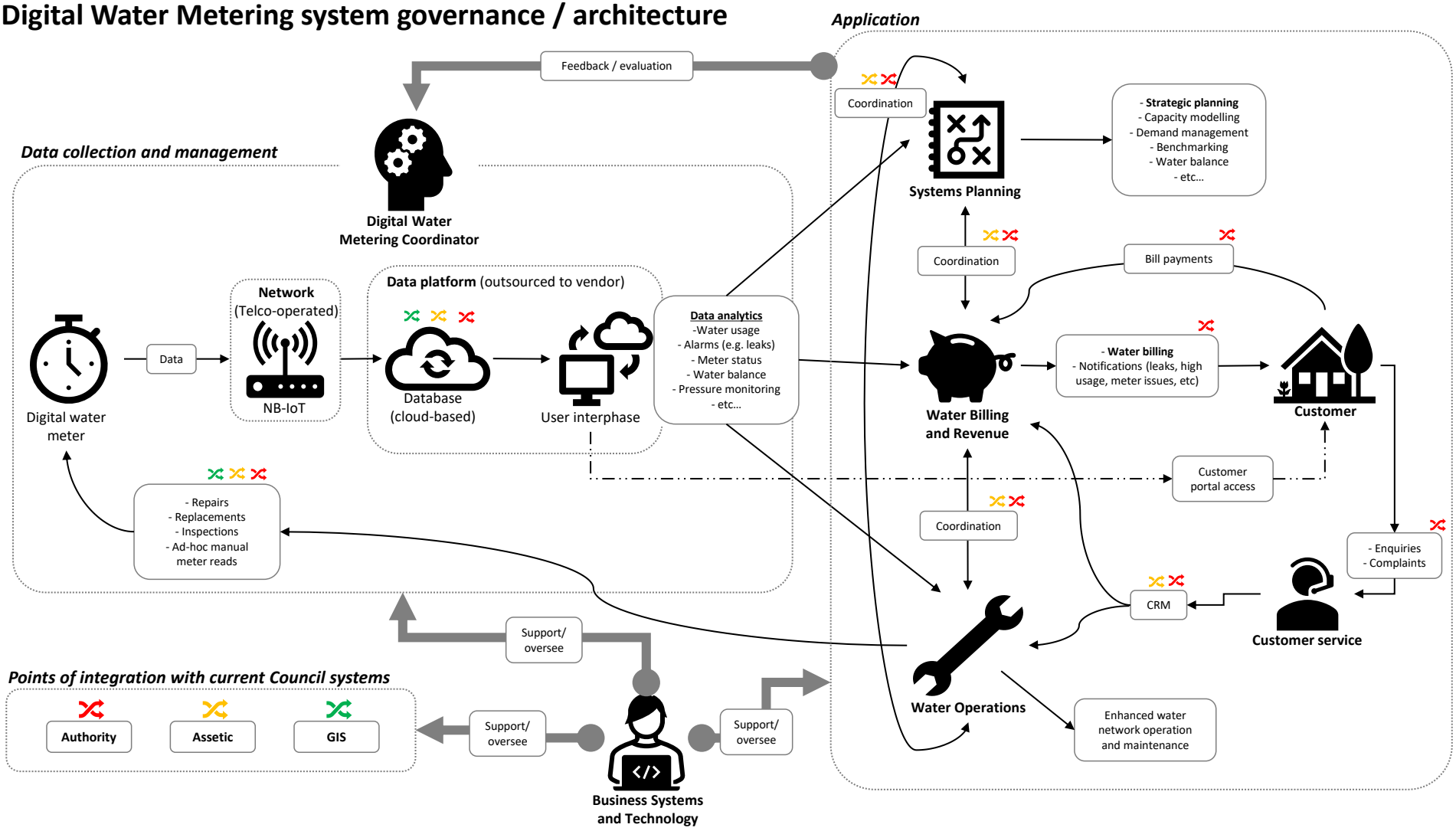
8. Consultation and Engagement

Council included internal and external consultation during the pilot program. External stakeholder consultation was carried out according to the approved stakeholder engagement plan (E2020/34816). It is expected that a full-scale rollout of Digital Water Metering may require community consultation in alignment with Council's Community Engagement Strategy.

9. Attachments

1. *E2024/84547 – WSAA 2022 Digital Metering State of Play Summary Report*
2. *E2024/84550 – Water Directorate 2021 Digital Metering Guidelines*
3. *I2020/695 – Report 20/05/2020 Executive Team Meeting (Operational) Smart Water Meter Reading Pilot Project Update*
4. *E2022/48821 – Report 25/05/2022 Your Say Detailed Project Report Smart Water Meter Pilot*
5. *E2022/48831 – Smart Water Meter Pilot Project Community Survey*
6. *E2020/70642 – Memo - Smart Water Meter Pilot Project - Request for Approval of Tender*
7. *E2024/93415 – Digital Water Metering pilot – Budget estimations for a full-scale implementation*
8. *E2023/12961 – 2022 Community Engagement Strategy - Byron Shire Council*
9. *E2024/93422 – Conceptual diagram - Digital Water Metering system governance and architecture*

Digital Water Metering system governance / architecture



Digital Metering State of Play Summary Report

OCTOBER 2022

Does your organisation have a digital metering strategy?

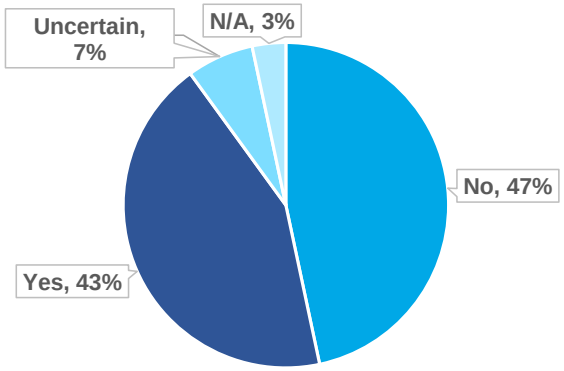


Figure 1 Organisations having a digital metering strategy

Are you willing to share your digital metering strategy with the Working Group?

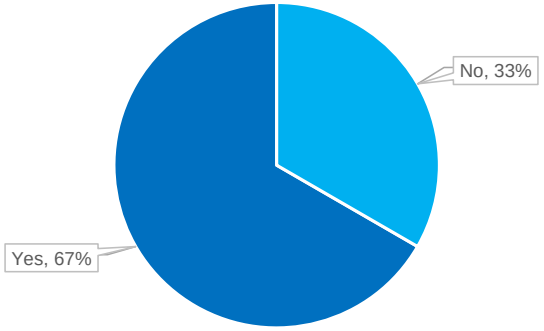


Figure 2 Organisations willingness to share their digital metering strategy

Observations:

- 36 responses received from 30 water corporations and councils.
- A number of regional organisations with known rollouts did not respond
- One large metro utility and two New Zealand utilities did not respond

Do you have Executive Support?

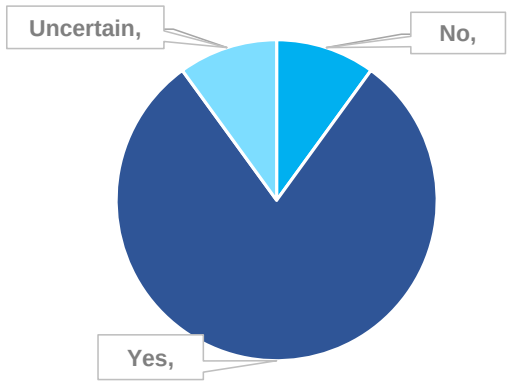


Figure 3 Executive support for digital metering is considerable

Do you have a Champion working on Digital Metering?

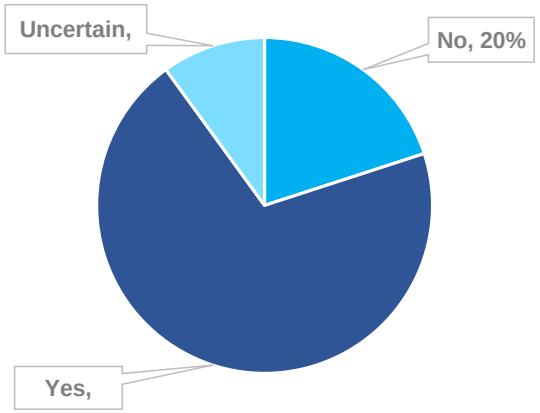


Figure 4 Most organisations can identify a champion for digital metering

Observations:

While most organisations have either Executive Support or a Champion, the number that had both was only 63% (19 of 30).

Where are you at with Digital Metering?

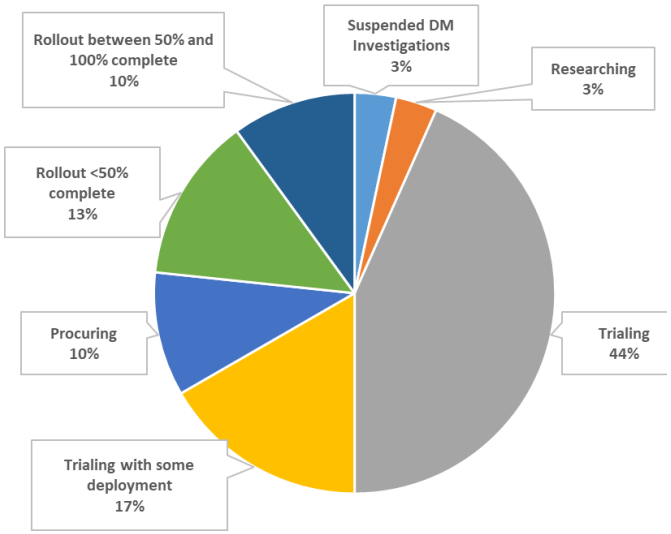


Figure 5 Assessed status of Digital Metering Project

Are there any drivers for your digital metering implementation?

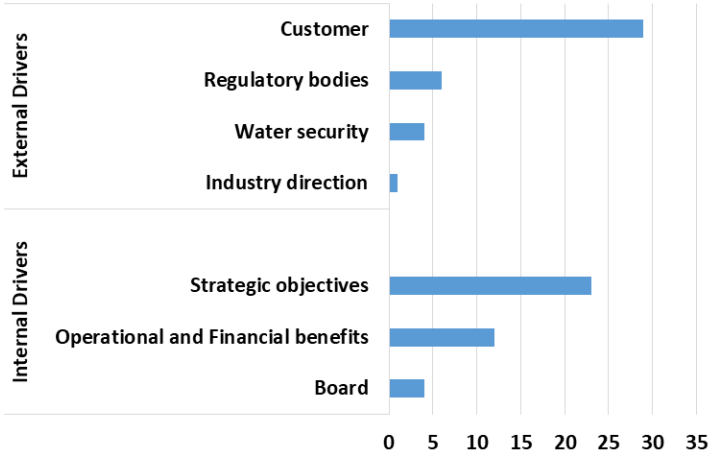


Figure 6 Organisations' priorities for Digital Metering Implementation

Observations:

Digital metering is seen predominantly to deliver against organisational objectives and customer expectations and benefits

What are the roadblocks/ major challenges to get digital metering up and running at your organisation?

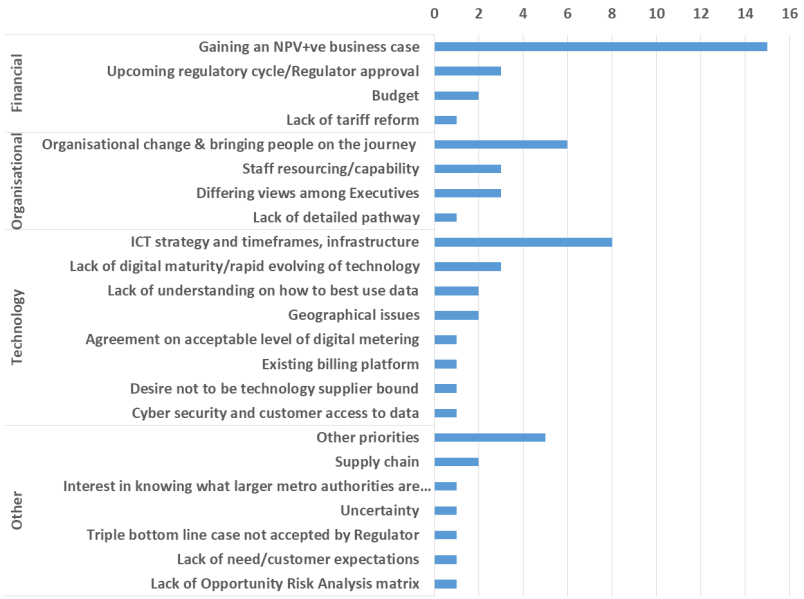


Figure 7 Roadblocks and challenges faced by the 30 organisations in moving forward with digital metering

Projected total digital meter deployment

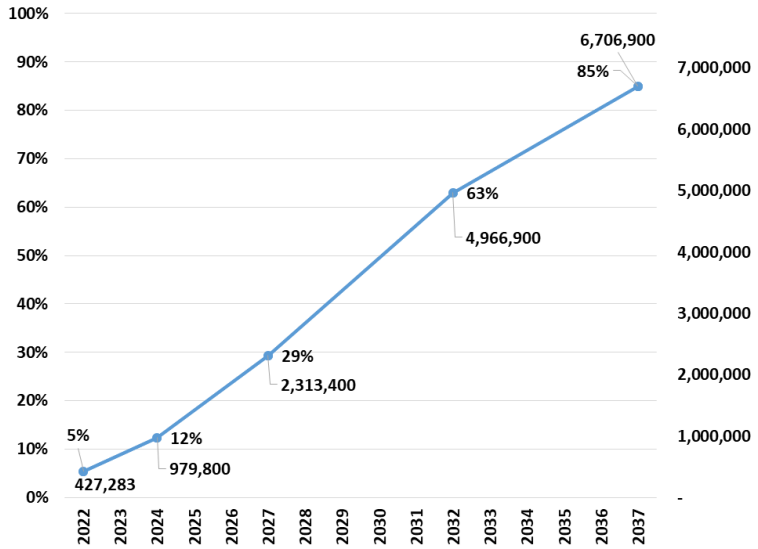


Figure 8 Total number of digital meters (rounded to nearest 100) and % of all responding organisations' fleet in 2, 5, 10 and 15 years

Observations:

30 responding organisations only. These figures understate both the current rollout and the 15-year rollout because of the missing data from organisations that did not respond and population growth (not requested).

Summary of Observations

Thirty responding water organisations provided an insight into their digital metering projects as at end-June, 2022.

One major Australian utility and a number of regional Councils with known rollouts and two New Zealand utilities did not respond.

Most organisations

- Enjoy Executive support
- Have a digital metering champion
- Are still at the trialling stage – three had achieved substantial rollouts, another seven have rollouts progressed or are currently procuring
- Identified difficulty in achieving a NPV positive business case as the main challenge
- Use trials to attempt to quantify the benefits
- The technology continued to be a focus rather than the business and customer benefits

Many organisations

- Considered the technology immature despite digital metering being used for over 20 years
- Were caught in a continuous loop of technology assessment
- Wanted additional sensors on digital meters

Some organisations

- Have concerns about feature creep on digital meters and the adverse impact on meter costs
- Consider vested interests among some organisations also acting as vendors “corrupted the exchange of ideas and experiences” without having installed in volumes themselves

Innovative approaches to manage project costs such as leasing meters, creating buying groups and minimalist implementations were not evident.

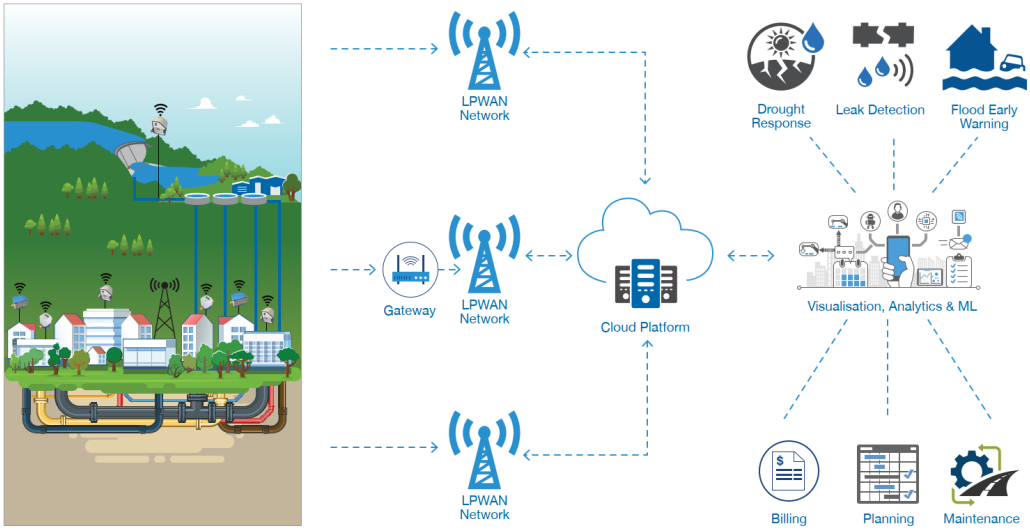
The current business environment (government commitment to climate change action targets, labour shortages, rising inflation and borrowing costs, increased customer expectations in a digital world and interest in personal contribution towards climate change action) provide fertile ground for digital metering implementation.

Survey conducted by the Intelligent Water Networks and Water Services Association of Australia. Analysis and comments provided by Dr. Ian Monks

Completely Updated and Re-Written

Guide on Digital Metering

Evaluation, Costs and Benefits
for
NSW Water Directorate Members



November 2021

WaterGroup Pty Ltd

Document Control

Project Name Guide on AMR Technologies

Report for Water Directorate

Version	Date	Prepared by	Reviewed by	Approved by
0a	24/10/21	GHD	DMcG	
1a	15/11/21	GHD	DMcG	GHD
1b	17/11/21	GHD	LS	GHD

Acknowledgement

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

EXTENDED EXECUTIVE SUMMARY

Councils, communities and utility service providers are increasingly moving towards a smarter and more connected world. The catch phrase "digital utility" summarises this. IoT, the Internet of Things, has enabled the gathering of data at a hitherto unheard-of volume, complexity and affordability. Collecting and analysing this data in a meaningful way to determine corresponding action will transform the way we deliver water services.

Replacing mechanical meters manually read once a quarter with devices that deliver hourly interval data on a daily basis forms the backbone of this strategy. It gives a water authority instant visibility in terms of expected network performance, water demand, water losses and other abnormalities. It allows for immediate intervention where, when, and as required.

The challenge is how to select the most appropriate technology that is affordable today while providing immediate, mid and long term benefits for a council/water utility, its ratepayers and the community as a whole.

An immediate benefit is replacing the manual meter reading with automated meter reading (AMR). Yet, it is self-evident that the benefits of smart water metering go well beyond that. Building and capturing the many benefits available from an advanced metering infrastructure (AMI) network include using the data gathered for automatic billing, an online water balance, automatic notification to customers with abnormal water consumption including leaks, identifying substantial water losses and in particular step changes in council's own water network, improved capacity planning, a significantly enhanced customer relationship, image, and much better demand management.

Typically, it has been the latter that has provided the most compelling business case for most smart water metering projects to date. Where regular automatic recording of water use has allowed the reduction of demand to a point where the capital expenditure for an otherwise required significant supply capacity augmentation project, i.e. a new or enlarged dam, a water treatment plant or transfer pipeline, could be deferred.

The advent of modern Internet of Things (IoT) systems coupled with other cost effective online monitoring technologies such as leak detection, and the ability to combine all these related data streams with other data, has increasingly opened up the opportunity for councils to capture additional benefits at small additional costs.

Early identification of water loss in the network, developing a better understanding of network operations, marginal capacities, and detecting abnormal consumption patterns as soon as they occur, and avoiding the risks or large infrastructure damage associated with it, are all key benefits. IoT has made data acquisition far more economical, flexible, and simpler than ever before. The interoperability and price point offered by new smart metering technologies enables water utilities to manage infrastructure and resources much more efficiently than ever before.

This report has been prepared to help and guide Water Directorate members through the plethora of the different available options and technologies. Significant improvements since the original report prepared in 201 are that it has now become even easier to mix and match different technologies whilst maintaining flexibility to cater for future requirements.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

It means, that a Council can readily embark on a smart metering project without having to formulate a full strategy. Indeed, it is more likely that this strategy will be an evolving target that will continue to be refined as experiences are gathered from ongoing digital metering projects. Because the flexibility exists to adapt and change, there is little risk of "stranded assets".

The olden days where it was imperative to "get it right" when the initial far reaching multimillion dollar strategy decision had to be made, are gone. Council can now begin the journey with small steps and take it from there. The project can stay as small or grow as large as Council wants to, and as funds and internal capacity allow.

The Water Directorate provides a reliable source of technical water efficiency information to its members. It works towards promoting efficient operation of Local Government water and sewerage infrastructure. The Directorate comprises 87 Local Water Utility members across regional NSW. This is why the Directorate engaged WaterGroup to provide this updated report.

Smart or digital metering consists of:

- A mechanical meter with a probe and logger attached to automatically collect meter reading data, or an integrated electronic meter. These devices read and transmit meter data to a local transmitter.

  Many integrated electronic meters no longer use mechanical water wheels to measure the amount of water dispensed. Instead, they use an integrated solid state ultrasonic or mag flow measurement system. It has the advantage that it does not drift over time, is less susceptible to fouling and particles and thus remains more accurate over the lifetime of the meter. Additionally, it measures lower starting flows. As a result, based on a peer reviewed AWA paper, it is generally accepted that these meters capture, on average, 4% more revenue for the utility than its older mechanical counterparts.
- The collection of this data can happen by drive by methods or fixed networks. Nowadays, drive by system have become increasingly outdated. Instead, meters connect to a communications network established as part of the smart metering project as is often the case for technologies like Taggle, Ventia, or Suez with the WIZE network. Or it may already exist, as may be the case for LoRaWAN or Sigfox. NB-IoT coverage is provided in most areas already.

  In Australia, LoRaWAN is typically provided by either NNNCo, Meshed, or Geowan, although a Council could readily provide it itself. Sigfox is provided by Thinxtra. NB-IoT is delivered through the existing mobile phone network by Telstra, Optus or Vodafone.

  3G, 4G or 5G are no longer appropriate technologies for smart water metering. Their cost and energy consumption lead to an unacceptably low battery life.

  Taggle, Suez/Wize, LoRaWAN or Sigfox receive their data via locally installed transmitters creating a meshed network. The loggers/meters have a modem to directly communicate to the network.

  For NB-IoT each logger/meter has an individual SIM card embedded, just like your mobile phone. It links directly to a Telstra, Vodafone or Optus telecommunications tower.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

- The data collection, visualisation and analytics typically require a cloud-based software as a service set up. It no longer needs the installation of software on the client side. It means, that setup costs are typically relatively small while remaining infinitely scalable. Hence, one can start small and yet use the platform for a future Council wide rollout, change to something else, or bolt on additional capabilities. Most platforms allow for the ingestion of data collected from different meters, loggers or communication networks.

The three components explained above comprise a smart metering system. Such a system can be provided through a single supplier end to end or it can be procured as individual components from separate providers. Taggle, Ventia or Suez are examples of a single source end to end system. These are more closed systems meaning there is a close connection between the hardware, the communication network and the software.

LoRaWAN and Sigfox are often provided by the council specifying this as its preferred network and then requiring the market to provide solutions matching these requirements.

NB-IoT is the most open system. The meters/loggers, the communication network and the transmission protocol are all based on globally standardised and published protocols. It means that any manufacturer, telco or software vendor can interface with any one of the three components as they are all based on global standards. A Council can either procure each of those components individually and then combine them in a whole integrated, working system, or it can go to market for an integrated end to end solution.

Increasingly, there are now also offering available to procure metering as a service (MaaS) whereby a Council no longer has to outlay any capital but it simply pays effectively for the data it receives.

Unfortunately, it is impossible to make a clear recommendation which system or technology would have a clear preference over others. It depends very much on what the Council wants to achieve, its own capabilities to derive the many benefits available, its risk appetite, and which vendor it feels most comfortable engaging with.

Often, decisions can also be dictated by other council policies such as e.g., investment in establishing a local LoRaWAN network. A key factor is t whether a Council is prepared to manage several contracts and bring them together as a whole, or whether it prefers to engage just one-party end to end ("one throat to choke").

Costs have substantially dropped since the last report four years ago both in terms of initial capital but even more so in terms of the ongoing operational communications costs – while capabilities and lifespans have increased. There is often little difference between different vendors. It very much depends on how each tender is structured on which offering comes through as the most cost effective.

A big factor is what benefits a Council believes it can extract, and how they are priced into the equation. For example, if a council is largely interested in automated meter reading, then the most simple and basic smart metering solution will do. Little value would be placed on data, flexibility and future upgradability.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

Likewise, a Council that is aware that data is king and will only ever become more valuable in the future, would place a high value on a system that provides rich, more granular and reliable data, and the opportunity to respond to changing future needs. It may be prepared to pay a little bit more for that system today knowing that future benefits will far outweigh any possible savings today.

Basic budget costs are as per the spreadsheet below.

Table 1: Suggested Digital Metering Budget Costs

Digital Metering Budget Cost Estimator

Note: This is a generic high level budget estimating sheet only. For a more detailed costing, customised for individual needs, separate engagements shou

	Cost Guidance		
Item	**Total No. of Meters/Loggers**	**Budget Price Range**	**Comments**
Capital Costs			
Design & Engineering	0-5,000	$10,000-$25,000	these costs will vary and depend on who and how they are performed. E.g. a council may do it all in house, or only get some extra help.
	5,000-50,000	$25,000-$40,000	
	50,000+	$40,000-$100,000	could he higher than max stated
Tender & Procurement Costs	0-5,000	$5,000-$15,000	as above
	5,000-10,000	$15,000-$25,000	
	10,000-25,000+	$25,000-$100,000	
Network Infrastructure	1-10	$8,000-$12,000	where required, i.e. not pre-existing, Typically for Taggle, Suez, sometimes for LoRaWAN. N/A for NB-IoT.
	11-50	$5,000-$8,000	
Integrated electronic smart water meters - supply only	10-250	$290-$350	includes allowance for S+H, QA, registration etc. Individual unit prices may be $10-$35 lower depending on the deal struck.
	250-1,000	$250-$290	
	1,000-5,000	$220-$250	
	5,000+	$195-$220	
Retrofit loggers - supply only	10-250	$250-$290	includes allowance for S+H, QA, registration etc. Individual unit prices may be $10-$35 lower depending on the deal struck. Take off $50-80 from unit prices for Taggle/Suez loggers. Does not include supply of mechanical meter, get price from normal meter supply contract if required.
	250-1,000	$220-$250	
	1,000-5,000	$180-$220	
	5,000+	$150-$180	
Install loggers or smart meters	10-250	$70-$85	includes allowance for setup, QA, documentation, etc. Assumes no more than 15% of meters are not "easy" to install, i.e. access restrictions, meter not found, no stop valve, covered in dirt, etc. Allow $50-$150 extra for each "problem" install. Take off $20-$35 for installation of loggers only, i.e. without meter.
	250-1,000	$60-$80	
	1,000-5,000	$50-$70	
	5,000+	$40-$60	
System Setup & Configuration	10-500	$5,000-$8,000	depends a lot on the vendor and technology and Council's pricing request. Could be part of the above unit prices. Could be hihgly variable.
	500-5,000	$8,000-$25,000	
	5,000+	$25,000-$95,000	
Integration with other systems, commissioning, fine tuning	Highly scope dependent	$10,000-$100,000	very much depends on how many other systems it is to be connected to, e.g. billing, CRM, asset management, SCADA, etc.
Project Management	6%-12%	$5,000-250,000	estimate an allowance as % of total
Miscellaneous/Contingency	6%-12%	$10,000-$350,000	estimate an allowance as % of total
Total Capital Cost		**$300-$550**	overall unit price

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

Item	Total No. of Meters/Loggers	Budget Price Range	Comments
Capital Costs			
Design & Engineering	0-5,000	$10,000-$25,000	these costs will vary and depend on who and how they are performed. E.g. a council may do it all in house, or only get some extra help.
	5,000-50,000	$25,000-$40,000	
	50,000+	$40,000-$100,000	could he higher than max stated
Tender & Procurement Costs	0-5,000	$5,000-$15,000	as above
	5,000-10,000	$15,000-$25,000	
	10,000-25,000+	$25,000-$100,000	
Network Infrastructure	1-10	$8,000-$12,000	where required, i.e. not pre-existing, Typically for Taggle, Suez, sometimes for LoRaWAN. N/A for NB-IoT.
	11-50	$5,000-$8,000	
Integrated electronic smart water meters - supply only	10-250	$290-$350	includes allowance for S+H, QA, registration etc. Individual unit prices may be $10-$35 lower depending on the deal struck.
	250-1,000	$250-$290	
Annual O&M Costs			
Network Access	10-1,000	$10-$12	unit price for network access charges, e.g. SIM cards. May not be charged as a unit cost for some systems, such as e.g. LoRaWAN.
	1,000-5,000	$8-$10	
	5,000+	$5-$8	
O&M of Network		$5,000-$50,000	depends on if applicable, e.g. if Council operates its own LoRaWAN network, and how O&M costs are accounted for
Device Management Layer	10-1,000	$10-$12	depends on whether this is requested/quoted as a separate layer or integrated into one whole
	1,000-5,000	$8-$10	
	5,000+	$5-$8	
Data Visualisation and Analytics Layer	10-1,000	$12-20	depends on whether this is requested/quoted as a separate layer or integrated into one whole
	1,000-5,000	$8-$12	
	5,000+	$5-$8	
Platform for Indiv. Customers		$4-$12	assume that no more than 20% will use it, i.e. budget for <20% of total smart meter connections only
Licence Fees	per installation	$15,000-$60,000	depends on if applicable if vendor charges it separately. Usually nowadays all contained in above SaaS annual fees.
Other	1,000+	$1-$5	allowance for integration with other systems, e.g. billing addit. analysis, API, etc. Could be used for contingency too.
Total O&M Costs		**$15-$35**	overall unit price
Annual Benefits			
Increased meter revenue		$15-$35	typically 4% of annual revenue. Applies to integrated electronic (solid state) meters only
Increased billing efficiency		$0.50-$2	Possible benefits include monthly or real time fully electronic billing through the app. Needs to be assessed separately.
Removed meter reader costs		$7-$12	
Reduced network leakage	assume existing loss is 8-15%. Then x # of connections x 500L/d		enter your estimated reduction in leakage in kL/yr. Assume 5-20% x marginal cost of water in $/kL
Marginal cost reduction			this needs to be obtained via a separate study
Drought response and demand management benefits			this needs to be obtained via a separate study
Other 1			this needs to be obtained via a separate study
Other 2			this needs to be obtained via a separate study
Total Annual Benefits		**$35-$125**	overall unit price
Net Annual Cost/Benefit		**$35-$100**	
Simple payback in years		**5-15**	

A costing spreadsheet has been provided that allows to input capital costs based on guidance costs provided for different systems as well as ongoing annual operating and maintenance costs. It also provides fields to enter benefits as all of these will vary significantly from council to council. It then adds it all up to create a simple payback calculation.

A matrix has been prepared to evaluate the different technologies against a number of suggested key criteria. This table has also been provided to members as a live Excel sheet including a blank template that a Council can use for its own assessment

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

Table 2: Evaluation Matrix for Digital Metering

Assessed Ratings for Digital Metering Technologies									
Criteria	Drive-by Systems	LoRaWAN	Taggle	Ventia	WIZE (Suez)	Sigfox	Silversprings	NB-IoT	Notes
Note: Ratings are indicative and can vary substantially based on each Council's own conditions and preferences									
Capital Cost	4	4	5	5	5	4	4	3	
Annual O&M Cost	5	3	4	3	4	3	3	2	
Security	5	3	4	4	4	3	3	3	
Battery Life	4	3	4	4	4	4	3	3	
No Vendor Lock-In	1	3	1	2	2	1	1	4	A
Interoperability	1	4	3	2	2	3	3	5	
Use for Other Applications	1	4	3	2	2	3	2	5	
Data Richness and Flexibility	1	2	1	1	1	1	2	5	
Firmware Upgrade (incl. FOT	1	2	1	1	1	1	1	5	
Existing Coverage	N/A	Assign a score of 5 if network exists already, 2-4, if partial, 1 if no coverage						4	B
Ability to Expand Coverage	5	5	5	5	5	3	4	2	
Availability of integrated electronic meters	5	2	2	2	4	2	2	5	
How Future Proof is the Solu	1	4	3	3	3	3	3	5	
Overall Score (unweighted)	**34**	**39**	**36**	**34**	**37**	**31**	**31**	**51**	
Note: Care needs to be exercised when looking at the unweighted overall score as it dilutes individual criteria. Sometimes it is better to ignore criteria with a similar score and focus on the differentiating ones. Or the focus could be on criteria most important to a particular use case only. Likewise, a Council may choose to ignore some.									
Comments									
A - there is vendor lock-in for the telco until eSIMs are available (ETA late 2022)									
B - available for most areas in Australia with mobile phone coverage, even if coverage is poor									

Data sheets from the suppliers who responded to our request, representing various technology options have been provided in Appendix C.

It is hoped that this Guide will help Water Directorate members in their information gathering and decision-making process as they transition to a digital utility.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

HOW TO USE THIS REPORT

To help the reader to quickly navigate to relevant sections without having to read the entire report, the following guide has been prepared. In a digital version all links should act as hyperlinks. To activate them hold the Ctrl key while clicking on the Section, Table or Figure number or label.

Question	For the Answer go to
Let's get to the crux of it: How much does it cost?	Table 1: Suggested Digital Metering Budget Costs
What are the benefits of smart metering?	4.1 Key Factors for the Business Case
What's the business case?	4.2 Business Case Development, Table 3: Business Case Development for SM System, Table 4: Digital Metering Budget Cost Estimation Sheet
What are the pros and cons of each system?	Table 2: Evaluation Matrix for Digital Metering
So what's the upshot of all of this?	6 Conclusion
How do I get an overview of the digital metering landscape?	Read the extensive Extended Executive Summary
What are the different components?	3 Components of a Digital Metering System
What are the different communications systems like Taggle, LoRaWAN, NB-IoT?	3.3 Communications Layer
Which communications system should I choose?	3.3.11 Selecting a Communications Network
How do the different technologies compare?	5.1 Definition of Evaluation Criteria, Table 5: Evaluation Matrix for Digital Metering
How do I retrofit an existing mechanical meter to turn it into a smart meter?	Sections 3.2.1 to 3.2.3
How long does the battery last? What impacts on its life?	Sections 3.2.5, 3.2.6, 3.2.7
Which system has the best signal penetration?	3.3.10 Signal Penetration
How do I collect and analyse the data?	3.4 Data Collection and Analysis
How do I get value from all the data?	3.4.6 Deriving Action from the Data Collected
How do I understand all the jargon?	1.4 Glossary of Terms
What is better? A single vendor system like Taggle or one where a number of systems are bolted together?	3.5 Smart Water Metering Systems
How do I best procure it?	5.3 Procurement
How is the report structured?	2 Report Structure
Where can I get additional information?	9 Appendix C - Sample Data Sheets

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

Table of Contents

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

Table of Figures

List of Tables

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

1 INTRODUCTION

1.1 Background

The Water Directorate is committed to providing an independent source of advice to its members on how to improve Local Government water and sewerage infrastructure. Its members include 87 local councils and water utilities in NSW.

The smart metering industry evolves year after year and it is often hard to keep up with new technologies in the market. Installing a new smart water metering system involves significant capital costs. This holds true whether existing mechanical meters are retrofitted with a sensor and a logger, or whether they are replaced with a new integrated electronic meter.

Even if a replacement is done at the end of the mechanical meter's useful life span, digital metering systems have significantly higher capital and ongoing operating and maintenance costs. These comprise network connection and communications, operations and maintenance costs plus applicable back end data display and analytics charges.

These must be carefully evaluated against all the possible benefits available, and the capacity and willingness of the organisation to realise them. This should be done as part of a careful and well considered decision making process. It must take into account all facets of such a project. It should use a total lifecycle analysis to evaluate the different options available, and thoroughly consider all costs and benefits.

The Directorate has engaged WaterGroup to provide a report which assesses the different Automated Meter Reading and Smart Metering (Digital Metering) technologies including backend data collection and analytics services available in the market today. It includes the latest IoT technologies which have revolutionised the remote metering industry.

The report provides an overview of the current digital metering technologies. It assesses their reliability and performance. It also analyses opportunities that certain technologies present over others.

As the members of the Directorate come from both rural and slightly more urbanised areas, the report provides a comparison on suitability of technology based on urban and rural applications as well.

1.2 Scope

This report has been provided as an update of the 2017 report to investigate and understand the digital metering technologies available in the Australian market, assessing their costs and benefits, suitability for rural and urban applications, and what technology provides best futureproofing.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

1.3 Objectives

Key objectives from conducting this study include:

- Gaining an understanding of digital metering technologies available in the market today
- Reviewing different options and assess suitability for rural and urban meters
- Understanding the costs associated with a digital metering system
- Understanding the benefits associated with a digital metering system
- Understanding what is required to capture those benefits
- A guide to let a Council decide which ones are relevant to its particular case and whether the organisation has the capacity to deliver those
- A guide to help a Council to prioritise which benefits may be relevant and attainable to it now, mid and long term.
- How the above and other requirements, in terms of flexibility required, impact on the decision process, and what technology to choose.
- A guide on how to quantify the various benefits

1.4 Glossary of Terms

Generally, the following definitions relating to smart water metering are applied in Australia.

It is important to note that due to the current rapid technology development many of these definitions are fluid. Often there may not be universally accepted singular definitions. It is therefore suggested that instead of placing too much focus on a particular definition the focus should be placed on the features and benefits of a particular solution, and on understanding what people mean when they use a certain term.

In this report, the term *Digital Metering* is used as the overarching term comprising most of the components defined below.

3G/4G/5G: 3rd, 4th, 5th Generation wireless mobile technology.

AMI: Advanced Metering Infrastructure. It means the installation of a fixed wireless collection network and the backhaul of metering data to a metering data management system. Typically, AMI refers to systems with bidirectional communications and higher capabilities than *AMR*.

AMR: Automated Meter Reading. The automated collection of meter reads. May still require a meter reader to visit the property or be nearby (drive by systems). Typically refers to systems with only unidirectional communication capabilities and readings transferred once per hour or just once per read, e.g. weekly or monthly.

CAT-M1: a network operated by the public telcos through the mobile phone network similar to ***NB-IoT***. Its main difference is that it has a slightly higher data throughput capacity, typically at the expense of a slightly lesser signal penetration. To an extent, in Australia, it has been surpassed by the rollout of and focus on NB-IoT.

WaterGroup PtyLtd ABN 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

Digital metering: The overall all-encompassing term capturing everything that comprises smart water metering including hardware and software systems.

Device: In this report this term is used to describe a logger attached to a mechanical meter to enable it to be electronically read, or an integrated electronic meter.

Device Management Layer: The first port of call, i.e. the initial software interface to which a logger or meter connects to. Where applicable this is also the software layer that allows configuration and firmware updates.

Digital Twin: A model that simulates in real time the actual operations of a utility based on data continually collected from all types of sensors across its networks and operations.

Digital Utility: A utility that collect sufficient online data across their network operations that it has a real time overview of its entire operation to the point where it can run a real time model of (parts of) its operations.

Firmware: The software that is on board a logger/meter, i.e. its operating system.

Head End (System): A term used to refer to the software part where the data arrives, is collected, stored, visualised and analysed. It may include the part that is also responsible for passing that data on to other Council systems such as e.g. its billing system.

IoT: The Internet of Things. It is the internet connectivity of all types of devices ('things') such as smart meters, sensors, gauges, status indicators and many more.

IoT Devices: This is used as an umbrella term to include all 'smart' and 'connected' devices such as 3G or NB-IoT, LoRaWAN, Sigfox devices, and many others.

IWN: Intelligent Water Network. It refers to the integration of intelligent devices including water meters, pressure sensors, and meter data, into all relevant business processes and systems and using this information to guide strategy and investment. IWN is the backbone of a Digital Utility.

LoRaWAN: The name LoRaWAN comes from **Lo**ng **Ra**nge **W**ide **A**rea **N**etwork. It is promoted globally by the LoRa Alliance. It is an open standard allowing new wireless technology enabling businesses to take advantage of the IoT phenomenon. In Australia it is commercially provided by companies like NNNCo, Meshed, Geowan or Ventia, although it can also be installed by council itself.

LPWAN: Low Powered Wide Area Network. It is a back-end infrastructure to receive and distribute data, used by low power consuming devices.

LTE: Long Term Evolution, trademark name for a version of 4G wireless standards.

NB-IoT: Narrow Band Internet of Things. It is a wireless protocol globally standardised by the same industry group (3GPP) who standardised 3G/4G/5G. It is operated by public

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

telecommunication companies such as Telstra, Optus, and Vodafone using their existing mobile phone telecommunications infrastructure.

SCADA: Supervisory Control and Data Acquisition. SCADA is a control system architecture that uses computers, networked data communications, and graphical user interfaces for process control, supervision and automation of treatment plants, pump stations and other critical assets. It is very different to IoT in that it focuses on a relatively small number of critical devices and it exerts control. Conversely, in the IoT world individual devices are dispensable because there are many other delivering similar information and, in most cases, there is not control over the asset. E.g. a smart meter delivers simple water meter reading data and offers no individual control. If one meter fails to automatically read, it has little impact on the overall operation of the utility.

Sigfox: Sigfox is a global wireless network provider from France. It builds wireless networks to connect low-energy objects which transmit small amounts of data. In Australia, its network is operated by Thinxtra.

Smart Metering: The term smart metering is used as a generic description for the process of remotely obtaining data from water meters, whether it is via addon devices or integrated electronic meters.

Smart Water Metering: It refers to the integration of meter data into business systems (e.g. billing system) and the sharing of information with customers (e.g. via a customer portal/web).

Taggle: The pioneer of automatic water meter reading in Australia. Developed by CSIRO engineers who developed the Wi-Fi protocol it uses a proprietary communications network to send a meter reading signal to a proprietary receiver and from there to associated head end system.

WIZE: A communications network and smart metering system distributed in Australia by Suez using add on loggers (a bit like Taggle) or integrated meters.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

2 REPORT STRUCTURE

Below is an outline of the contents of the report.

2.1 Technology Background

This provides a brief understanding on what digital metering means and what the different components of the technology are.

2.2 Market Overview

This provides an overview of the different technologies available. It highlights the key technology features of various systems and how they work answering questions like: How do they attach to a meter? Can they be retrofitted? Do they require new meters? Is it open source/closed source (proprietary)? Coverage, retrofit, staging, data display, and more. Software options.

2.3 Cost Benefit Analysis

The information is presented such that it could be adopted by a council to become the template of its business case. It could also readily form the basis of a funding application, should such an opportunity present itself.

2.4 Evaluation of Technologies

Here, key systems are assessed and evaluated against key criteria. It helps shortlist certain technologies/providers, and just as importantly exclude some that do not meet a utility's criteria.

It also identifies where a mix of several technologies (hybrid system) could best meet a water utility's needs.

A new section has been added to specifically talk about cloud technologies and IoT style internet platforms as this landscape has seen dramatic change since the 2017 report.

2.5 Conclusion

This section presents a summary of the findings.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

3 COMPONENTS OF A Digital Metering System

3.1 Differences between AMR and AMI

Digital metering, smart metering, AMR and AMI are terms used to describe essentially the same thing. To an extent, it is academic to discuss the differences.

However, strictly speaking AMR (Automatic Meter Reading) should be distinguished from other more encompassing terms like AMI and Digital Metering.

AMR simply means a way to automatically read meters. There are two ways:

1. Drive by Systems. Here a meter has an integrated transponder. It continuously sends out the current meter reading. When a person drives by with a specific receiver, whether as part of another routine, e.g. rubbish collection, or specifically to collect this data, the meter reading is electronically recorded.
2. The other way is that a logger is installed on the meter and connected via a probe to collect readings and to transmit the data to an online portal or database via different types of communication systems (see 3.3). It is then possible to view the collected data online, largely for billing purposes.

When significant benefits from the system are expected to come from addressing issues like monitoring abnormal consumption, network and water loss management, demand management, etc. then it is better described as AMI. Hence, an AMI or Digital Metering system is one that derives its benefits well beyond just AMR (automatic meter reading).

Additionally, they also often offer further functionalities such as two way communications allowing remote configuration of logger/meters. It includes the ability to change the logging or upload frequency etc. The components of a typical digital metering system are detailed in Figure 1.
.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

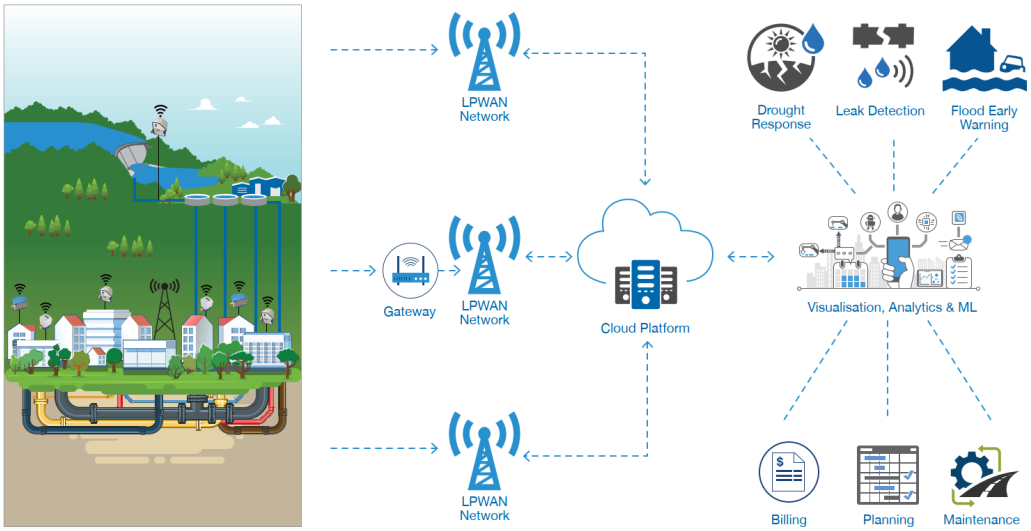


Figure 1: Typical AMR System

3.2 Hardware

3.2.1 Water Meters

Water meters are used to measure the volume of water used by residential or commercial properties. The majority of residential water meters are 20 mm in size. Water meters for commercial and industrial properties (non residential) range in size from 25 to 80 mm with the largest ones up to 150mm and beyond.

The water utilities themselves install water meters within their network, from treatment plants and storage tanks. These can range in size anywhere from 50 mm to 650 mm and beyond.

The majority of present day customer water meters are mechanical meters. Essentially, these have a water wheel inside which turns as water passes through. It measures the volume of water dispensed by that particular meter.

Most mechanical meters use the turn of that wheel to generate an electronic pulse, a bit like a Morse code. It can be used to allow a logger via a sensor to electronically record the volume of water that has gone through that meter.

Larger electronic meters are typically Magflow meters but more recently also ultrasonic ones. These can be read either via pulses or via a direct interface such as Modbus.

3.2.2 Sensors/Probes

Sensors are the probes that connect to a mechanical water meter to collect readings from it. One of the most common ones is referred to as a T-probe. it connects to the Elster V-100 meter.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

3.2.3 Loggers/Transmitters/Pulse Readers

All three terms are often used interchangeably. They are essentially synonymous. It refers to a device that reads the pulses generated by a water meter proportional to the amount of water that has flown through it. It collects those readings via a sensor/probe and transmits them at regular intervals using any of the communications networks mentioned, whether it is a drive by system or a fixed network such as NB-IoT, Sigfox, LoRaWAN, Wize, Taggle, Ventia or others.

A logger may or may not have a temporary storage/buffer capacity such that it can temporarily store some data locally before it is uploaded.

The disadvantage of the sensor and logger arrangement is the reading of pulses. This can be problematic and unreliable as one pulse can be read as multiple pulses or missed due to bounce and debouncing of the signal. Further, the cable connecting the logger to the sensor is usually exposed and thus may be prone to damage. Loggers with integrated sensors available for some of the most common older meters such as the Elster V100 avoid this.

There are now also mechanical meters with an integrated logger and sensor such that meter, sensor and logger become one unit. Usually these are available only for the most common water meters such as the Elster V100 or for Itron.

See also the note at the end of 3.2.4 regarding the complete lack of relevant standards and approvals for this technology for water metering and billing.

3.2.4 Integrated Smart Meters

Integrated purpose built smart water meters have mechanical or electronic flow measuring, volume recording, and communications capabilities all in one device. Of these there are two types:

- Mechanical meters with an integrated sensor and logger. These are effectively as described above comprising a mechanical meter, a sensor and logger except that they are all combined in one housing so it looks like one integrated unit.

  Examples of such types are the units offered by Taggle, Suez, or the Telstra/mIoT Metrum.
- Integrated network enabled electronic meters. They typically use magnetic or ultrasonic solid state flow sensing. This provides additional benefits such as higher accuracy and measurements at very low flow rates, i.e. water previously not billed is now recorded. This leads to additional revenue which can sometimes be enough to pay for the entire operation of the system. These meters are also less susceptible to blockages causing malfunctions as there are no moving parts or restrictions within the meter.

  Meter reading and logging are electronic thus ensuring that the read from the meter and the reading electronically recorded are exactly identical.

In both types, the transmission modem is integrated into the meter. It allows sending data directly to the outside world via its chosen communications network.

It is important to note that there are no Australian nor international standards or approvals, neither for water meter sensors nor the loggers used to read water meters

WaterGroup PtyLtd ABN 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

relative to their recording accuracy for billing purposes. This could be a potential future problem. In theory, any customer could challenge a water meter reading and the associated bill based on data acquired this way. The water industry should urgently address this.

3.2.5 Battery

Regardless of whether it is a plug-in logger or a smart water meter all of these devices are powered by an internal long life lithium-ion battery or batteries. For some devices these are replaceable although more typically they are not as the meter internals are fully encapsulated by a gel ("potted") to avoid water ingress.

3.2.6 Power Consumption and Device Life

Since the water industry is used to the old mechanical meters having a typical lifespan of 15 years, it has become commonplace that these electronic devices are also expected to last 10 to 15 years. This is still one of the most critical parameters and frequently quoted as the greatest obstacle seen to the wider, faster and more far-reaching adoption of smart water meters: The (perceived) risk of not being 100% sure how long these meters will last under real life operating conditions.

In theory, how long a device lasts is a direct function of its battery capacity and its energy consumption for logging and transmitting data. In reality, it is far more complicated than that. Factors such as one or two way communication, signal strength, environmental conditions and battery degradation play a much greater role than simply dividing the battery capacity by the energy used per logging and transmission cycle.

Power consumption and device life are strongly influenced by the communication system. As explained below, typically one way systems allow for more accurate estimation of the power consumed for data transmission during the life of the device than two way systems. Simply speaking, one way systems send out the data and don't care whether they were "heard", i.e. whether the data was received. Two way systems will check that the data has been received OK (read receipt). If not, they will try again and if need be "talk louder". This increases the chance of successfully transmitting data, but it also consumes more power. Modern device design and communication protocols carefully manage, optimise and limit extra power consumption due to this.

An often overlooked point though is that the degree at which the battery degrades over 10 to 15 years, being exposed to wind and weather and temperatures ranging anywhere from minus degrees to over 50°C has a far larger impact on how long a battery lasts than some academic discussions measuring individual logging and transmission cycles and comparing them to battery capacity. The variance due to this factor is the same for one or two way systems as it simply relates to the battery chemistry and performance.

3.2.7 One Way and Two Way Communication Systems

Smart metering systems using one way communication transmit data from the device to the receiver only. Sometimes, as is the case for LoRaWAN, there is some feedback whether the data has been received OK or not, allowing the transmitter to change the channel or increase its signal transmission strength.

WaterGroup PtyLtd ABN 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

The advantage of all one way systems is that their power consumption per transmission is always exactly the same. It is exactly known how much power a device will use to transmit to upload e.g. hourly data over a 10 year period. However, the other factors described above such as the impact of environmental conditions on battery performance and degradation still apply.

Two way systems work similar to a mobile phone. First, a connection is established (handshake). Then, a signal is sent out and a receipt is requested. If the data has not been correctly received, the device will retry several times and possibly increase the send power to achieve a successful transmission.

Clearly, this means that a device in a bad signal area will require more power and exhaust its battery more quickly. Conversely, a device in a good signal strength area may last a lot longer than the expected 10 to 15 years as long as the battery lasts that long.

3.3 Communications Layer

The communications network, often also referred to as the communications layer, is vital to the success of a smart metering project. Many previously existing communications networks were designed for higher data throughputs, network speeds and instant access such as those used for mobile phones.

Newer LPWAN wireless network technologies are designed for low power devices sending small amounts of data at regular intervals. This lower throughput requirement enables these networks to offer advantages in range, power consumption and cost.

The key network protocols are presented below.

Note that at this stage, a chip or modem that could communicate over a range of these networks does not exist yet in a production device. Due to cost pressures, this may not be a feasible option for large volume devices.

3.3.1 Drive-by Systems

These systems provide the ability to collect data through walking or driving by the water meters. Data is transmitted through the radio from the meters and is received via a mobile receiver. The handheld unit has matching software. It is able to organise meter read trips and process data on a desktop computer after the data has been acquired. Figure 2 shows the typical layout of a drive by system.

These systems typically require a new water meter to be installed as the transmitter unit is often integrated into the actual water meter.

WaterGroup PtyLtd ABN 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

Figure 2: Typical Drive-by System Architecture

3.3.2 Low Power Wide Area Networks (LPWAN)

Low power wide area networks (LPWAN) is the collective term used to refer to a new era of devices that allow simple, cost effective transmission of data from thousands of devices. LPWAN provides the backbone of the Internet of Things (IoT).

LPWAN technologies are designed to provide long range communications to widely distributed low cost and low power battery powered devices. The functionality provided by the LPWAN network fits well for digital metering systems where small packets of data from a large number of meters need to be sent at regular intervals to a cloud based data management system.

Such systems are often referred to as fixed networks as opposed to the drive by systems explained above.

3.3.3 LoRaWAN

LoRaWAN, short for low range wide area network, refers to a global communications standard that allows for the connection of IoT devices to a central receiver. A LoRaWAN network can bet set up by the Council or by others. In Australia there are LoRaWAN network operators such as NNNCo, Meshed or Geowan.

The benefit is that the network can be established at relatively little cost where no other coverage may be available. This is an advantage in particular in areas without coverage. Additionally, councils and water utilities often have the advantage that they own strategically advantageous and suitable sites to mount these receivers and their antennas, such as water tanks or other structures on naturally elevated ground.

However, this is also a disadvantage of this technology. The effort and complexity of establishing such a network in securing appropriate sites under an appropriate legal context can be significant. A large amount of time, resources and costs can be expended.

In theory, communication through a LoRaWAN network is free of charge, i.e. there are no ongoing communication costs to be paid to a telecom such as for example for NB-IoT. However, for a full and frank cost disclosure, the cost of operating and maintain the network, i.e. activities relating to upgrading the firmware and hardware in the receivers, and replacing them when they fail should also be taken into account to ensure a true lifestyle cost analysis. Where the LoRaWAN network is provided through a third party provider, access charges will need to be paid like for any other network.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

LoRaWAN, as a global standard, provides the flexibility to add monitoring of just about any other parameter such as pressure, level, gas, power or equipment status. See Figure 3 for system architecture.

LoRaWAN is largely a onew way system although it does allow some limited feedback to adjust signal strength or change a channel to improve reception. There is also limited capability to send configuration commands across the network. Some vendors claim that they can also do firmware upgrades but that is yet to be confirmed.

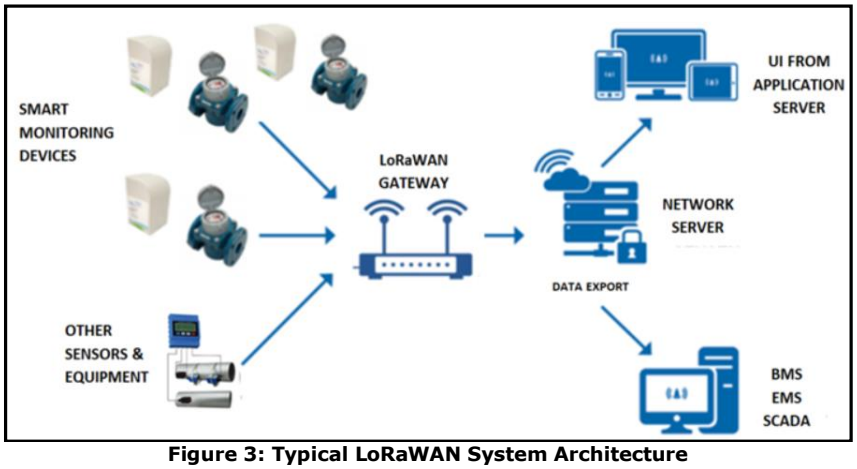


Figure 3: Typical LoRaWAN System Architecture

3.3.4 WIZE

WIZE is another communications layer similar to the above. In theory, it is meant to be standardised through the WIZE alliance. However, in Australia it is at this point exclusively distributed through Suez, a large French global utilities company. Its layout and architecture is very similar to that of Sigfox.

3.3.5 Proprietary Communications Protocols such as Taggle or Ventia

Essentially these operate exactly the same as any of the above. A communications network comprising strategically placed receivers is established. Then each individual device connects to it. The only difference here is that instead of using a communications network based on global standards, a system is used that is only supported by one particular vendor. Obviously, this means that hardware, network operations software or any other system component cannot readily be obtained on the market but all has to be bought from the chosen vendor, i.e. vendor lock in.

3.3.6 Sigfox

Sigfox is a communication system invented and globally promoted by a French company called Sigfox. In Australia it is distributed by a company called Thinxtra. it is a dedicated communications network to connect IoT devices cost effectively and simply. Sigfox is a one way system.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

All major cities in Australia are covered by the Sigfox network. By now over 85% of the Australian population is covered. The system architecture (Figure 4) consists of devices communicating through the use of a relatively small number of 'towers' or receivers similar to the way the systems explained above work.

Sigfox had a major push in Australia to become the network of choice for smart water metering. However, this has slightly dropped off in recent years in favour of some of the other technologies described herein.

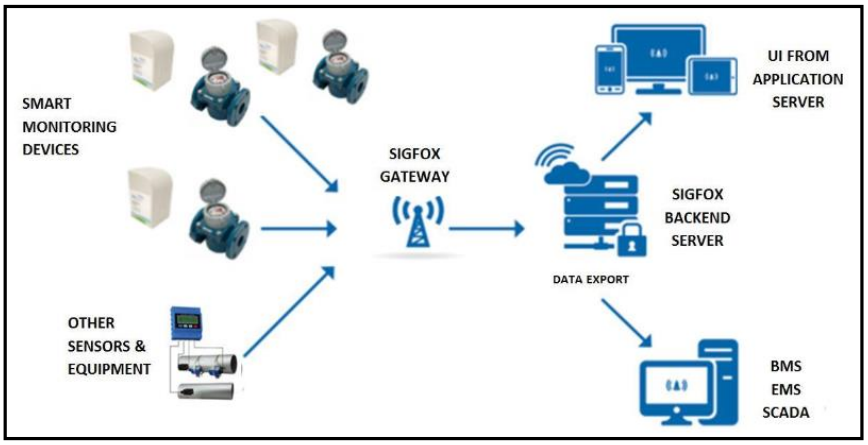


Figure 4: Typical Sigfox System Architecture

3.3.7 Silversprings

This was another network that has been promoted around the globe and in Australia. South East Water did some early trials with it and the ACT Government bought a licence for it. Its core functionality is not that different to the systems described above. In general though, this appears to be a less favoured technology for smart water metering these days.

3.3.8 3G/4G/5G LTE, NB-IoT and Cat-M1 Networks

In these networks the loggers/meters have an inbuilt SIM card. It may be inserted and replaceable but more often it is soldered in and non-replaceable. A common form factor is MFF. With a physical non-replaceable SIM a device is locked to a particular network for its entire life.

One exception is when roaming agreements are in place, e.g. the same Vodafone SIM card can connect to e.g. an Optus tower if there is no Vodafone connection. In Australia, this is a relatively recent development. Vodafone and Optus support it. Telstra is hindering it. The water industry should be lobbying Telstra to accept this.

eSIMs are more flexible. They are incorporated into the chip, i.e. there will no longer be a physical card in the device. They allow a device to select the network that has the best signal strength in its area, or to switch from one provider to another should a better deal be obtained. In Australia eSIMS are still getting blocked by Telstra. The water industry should lobby Telstra to accept eSIMs.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

The device connects, just like a mobile phone, to the nearest mobile phone tower in its range. This can become an issue in areas where a signal is difficult to attain because essentially the signal is there or not.

3.3.9 NB-IoT

Of all the public telecommunications technologies, NB-IoT is emerging as the main communications technology used worldwide for smart water metering data.

This system can be applied to a Council's entire water network in one single rollout, to a certain critical section only, e.g. as a pilot, or as a representative method of monitoring a carefully selected sample of the entire water network at a fraction of the cost. It is thus extremely flexible and versatile. It can readily be expanded and scaled at will as funds become available and as needs dictate.

Since the network is the public mobile phone network, there is less flexibility to cover an area that e.g. does not have NB-IoT coverage. Coverage maps are available here https://www.telstra.com.au/business-enterprise/about-enterprise/our-network/iot-coverage-map. Recently, providers like Vodafone have offered mini cell towers that can provide both an NB-IoT signal and standard 4G coverage for areas not otherwise covered.

There are three main application layer communication protocols: Light weight Machine to Machine (LwM2M), CoaP and MQTT. These are the protocols used to communicate from the device to the network. LwM2M is the most common one for water meters. It has been developed as a quasi open standard by South East Water (SEW). It is published here: https://omaspecworks.org/what-is-oma-specworks/iot/lightweight-m2m-lwm2m/. CoaP is more proprietary and less common now. MQTT is often used for devices that generally have the capability for a higher data throughput, such as e.g. the mIoT Captis.

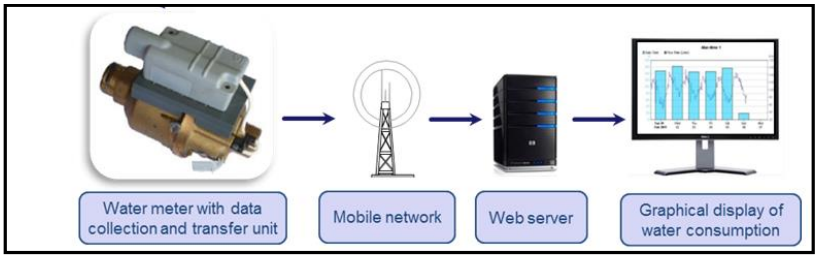


Figure 5: Typical Public Telco Communications System Architecture

NB-IoT wireless networks do not have any initial establishment costs for the user. Ongoing usage costs are similar to those of other LPWAN systems.

Devices collect data from meters at a pre-set frequency and then upload it. NB-IoT allows for transfer of larger data packet sizes than any other IoT networks.

WaterGroup PtyLtd ABN 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

3.3.10 Signal Penetration

There are large and varied claims relative to signal penetration and range of the different communication technologies. Whilst it can be difficult to discern some of these claims, the following key facts can be stated. These apply irrespective of the communications technology used.

- Signal penetration is, to an extent, still some black art. It is impossible to predict with accuracy that every site, with a water meter, will have guaranteed coverage.
- There will be areas where a good signal is received and yet the meter next door or across the road might receive a very poor signal only.
- The more locations are covered by at least two or more receivers the greater the chance that every single device can connect to transmit its data.
- Some technologies have demonstrated that a signal can be transmitted over up to 100km. In practical terms this matters little, as the above still applies.
- The device used, and in particular the design of its antenna, has a significant impact on whether the data is received in poor signal and reception areas or not.
- The usual method to establish whether an area has adequate signal coverage or not, is to use published maps or to do a desktop or in the field signal survey. It must be appreciated though, that no matter how much testing is done, and irrespective of the communications network, no technology can outright guarantee 100% coverage at every single location. In practice though with a well designed system and a generally ok signal coverage in the area, well over 99% of devices achieve a reliable data connectivity.
- Systems installed specifically for a smart water metering or smart city system such as LoRaWAN, WIZE with Suez or Taggle have greater flexibility to install an additional receiver to cover an area that would otherwise not have coverage. Sigfox or NB-IoT have less flexibility in that regard.
- Compared to 3G, 4G or 5G NB-IoT represents a significantly improved signal penetration as well as a much lower power consumption for the same (or better) signal strength.
- Typically, the signal has to be received at the location where the water meter is installed since, at this stage, none have an option for an external antenna yet. A workaround is to install a water meter with a plug in sensor connected via cable to a logger located e.g. on a stake higher up or possibly with an external antenna. In practice, these solutions are hardly implemented. Should it indeed not be possible to read a meter remotely, it is often easier to manually read these few isolated locations.
- NB-IoT is the only technology that can locally buffer a reasonable amount of data in the device and then upload it at a later date should the connection be missed over a few days. This significantly improves the chances of ongoing reliable network connectivity.

3.3.11 Selecting a Communications Network

Key criteria to be considered include:

1. What type of network is already available for the area where the smart meters are to be deployed?
2. Does council want to operate the system itself or does it want a third party provider to provide the communication systems?

WaterGroup PtyLtd ABN 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

3. How important are flexibility, upgradability, global standards, future proofing, and possible future needs for increased data richness?
4. Security
5. Other

Network Availability
Nowadays, most areas including in regional towns and surrounding areas are covered by NB-IoT. There is also an increasing rollout of LoRaWAN. Sigfox has somewhat stalled. The others, like Taggle or Suez are only available in areas where a smart metering project has already been rolled out.

If there is no network, then the council would usually have to select either LoRaWAN or one of the proprietary systems to establish a communications network to cover the area in question. Obtaining coverage by Sigfox is less flexible and harder. Getting any of the public telcos to switch on NB-IoT just for a smart metering project is the least flexible option and will usually not happen unless the telco already had corresponding plans.

Who operates the communications system?
If a council wants to operate the communications layer themselves, then there is effectively just the LoRaWAN option. Most other communication systems are typically provided by third parties as a service.

If a council wants to build the communications network itself it can essentially provide "free "connectivity. However, it is important that the cost of establishing, operating and maintaining the system are taken into consideration and honestly accounted for when comparing it to the usage charges raised by third party telecommunication providers to achieve an apple with apple comparison.

Flexibility and global standards
As mentioned above, NB-IoT is the most flexible communications layer in regards to future software and firmware upgrades. It collects richer, i.e. more granular data. E.g., it could take 15 min or even 5 min readings for a while during a special investigation period. It can also backfill data when a transmission was unsuccessful.

LoRaWAN offers a limited degree of flexibility in that regard. All the other technologies are pretty much "set and forget", meaning that the system remains as it was when it was deployed. Hence, it will operate with the same firmware and configuration settings (e.g. hourly read with an hourly upload) for the entire 10 to 15 year life of the system. If changes are required, the device would have to be physically visited and manually reconfigured in the field.

Security
Security in any distributed IoT system is a major consideration these days. In principle, it could be argued that a one way system inherently is somewhat safer than a two way system. However, given the small data throughput and the security within the devices this becomes almost academic.

The key security concern would be at the back end where data is received, processed and passed on. This would be the same for any communications layer.

WaterGroup PtyLtd ABN 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

Summary
Whatever network is chosen, the management of data transmissions is crucial to achieve long lifecycles and battery life, and, in particular, value from the data collected.

Table 5 in Section 5 presents the key selection criteria.

3.4 Data Collection and Analysis

3.4.1 Overview

Once a logger/meter is installed in the field, the data is transmitted, stored, analysed, displayed and possibly passed on or exchanged with other systems.

Thanks to modern IoT, all systems can be categorised as follows. All have three distinct functionalities/layers. Some systems, in particular the proprietary ones, may appear as if they were one. However, they will still comprise these three key aspects.

- the data acquisition part i.e. the communications network
- the device management layer
- the data visualisation and analytics part.

Nowadays all of these systems are cloud based. There are literally no systems left that would rely on the previous arrangement of having to instal dedicated software at the council's premise or running a virtual server at a data warehouse facility.

It means that from a costing perspective all fees are payable as an annual subscription (software as a service, SaaS). In return, there are typically no more large annual licence fees payable nor does council need to worry about software upgrades, security patches, and relevant subscriptions. Everything is looked after and covered through the monthly/annual fee per point fee and provided as a cloud service.

Obviously, this also means that there is no need to provide, operate or maintain any server hardware.

3.4.2 Meter Reading and Upload Frequency

The norm for most residential smart metering systems is to take 30 min or hourly meter readings. This is seen as striking the best compromise between having enough granularity in the data to allow analysis of abnormal consumption and to diagnose the likely issue, e.g. a leak or excessive irrigation, and battery consumption as well as dealing with the volume of data produced.

For commercial users, the typically accepted standard is 15 min to allow a more meaningful analysis and troubleshooting/root cause analysis of abnormal usage.

The upload frequency depends on the communications systems used. Sigfox, Taggle and WIZE would usually upload one reading at a time. Thus meter reading and upload frequency would be the same. Typically, LoRaWAN operates the same although in theory it can upload a few readings together, i.e. it could read hourly and upload every 4 hours.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

Only NB-IoT is significantly different in that regard. For domestic smart metering, it would usually take readings in half hour intervals and upload them daily. One large advantage of this technology is that both the reading and the upload interval can readily be changed via a remote command from the device management layer. This is a unique feature of NB-IoT. None of the other technologies have that.

3.4.3 The Data Acquisition Part

This component simply relates to any of the communications networks described above. It covers acquiring the data from the device in the field and sending it to the cloud. The related software allows for the management of the device and its communications. A typical example of this would be Telstra's JASPR, its SIM card management system. Depending on the system, this piece of software may be part of the overall system.

Whether it is a separate component or integrated actually does not matter. In the modern IoT world all of these components work together rather seamlessly. It also means that it is possible to mix and match different communication networks and systems because at the end of the day data is acquired and then passed on to the next layer.

It provides large flexibility to councils. There is no longer a major decision required that locks in a particular system or vendor almost forever. Everything is flexible and can readily be chopped and changed, amended and adjusted as needs evolve.

In summary, the data acquisition part makes sure that all the devices in the field deliver their data into the cloud to the device management layer (see below).

3.4.4 Device Management Layer

This piece of the puzzle receives the data from the devices in the field. Its main functionality is to maintain the connection and registration of each device. It needs to show the status of all devices to allow the operator to see which devices are online or offline, when they have lost connection, battery status and signal strength, and any other information that is required for the proper operation and maintenance of a smart metering system.

The device management layer may often also collect data from many other, not water related, types of IoT devices. it is agnostic to what type of data the device connects to and sends. It is simply essentially the receiving warehouse. It makes sure that goods (data) are properly received, labelled and assigned so that it can be forwarded to the relevant "end customer", i.e. the data visualisation and analytics part.

A key component here is the operations and maintenance module. It allows to monitor the functioning of the system, the triggering and recording of corresponding corrective actions, and the root cause analysis to determine any deeper underlying issues. This module may also be part of the next component.

3.4.5 Data Visualisation and Analytics Layer

This module is specific to the kind of data delivered from the device management layer. It is usually the interface looked at most often, both by Council and the customer.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

Major features for a water management module are:

- Data cleansing and normalisation. This may also be done in the device management layer. It is an often understated component. It relates to determining how to handle missing or corrupted data, data with different time stamps or data that is obviously erroneous.
- Visualisation of individual customer usage data.
- Feature rich and sophisticated interface for council operators and in particular for commercial customers for a more detailed analysis of water usage.
- Simplified interface for everyday residential customers. Too many advanced features for an in-depth analysis would typically just confuse standard residential users who might only log in once in a while.
- A sophisticated alarms module allowing to set alarms based on exceeding certain thresholds whether that is constant overnight flow (baseflow) or excessive usage.
  Ideally setting these alarms should be very flexible so that it can be distinguished by weekdays/weekends, holidays and by time of day. The alarms should be easily manageable such that bulk edits can be made to change an alarm setting that may apply to a large number of individual residential users. An example may be setting a baseflow alarm of >2 L/min.
  It is also important to have different levels of priorities as especially in the beginning the council may be overloaded with the number of alarms it gets. The system therefore needs to have the ability to triage these alarms such that only the most critical ones get displayed initially. As a council works through those the threshold can then gradually be lowered until there is capacity to look at even the smaller abnormalities.
- The major feature of any such software is its capability to do an online water balance. The system must allow to create virtual meters such that a number of physical meters can be added up to new data series (a virtual meter). In this fashion e.g. all of the water supplied to a particular zone via customers that have been smart metered can be added up and compared to the amount of water supplied to that zone via its district meter.
  The difference, i.e. the non revenue water, can then be directly and automatically calculated as a third series being the total volume of water supplied to that zone minus the volume of water sold, i.e. the volume of water recorded by the water meters in that area.
  This theme can be extended such that if not all meters were smart metered, a virtual series could readily be calculated that extrapolates water usage from say 10-15% of smart meters in the area to the entire zone. It might even distinguish between residential and non residential meters thereby providing a rather accurate assessment of how much water has been used within a DMA even if less than 20% of the customers in that zone were actually smart metered.
- The above can then readily be used for leak reduction, both on the customer side as well as in the network.
- A key part is the ability to use the software for demand management and analysis. It also allows to conduct some end use study assessment, in particular for e.g. irrigation. This aspect is of particular importance when it comes to drought management, managing water restrictions and driving down demand when water supplies run low.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

Having the data available that readily allows to turn it into such valuable information for demand planning can become one of the major benefits of any smart water metering system.

- Generating automatic reports. Examples might be weekly consumption reports, water balance reports or monthly or quarterly customer billing summaries etc. The more flexible the reporting module is, the better as there are always different and changing requirements by different users.

The above are the core components of just about any smart water metering data and display system. Additionally, the following modules may be available. Alternatively, existing or standalone systems can be used for those as well. Nowadays all have pretty standard data exchange capability via API (application protocol interchange). It allows for data to be exchanged between one system and another, and to be continuously and automatically synchronised.

Examples of such additional modules include:

- Smart metering often starts with the intent to move towards automated billing. Nowadays, the integration of a billing system is typically done by interchanging data from a dedicated visualisation and analytics system to council's existing or possibly new billing system. Obviously, some smart water metering platforms also to offer an integrated billing system.
- Leak detection. As water meters with new capabilities such as individual vibration sensors as well as standalone leak detection sensors within the network become more commonly available, an additional component may be the ability to further narrow down and localise the location of leaks both on the customer side but in particular within the network. As above, this might be done via a standalone system with automatic API data interchange or integrated into the smart water metering platform.
- CRM. Some systems also include a CRM module (customer relationships management). A basic capability should certainly be there to allow for the recording of actions taken such as when e.g. an alarm is recorded, the customer is notified and what action was taken to rectify it.
- Display of analogue data. As more cost effective pressure sensors including meters that have these devices integrated, become available, there may be dedicated platforms to handle these types of data stream, or it can be done within the existing platform. It includes other sensors as well as water quality parameters. Some of them have their own requirements how this data is to be processed and presented for meaningful analysis.
- Integration with SCADA. Other important information such as especially district meters may often be available within SCADA already. It goes without saying that this data should be within the smart metering platform as well. If it is only a few points it is often more cost effective to split the data at the hardware side and provide separate feeds to both SCADA and the smart water metering platform. If there are more points, then it might be more cost effective to develop an API for data to be interchanged.

3.4.6 Deriving Action from the Data Collected

The success of any smart metering project is reliant on the amount of savings generated from it. This can only be possible if data collected by the smart metering system is

WaterGroup PtyLtd ABN 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

turned into meaningful and practical action such that it can be acted upon. This will maximise the ability for the system to drive efficiencies, provide better customer service and ultimately save water and cost.

It can only be achieved through active monitoring. Active monitoring consists of setting up customised alarm benchmarks for each site, regularly monitoring abnormal usage and the alarms received, logging on to the smart metering portal, analysing and acting on the data collected.

Benefits include reduction of water consumption and costs, early detection of abnormal water usage, prioritisation of water conservation across one or more sites and increased ROI.

This may be carried out internally or outsourced to a third party provider with experience in water data analysis.

Permanent network monitoring is another example of deriving action from data. It assists in creating an online water balance across a DMA (District Metered Area). This leads to reduced non-revenue water in the network.

Figure 6: Interoperability amongst IoT Systems

3.5 Smart Water Metering Systems

3.5.1 Mix and Match IoT Platforms

Due to the standardisation of protocols and data exchange most of the hardware, network communications and software components described above can be readily and regularly combined with each other – and still create a seamless and straightforward single sign on (SSO) user experience.

WaterGroup PtyLtd ABN 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

This approach allows council to pick and choose for each component of its IoT based digital water metering platform the components it likes best. Additionally, it can also bring in other vendors thus maintaining competitive tension avoiding vendor lock-in. In turn, it opens itself up to the opportunity and flexibility to get more advanced technology as well as new pricing and delivery models as they may become available in future.

3.5.2 Single Vendor Systems

For single vendor systems such as those offered by e.g. Taggle, Itron, Suez or other smart metering systems the vendor may own, maintain and operate wireless radio networks that make data collection from their devices possible through low power and long-range communications. Radio receivers are strategically placed across the network. Low cost transmitters connected to water meters or integrated smart meters communicate data at regular intervals to receivers. Data is then passed on to the corresponding cloud server.

This category of smart metering system includes systems where a single vendor supplies the metering devices, the wireless communications, and the gateways. It often includes the software for managing the data received from the devices.

These systems are usually designed specifically for the purpose of smart metering. They offer good performance for this one particular application.

Many of these vendors offer transmitters that can easily attached to the most common pulse-enabled water meters such as Elster V100 where a matching probe is integrated into the transmitter unit. This is available for other common meters too. For others, a separate pulse sensor and cable may need to be attached to the meter and connected to a transmitter.

While these systems are well suited to smart metering, available sensors and devices for other applications such as smart lighting, smart waste, GPS tracking, and other smart cities use cases are few or zero in number. It limits the ability of interoperability/integration of all smart devices in a future smart city concept.

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

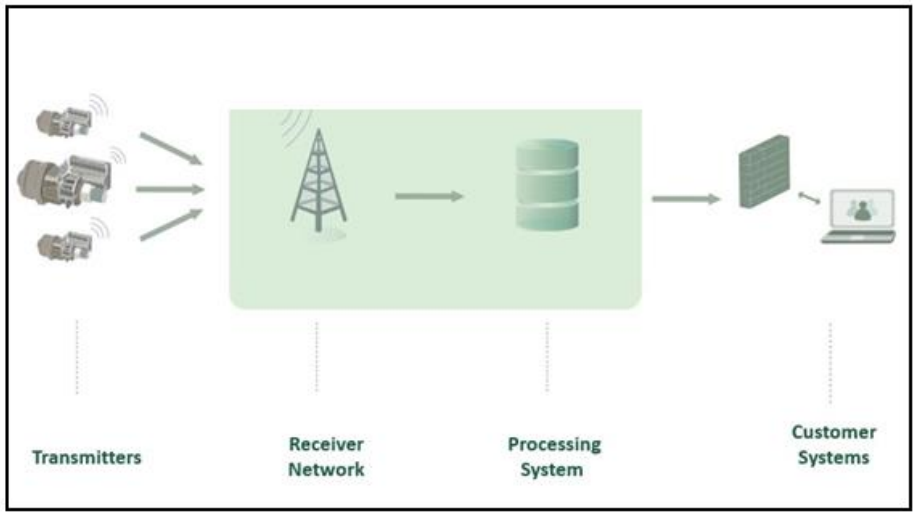


Figure 7: Typical Single Vendor Network Architecture

WaterGroup PtyLtd ABN 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

4 COST BENEFIT ANALYSIS

Money is one of the most critical points when implementing a smart metering system. Is there a business case? An important aspect is being fully aware of the ongoing support costs (which can be substantial) and the resources required.

4.1 Key Factors for the Business Case

A previous survey of a large number of Australian water utilities still remains valid. The responses detailed in Figure 8 were provided as the key business drivers towards the implementation of an automated meter reading system.

The green bar shows how often each criterion was rated as the number one priority. The orange bar shows how often each criterion was listed amongst the top three priorities. It is evident that effectively all of the main advantages listed above rate had an almost equally high level apart from reducing operating costs, improving the billing system, safer meter reads, and better meter fleet management.

As depicted in Figure 8, reducing non-revenue water stands out as the one factor that was significantly more often the number one driver towards implementation of a smart metering system.

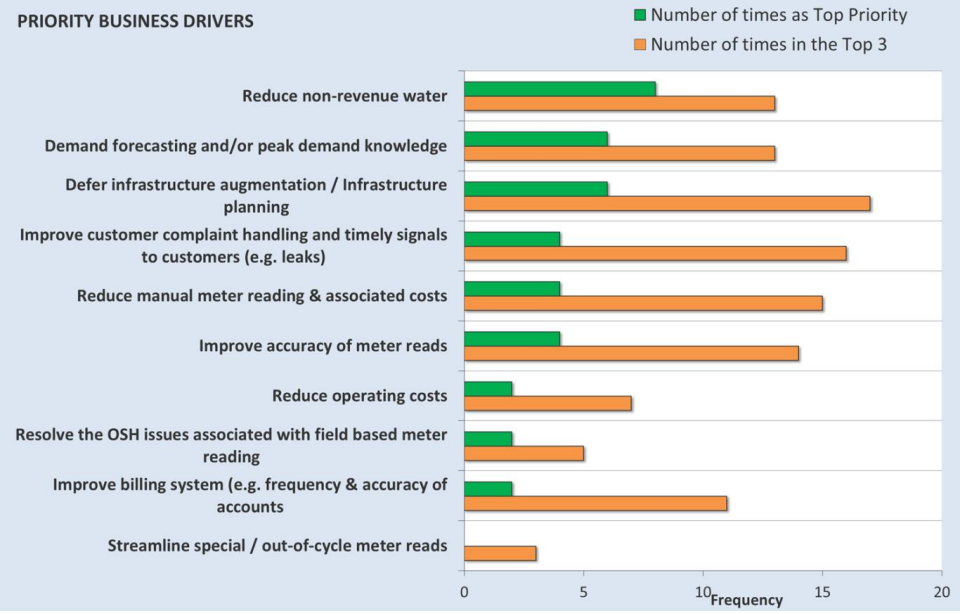


Figure 8: Priority Business Drivers[2]

Note: [2] Beal, CD & Flynn, J (2014) The 2014 Review of Smart Metering and Intelligent Water Networks in Australia and New Zealand. Report prepared for WSAA by the Smart Water Research Centre, Griffith University, November 2014.

WaterGroup PtyLtd ABN 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

4.2 Business Case Development

Table 3 below presents the parameters that could go into an economic evaluation.

Table 3: Business Case Development for SM System

#	Cost Benefits	Explanation	Questions to Consider	Simple Business Case Examples
1	Eliminated/reduced manual meter reading costs and increased accuracy	Replace cost of manual meter reading (salary, super, vehicle, meter reading transfer technology) with smart meters with 15 year guaranteed life and comms network.	• How many customers? • How many times do you read meters / year? • What is annual cost (or other time unit) of manually reading meters?	A X % increase in smart meters resulted in an X % reduction in manual meter reads, equating to a savings of X$/month
2	Avoided costs of special reads	Special read costs can be avoided with AMI. Obtain off-cycle, "final" meter reads and connects/disconnects for customers moving or leaving the area. This is typically a cost borne by the customer, so by improving reading efficiency and replacing cost of manual meter reading, the customer will directly benefit & improve customer-client relations.	• How many manual special reads pa do you do? What is the cost per special read? What % reduction in manual special reads are you experiencing or predicting? • Note: There is a customer service improvement to instant final reads (see below)	A X % increase in smart meters resulted in an X % reduction in special meter reads, equating to a savings of X$/month (year?)
3	Avoided network operating costs – pumping and treatment	Reduce customer consumption when presented with timely and actionable information, leading to reduced electricity pumping costs, and reduced chemicals and sewage treatment cost.	• What was, or is projected to be, the reduction in total network demand? • What is the $/kL cost for supplying water to the area now serviced by smart meters?	A 10% reduction on paper billing resulted in X $$ less processing (e.g. total costs of labour, printing, postage costs.)
4	Reduction in billing and collection costs with monthly electronic billing and collection	Customers receiving electronic bills and having to opt out of it to receive a paper bill, reduces the cost of postage, printing, processing manual payments, etc.	• Do you know the % of customers now receiving automated bills and avoiding postage, printing and processing?	A 10% reduction on paper billing resulted in X$ less processing (e.g. total costs of labour, printing, postage costs.)

WaterGroup Pty Ltd **ABN** 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 **F:** 02 9499 4950 water@watergroup.com.au www.watergroup.com.au

#	Cost Benefits	Explanation	Questions to Consider	Simple Business Case Examples
			• What is the difference in cost to process a manual bill versus and AMI bill (and collect payment)? • Have you observed a reduction in bad debts?	
5	Reduction in Call Centre (and walks in, emails) costs	Improved metering and billing accuracy, eliminating bills based on estimates. Customers being informed in near real time of their consumption, both in $ and litres, creates less customer queries; Service agents responding to Customer queries armed with rich visual information including heat maps of where calls are coming from, and near real time data of how much water and when a customer is using, ($ & L), means faster first contact resolution.	• Do you keep a record of the number of calls per month / year? • How many staff (FTE) do you have in call centre & reception OR estimated cost per call/walk-in?	The average number of customer calls received per month with respect to billing per 100,000 customers is XXX, equating to a X$$ reduction in labour hours. (estimated time per call x average labour costs per hour)
6	Reduce non-residential non-revenue water data errors / losses	Non-residential sector water meters can offer significant improvements in meter reading accuracy based on more accurate sizing according to flow demand and placement of meters. Other sources of data errors include lost meters, incorrect meter reads and information recorded, incorrectly installed meters.	• As above • Have you identified any non-residential water meters that had undetected data errors or were incorrectly sized? • What was the revenue improvement?	A % reduction in estimated non-revenue non-residential water loss through data / billing errors has resulted in a savings of $/kL.
7	Reduction in network leaks	In addition to post-meter leak detection, network detection can be further enhanced by installing pressure sensors on the wider network to give almost real-time feedback, reducing the number of pressure-induced bursts, backflow and impacts on customer service.	• Have you observed a reduction in the % of water lost in network leaks? • Have you been able to optimise pressure in your network or DMA to reduce average and peak demand? • Have you observed a reduction in main bursts?	If 1 GL was saved from reduced leakage and avoided pumping costs of 70c/kL and treatment costs of 5c/kL, this would equate to $750k annually.

WaterGroup Pty Ltd **ABN** 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 **F:** 02 9499 4950 water@watergroup.com.au www.watergroup.com.au

#	Cost Benefits	Explanation	Questions to Consider	Simple Business Case Examples
8	Reduction in labour costs associated with leak detection	Less wasted time in attempts to pinpoint the size and source of leaks and breaks.	• How many FTE are used for leak detection tasks? • Have you observed a reduction in FTE for leak detection tasks?	A 1GL reduction in leaks per year resulted in X% less FTE at a cost of X$/month per FTE, resulting in X$ savings.
9	Defer network capital investment	A reduction in customer demand (through leak detection) can result in a deferral of network capital infrastructure such as upgrading treatment plants, building new sources of supply (e.g. desalination plant) or increasing network capacity.	• Did the project allow a deferral of network capital investment? • If so, was it supply side / treatment system upgrade / network capacity upgrade? • What were the $ saved? • Capital $/m pipe / trunk increased pipe capacity and years deferred • $/kL for new supply option / upgrade	If a $20M upgrade was deferred 5 years, this would equate to the NPV of $13.7M over 5 years, discounted @ 6.5%.
10	Reduced bulk water charges	In most cases a pass through cost but can have major impact if price to Customer does not fully recover the purchase and delivery cost of water.	• How much do you pay for your bulk water? • Have you been able to quantify the reduced or avoided bulk water charges	"XX kL of wholesale water didn't have to be purchased therefore X$ have been saved"
11	Reduction in Water Restrictions monitoring	A reduction in water demand through smart metering may avoid the often unpopular alternative demand management strategy of enforcing water restrictions, which requires resources to implement and monitor and can be viewed as a negative for utility- customer.	• Do you have data on water savings during restrictions? • Known costs associated with implementing these restrictions?	The removal of water restrictions resulted in 1 less FTE at a cost of X$/month per FTE, resulting in X$ savings.
12	Detect revenue losses caused by declining or failed meter accuracy	Ensuring that all meters are recording water flow following repair of a break in a main. SM and IWN network tools such as 'critical slowing down' allows proactive identification of pending failures of metering systems, without knowing the actual condition of the	• Did you identify any failed meters or meters performing below acceptable standards that would have previously been undetected? • What was the annual volume of water that was being under recorded? How many years may	A X% reduction in non-revenue @ x$/kL/year (or month?), has resulted in a savings of X$ / year (or month)

WaterGroup Pty Ltd **ABN** 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 **F:** 02 9499 4950 water@watergroup.com.au www.watergroup.com.au

#	Cost Benefits	Explanation	Questions to Consider	Simple Business Case Examples
		meter. Corrective action can be taken, maintaining revenue integrity.	have elapsed before this was identified through traditional meter audits or replacement programs?	
13	Reduce residential non-revenue water data errors / losses	By eliminating data errors such as lost meters, incorrect meter reads, incorrectly installed meters, meter information recorded against wrong Customer, incorrect metering units (such as L or kL) recorded in billing system, meters being read but not billed, incorrect parameter definition such as consumer class, meter size, or ancillary attributions such as sewer or rates, revenue can be increased and non-revenue water reduced.	• Has smart metering allowed you to identify previously undetected billing errors? How many households and what was the annual $ value of the error? • What is the % of $/kL assumed for non-revenue water losses? • Have you seen this percentage drop?	A % reduction in estimated non-revenue water loss through data / billing errors has resulted in a savings of $/kL.
14	Faster detection of theft and unauthorised usage	Near real time monitoring allows illegal usage such as consumption at disconnected properties and restrictions enforcement to be monitored.	• Do you know the number of illegal connections per 100,000 properties? • Have you observed an increase in the number of illegal connections identified?	An increase of X illegal connections identified resulted in an increase of X$/kL in revenue (assuming X kL/month [year is consumed by the "illegal" households?])
15	Reduction in customer leaks	Near real time monitoring via smart meters can alert the customer to often costly leaks, thus improving customer relations and satisfaction through reducing customer costs and reducing network demand.	• Do you have before and after figures on customer leaks? • What are the annual costs associated with leaks $/kL including leakage refunds or relief.	An 80% reduction in significant leaks = a savings of 100 kL/household/year = $280 /year (assuming $2.80/kL)
16	Reduction in water use through data feedback to customers	Reduce customer consumption when presented with timely and actionable information.	• How many customers have indicated they are willing to use this feedback system / new billing system?	A 25-30% reduction in water use = a savings of 45 - 53 kL/household/year = $126 - $148 /year (assuming $2.80/kL).

WaterGroup Pty Ltd **ABN** 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 **F:** 02 9499 4950 water@watergroup.com.au www.watergroup.com.au

#	Cost Benefits	Explanation	Questions to Consider	Simple Business Case Examples
17	Avoided costs of special reads	This is typically a cost borne by the customer, so by improving reading efficiency and replacing cost of manual meter reading, the customer will directly benefit & improve customer-client relations.	• How many manual special reads pa do you do? What is the cost per special read? What % reduction in manual special reads are you experiencing or predicting?	Avoided reduction in special reads can save a customer $7.5/read.

WaterGroup Pty Ltd **ABN** 79 121 148 169 **A:** 15/33 Ryde Rd Pymble NSW 2073 **T:** 02 9499 8795 **F:** 02 9499 4950 water@watergroup.com.au www.watergroup.com.au

4.3 Sample Costing Sheet for a Digital Metering System

Table 4 provides a sample costing sheet for implementing a digital metering system. Key factors for assessing costs include capital costs, ongoing data communication costs and maintenance costs. The capital costs will be incurred during the installation of the smart metering system. Data communications costs will be paid on an annual basis. These will cover the cost of data transmission from the loggers to the online database and hosting of the data.

The sheet is to provide a high level overview on costs only. The costs will differ based on the particular requirements of each utility. Similarly, benefits from the system will vary based on the technology chosen and the meters monitored.

An extract of the costing sheet is shown in Table 4. A working Excel sheet has also been provided as part of this report.

Table 4: Digital Metering Budget Cost Estimation Sheet

Digital Metering Budget Cost Estimator

Note: This is a generic high level budget estimating sheet only. For a more detailed costing, customised for individual needs, separate engagements should be sought. No warranties whatsoever are made.

	Cost Guidance		
Item	**Total No. of Meters/Loggers**	**Budget Price Range**	**Comments**
Capital Costs			
Design & Engineering	0-5,000	$10,000-$25,000	these costs will vary and depend on who and how they are performed. E.g. a council may do it all in house, or only get some extra help.
	5,000-50,000	$25,000-$40,000	
	50,000+	$40,000-$100,000	could he higher than max stated
Tender & Procurement Costs	0-5,000	$5,000-$15,000	as above
	5,000-10,000	$15,000-$25,000	
	10,000-25,000+	$25,000-$100,000	
Network Infrastructure	1-10	$8,000-$12,000	where required, i.e. not pre-existing, Typically for Taggle, Suez, sometimes for LoRaWAN. N/A for NB-IoT.
	11-50	$5,000-$8,000	
Integrated electronic smart water meters - supply only	10-250	$290-$350	includes allowance for S+H, QA, registration etc. Individual unit prices may be $10-$35 lower depending on the deal struck.
	250-1,000	$250-$290	
	1,000-5,000	$220-$250	
	5,000+	$195-$220	
Retrofit loggers - supply only	10-250	$250-$290	includes allowance for S+H, QA, registration etc. Individual unit prices may be $10-$35 lower depending on the deal struck. Take off $50-80 from unit prices for Taggle/Suez loggers. Does not include supply of mechanical meter, get price from
	250-1,000	$220-$250	
	1,000-5,000	$180-$220	
	5,000+	$150-$180	

WaterGroup Pty Ltd ABN: 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

Item	Total No. of Meters/Loggers	Budget Price Range	Comments
			normal meter supply contract if required.
Install loggers or smart meters	10-250 250-1,000 1,000-5,000 5,000+	$70-$85 $60-$80 $50-$70 $40-$60	includes allowance for setup, QA, documentation, etc. Assumes no more than 15% of meters are not "easy" to install, i.e. access restrictions, meter not found, no stop valve, covered in dirt, etc. Allow $50-$150 extra for each "problem" install. Take off $20-$35 for installation of loggers only, i.e. without meter.
System Setup & Configuration	10-500 500-5,000 5,000+	$5,000-$8,000 $8,000-$25,000 $25,000-$95,000	depends a lot on the vendor and technology and Council's pricing request. Could be part of the above unit prices. Could be highly variable.
Integration with other systems, commissioning, fine tuning	Highly scope dependent	$10,000-$100,000	very much depends on how many other systems it is to be connected to, e.g. billing, CRM, asset management, SCADA, etc.
Project Management	6%-12%	$5,000-250,000	estimate an allowance as % of total
Miscellaneous/Contingency	6%-12%	$10,000-$350,000	estimate an allowance as % of total
Total Capital Cost		**$300-$550**	overall unit price
Annual O&M Costs			
Network Access	10-1,000 1,000-5,000 5,000+	$10-$12 $8-$10 $5-$8	unit price for network access charges, e.g. SIM cards. May not be charged as a unit cost for some systems, such as e.g. LoRaWAN.
O&M of Network		$5,000-$50,000	depends on if applicable, e.g. if Council operates its own LoRaWAN network, and how O&M costs are accounted for
Device Management Layer	10-1,000 1,000-5,000 5,000+	$10-$12 $8-$10 $5-$8	depends on whether this is requested/quoted as a separate layer or integrated into one whole
Data Visualisation and Analytics Layer	10-1,000 1,000-5,000 5,000+	$12-20 $8-$12 $5-$8	depends on whether this is requested/quoted as a separate layer or integrated into one whole
Platform for Indiv. Customers		$4-$12	assume that no more than 20% will use it, i.e. budget for <20% of total smart meter connections only
Licence Fees	per installation	$15,000-$60,000	depends on if applicable if vendor charges it separately. Usually nowadays all contained in above SaaS annual fees.

WaterGroup Pty Ltd ABN: 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

Item	Total No. of Meters/Loggers	Budget Price Range	Comments
Other	1,000+	$1-$5	allowance for integration with other systems, e.g. billing addit. analysis, API, etc. Could be used for contingency too.
Total O&M Costs		**$15-$35**	overall unit price
Annual Benefits			
Increased meter revenue		$15-$35	typically 4% of annual revenue. Applies to integrated electronic (solid state) meters only
Increased billing efficiency		$0.50-$2	Possible benefits include monthly or real time fully electronic billing through the app. Needs to be assessed separately.
Removed meter reader costs		$7-$12	
Reduced network leakage	assume existing loss is 8-15%. Then x # of connections x 500L/d		enter your estimated reduction in leakage in kL/yr. Assume 5-20% x marginal cost of water in $/kL
Marginal cost reduction			this needs to be obtained via a separate study
Drought response and demand management benefits			this needs to be obtained via a separate study
Other 1			this needs to be obtained via a separate study
Other 2			this needs to be obtained via a separate study
Total Annual Benefits		**$35-$125**	overall unit price
Net Annual Cost/Benefit		**$35-$100**	
Simple payback in years		**5-15**	

WaterGroup Pty Ltd ABN: 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

5 EVALUATION OF TECHNOLOGIES

5.1 Definition of Evaluation Criteria

The principal technologies have been scored on a scale of 1 to 5 (1 worst, 5 best) against the criteria listed below.

- **Capital Cost** – The upfront cost to establish a system. This includes the metering devices, the gateways, the software, and the installation and commissioning. Lower scores indicate higher costs, higher scores indicate lower costs.
- **Annual Service Cost** – the ongoing cost for connectivity and the platforms (Software as a Service – SaaS). Lower scores indicate higher costs, higher scores indicate lower costs.
- **Security** – the level of security achievable with each technology and its fit for purpose. All categories of system have security provisions. It is up to the particular vendor and operator to ensure these provisions are utilised and a suitable level of security is achieved.
- **Battery Life** – the rate at which the device consumes power and therefore how often batteries or devices need to be replaced.
- **No Vendor Lock In** – to what extent is the solution wedded to one particular vendor for pretty much the duration of the contract. How much competitive tension especially re future ongoing annual costs does the solution allow for?
- **Interoperability** – can the system readily be used with other components – both hardware and software? How open is it to be combined with pieces other vendors offer (mix & match)?
- **Use for Other Applications** – the ability of each technology to be used for applications outside of smart metering, for the ability to enable other smart cities use cases such as smart parking or smart waste bins.
- **Data Richness and Flexibility** – the level of suitability for Digital Metering such as logging at less than hourly intervals and the ability to change this on the fly remotely. The ability to backfill data when a transmission was missed.
- **Firmware Upgrade (incl. FOTA)**– can firmware be upgraded, ideally over the air, i.e. not requiring to manually visit each device**.**
- **Existing Coverage** – is a network already available or does it first need to be built triggered by this digital metering project?
- **Ability to Expand Coverage** – the ease to expand coverage, at low cost, by installing additional receivers/transmitters.
- **Availability of integrated electronic meters –** are they available for this network communications technology
- **How Future Proof is the Solution** – this is largely impacted by the following key points from above: Interoperability, Use for other applications, Data richness and flexibility, Firmware upgrade over the air, availability of integrated electronic meters

The scoring for each criterion is based on the fit for purpose of each technology and how each ranks in comparison to the other technologies on the market.

A full working spreadsheet with a suggested rating and a blank template that can be used for a council's individual evaluation has also been provided.

WaterGroup Pty Ltd ABN: 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

Table 5: Evaluation Matrix for Digital Metering

Assessed Ratings for Digital Metering Technologies									
Criteria	Drive-by Systems	LoRaWAN	Taggle	Ventia	WIZE (Suez)	Sigfox	Silversprings	NB-IoT	Notes
Note: Ratings are indicative and can vary substantially based on each Council's own conditions and preferences									
Capital Cost	4	4	5	5	5	4	4	3	
Annual O&M Cost	5	3	4	3	4	3	3	2	
Security	5	3	4	4	4	3	3	3	
Battery Life	4	3	4	4	4	4	3	3	
No Vendor Lock-In	1	3	1	2	2	1	1	4	A
Interoperability	1	4	3	2	2	3	3	5	
Use for Other Applications	1	4	3	2	2	3	2	5	
Data Richness and Flexibility	1	2	1	1	1	1	2	5	
Firmware Upgrade (incl. FOT	1	2	1	1	1	1	1	5	
Existing Coverage	N/A	Assign a score of 5 if network exists already, 2-4, if partial, 1 if no coverage						4	B
Ability to Expand Coverage	5	5	5	5	5	3	4	2	
Availability of integrated electronic meters	5	2	2	2	4	2	2	5	
How Future Proof is the Solu	1	4	3	3	3	3	3	5	
Overall Score (unweighted)	**34**	**39**	**36**	**34**	**37**	**31**	**31**	**51**	
Note: Care needs to be exercised when looking at the unweighted overall score as it dilutes individual criteria. Sometimes it is better to ignore criteria with a similar score and focus on the differentiating ones. Or the focus could be on criteria most important to a particular use case only. Likewise, a Council may choose to ignore some.									
Comments									
A - there is vendor lock-in for the telco until eSIMs are available (ETA late 2022)									
B - available for most areas in Australia with mobile phone coverage, even if coverage is poor									

WaterGroup Pty Ltd ABN: 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

Table 6: Blank Table to Evaluate a Council's Digital Metering Project

Evaluation Matrix to Assess Digital Metering Technologies									
Criteria	Vendor/System 1	Vendor/System 2	Vendor/System 3	Vendor/System 4	Vendor/System 5	Vendor/System 6	Vendor/System 7	Vendor/System 8	Notes
Capital Cost									
Annual O&M Cost									
Security									
Battery Life									
No Vendor Lock-In									
Interoperability									
Use for Other Applications									
Data Richness and Flexibility									
Firmware Upgrade (incl. FOTA)									
Existing Coverage									
Ability to Expand Coverage									
Availability of integrated electronic meters									
How Future Proof is the Solution									
Overall Score (unweighted)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Note: Care needs to be exercised when looking at the unweighted overall score as it dilutes individual criteria. Sometimes it is better to ignore criteria with a similar score and focus on the differentiating ones. Or the focus could be on criteria most important to a particular use case only. Likewise, a Council may choose to ignore some.									
Comments									
A - there is vendor lock-in for the telco until eSIMs are available (ETA late 2022)									
B - available for most areas in Australia with mobile phone coverage, even if coverage is poor									

5.2 General Observations

General observations include:

- With the advent of new, especially IoT type, integration technologies, it is now easier than ever to interoperate various digital smart metering offerings. This allows a water utility to pick and choose whatever it may deem best for its particular application, needs, and business case.
- Vendors are heavily competing for a foothold in the rapidly developing smart metering market allowing councils a rich choice in options and where to get best prices and value for money.
- If network coverage exists already, then many of the key benefits of a digital metering solution can be obtained for a much smaller cost by installing some smart meters only. E.g., smart metering could be rolled out as part of a normal meter replacement process.

WaterGroup Pty Ltd ABN: 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

- Drive by systems can no longer compete with the demands of a modern digital metering solution. It should now be considered a technology whose time has passed.
- Assuming there is NB-IoT coverage, then it can have a cost advantage in areas or use cases where other technologies require the establishment of base stations for a relatively small number of meters to be connected to (<100-250).
- From a cost perspective alone, manual meter reading remains cheapest.
- The reason why a digital metering system does not provide a lower overall cost (without accounting for the additional benefits that these systems will deliver) is, that the "honest" annual O&M costs are usually higher than just continuing with manual meter readings. However, this does not compare apples with apples as digital metering typically provides at least 24 readings every day (and often more) as opposed to four readings per annum for quarterly manual reads.

5.3 Procurement

A key aspect that is not covered here, is the procurement process. In a field that is still relatively immature and rapidly developing, it can be fraught with danger to apply rigorous standard procurement processes that have been refined and set up to procure the purchase of standard, well known and defined products and services.

Attempting to apply the same procurement guidelines to modern IoT based digital metering products and services can lead to long delays and a procurement effort that is far in excess of the benefit received, and sub-optimal project outcomes.

Particularly careful attention must be given when trying to procure individual components separately from different providers. This may be hard enough in a mature field, but in the space of digital metering this is a path that should be considered very carefully.

In general, as the actual cost, especially for a trial, is relatively small ($50,000 - $100,000) the focus should be on how to have a working system in the field in the shortest possible time at an acceptable (i.e. fair and reasonable) overall project cost and effort. Consideration should also be given to how the pilot is to be evaluated, and, if successful, how it can be scaled and rolled out across a much larger number of meters.

Excessive amounts of effort spent on trying to identify the type, location and single aspect of every single meter can readily outweigh any commercial benefits gained in terms of achieving a "fixed lump sum contract with no variations".

When the total overall cost and efforts are considered, a more flexible, rates based, and well project managed but more collaborative effort based delivery model may deliver far better results.

WaterGroup Pty Ltd ABN: 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

6 CONCLUSIONS

This report provides an overview of the different digital metering technologies in the market today and how their features compare against each other. The choice of technology and what is best will vary from utility to utility based on what features they place most emphasis on and how they want to roll out their digital metering strategy. In other words, there is no 'one size fits all' technology.

Most important is to be clear on what a roll out is supposed to achieve. Is it just to replace the meter reading person? Is it to provide better information to customers and notify them of leaks. If so, how does that pay for the business case? How much is saved from reduced leak rebates? Is it about streamlining billing, reducing billing issues and time spent sorting those out? Has the opportunity been considered to use smart metering to introduce an all integrated one click streamlined electronic billing system of the future with the ensuing significant rationalisation and cost savings opportunities, as well as a much better customer experience?

Is there a capacity problem necessitating an expansion in supply capacity – or a reduction in demand? How ready, able and willing is council to embrace, work on and seek many of the additional benefits a smart metering project can bring such as better waterloss management, an online water balance, readily understanding leaks, finding and fixing them? Does council have the resources to derive those benefits? Is there a budget and a business case? How much willingness is there to work across all business areas, break down silos and capture benefits across the customer support section, the operations people, the demand management and planning staff, as well as the billing and metering department?

Once these questions are adequately answered (does not need to be perfect but should have been thought about) a project scope can be developed. This should be based on what outcomes are to be achieved – and less prescriptive. At an early stage these types of projects are best procured through a relatively open collaborative procurement process where the focus is less on how to squeeze the last dollar from the supplier but more so on how to get the best value for council. Paying a little bit more to work with the right partner may well pay off handsomely.

Considering how flexible most digital metering solutions nowadays are, the focus should be more on speed and getting things done, avoiding procrastination, than trying to get it absolutely right first time round and spending excessive amounts of effort, and possibly even money on professional consulting services, in an attempt to define every last detail – just to be surprised during the roll out that there are still things that had not been thought of. This is normal for a new project.

It is suggested that "Just do it!" is a much better and more cost effective approach. Time is not standing still and we will need to transition into a digital metering future. The sooner we embrace this and start the journey, the earlier we can get familiar with it, learn from it and understand how we can better manage scarce potable water resources now and into the future in readiness for the next drought

WaterGroup Pty Ltd ABN: 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

7 APPENDIX A - BUDGET COSTING SHEET FOR A DIGITAL METERING SYSTEM

A working Excel sheet of the cost table presented in Table 4 has been provided as part of this report, electronically attached as Appendix A.

8 APPENDIX B – EVALUATION MATRIX

A working Excel sheet of the evaluation matrix presented in Table 5Table 4 has been provided as part of this report, electronically attached as Appendix B.

9 APPENDIX C - SAMPLE DATA SHEETS

Data sheets for the different smart metering technologies have been attached to this document as Appendix B.

WaterGroup Pty Ltd ABN: 79 121 148 169 A: 15/33 Ryde Rd Pymble NSW 2073 T: 02 9499 8795 water@watergroup.com.au www.watergroup.com.au

BYRON SHIRE COUNCIL

REPORTS - INFRASTRUCTURE SERVICES 2.2

Report No. 2.2 Preliminary implemetation plan - Digital water metering

Directorate: Infrastructure Services

Report Author: Pablo Orams, Integrated Water Management Officer

File No: I2024/1436

Purpose

To present a preliminary plan for the implementation of a Digital Water Metering System across the Shire's water supply network.

This follows the in-principle endorsement by the Executive Team of report I2024/1130 (**Attachment 3**), which outlines the outcomes of Council's Digital Water Metering pilot undertaken between 2020 and 2023 and recommendations for a Shire-wide implementation of such system.

ET requested a further report with more detailed project planning, resourcing strategy, finance options, all in the context of the Utilities department's Long Term Financial Plan (LTFP).

Report

1.1. Preliminary budget

A revised 30-year budget for the implementation and ongoing management of a Digital Water Metering System is provided in **Attachment 1**. Revisions have been made following further consultation with internal staff, as well as insights provided by Rous County Council (RCC) staff after the successful implementation of their digital water metering system.

The budget assumes a partial integration with RCC's Digital Water Metering System, as it offers cost and governance efficiencies.

A summary budget is provided below. Numbers are presented as net present value:

Cost (NPV)	**Stage 1** *Planning, consultation, due diligence* (Year 0)	**Stage 1** *Implementation* (Year 1 - 5)	**Stage 3** *Ongoing operation, maintenance, expansion* (Year 6 - 30)
Capex	$0.3 MM	$6 MM	$12.3 MM
Opex	-	$1.5 MM	$10.6 MM
Total	**$0.3 MM**	**$7.5 MM**	**$22.9 MM**

1.2. Position within the Long Term Financial Plan

Utilities Long Term Financial Plan (LTFP) is currently being developed. Understanding the position of the Digital Water Metering project within all other planned expenditures is still to be defined. However, in consultation with the Utilities' Assets Engineer, an interim 10-year (2025 – 2034) simulation of capital expenditure was done to understand the relative position of the project.

A summary, with net present values, is presented below,

Interim 10-year Utilities Capex forecast (2025 – 2034)	
Capacity Upgrades	$64.2 MM
Capital Works	$57.5 MM
Major Projects (including Digital Water Metering = $7.2 MM)	$33.5 MM
TOTAL 10-year forecast	**$155.2 MM**

The project's expected 10-year capital expenditure is $7.2 MM, representing only **4.7%** of the total Utilities' department capital expenditure ($155.2 MM).

1.3. Additional human resources

Implementing a Digital Water Metering System represents a fundamental change in how Council will govern and resource water use consumption monitoring and related processes (e.g. water billing, leak detection, operations, planning, etc.).

Broadly, there will be a shift from the current manual collection and handling of low-resolution (e.g. quarterly) water consumption data, to an on-demand, high-resolution and data-rich system with comprehensive analytics capabilities. While this will greatly reduce resources invested in low value-add manual tasks, it will increase resourcing requirements for system administration, cross-departmental coordination and high-value decision making.

It is also expected that interactions with customers will increase as digital water metering unveils leaks and other issues shortly after they happen, rather than being identified (if at all) through quarterly manual meter reads.

The budget model presented in **Attachment 1** proposes additional roles to cater for these changes. It includes:

i. **Digital Water Metering Rollout Project Manager (1 FTE for 5 years, Grade 11, Skill step 3)**. This will be a fixed-term contract to oversee project implementation.

ii. **Digital Water Metering System Coordinator position (1 FTE, Grade 6, Skill step 3)** within Utilities' Systems Planning Team. This position will be responsible for

coordinating the on-going operation and maintenance of the system, including technical support to the various departments using it.

iii. **Support officer - Water Billing and Revenue (1 FTE, Grade 5, Skill step 3)**. This position will increase the capacity of the Water Billing and Revenue team to manage increased requirements for system administration and customer interactions.

1.4. Funding strategy

Various possible funding options have been identified following consultation with relevant Council staff. A high-level funding strategy for each stage of the project is provided below. It is important to note that defining the mix and magnitude of these options will require further work and consultation with Council's Financial Services department.

i. Stage 1 – Planning, consultation and due diligence (Year 0)

This is aimed at ensuring Council's readiness to move into the implementation stage. **$300 K** have been allocated to support the review of the project plan and budget, and undergo the necessary consultation and approval processes. Funds will be sourced from the **Water Fund**.

ii. Stage 2 – System implementation (Years 1 to 5)

This stage involves the full-scale transition of Council's water supply network to a Digital Water Metering System. **Capital** and **operational expenditures** for this stage are expected to be approx. **$6M** and **$1.5M** respectively (Net Present Value). Funding options include:

a. **Loan borrowing:** Likely to be the main source of funding for system implementation. Council's borrowing capacity for this project is to be defined following the finalisation of the Utilities department's long term financial plan modelling.

b. **Government funding:** In the past, the Australian and NSW governments have offered co-funding programs to regional water utilities and Councils to undertake projects to improve water security outcomes. These include the *Water Smart Australia program*[1] and the *Safe and Secure Water program*[2]. However, these are not currently available. Council will need to actively engage with government counterparts (e.g. DCCEEW) to identify any future funding opportunities.

c. **Cost savings:** As the system implementation progresses, Council will increasingly incur in cost savings and efficiency gains as it transitions away from the operation and management of mechanical water meters and related

[1] Water Smart Australia - DCCEEW
[2] Safe and Secure Water program | NSW Government Water

processes. These can be used to subsidise the implementation of digital meters, and may include:

i. the wind-down of manual meter reading costs, mechanical meter replacements and the current water billing system (MVRS).

ii. Reduction of non-revenue water (e.g. leakage), hence reducing bulk water costs paid to RCC.

iii. Other efficiency gains such as reducing staff time spent on low-value manual tasks (e.g. data handling) or reactive maintenance of assets (e.g. water main bursts that could have been predicted if digital pressure monitoring devices were in place).

Ongoing engagement with Council's Financial Services department will be required to untap these subsidies.

d. Developer contributions: By driving water supply efficiencies through digital water metering (e.g. reducing non-revenue water), it is possible that water systems asset renewals and capacity upgrades could be deferred. Additionally, digital water metering benefits will translate to higher levels of service to ratepayers. Council may decide to pass some of the costs to achieve these gains to developers, as value-for-money to the community is increased.

Additionally, the cost of supplying and installing digital water meters for new developments will be passed on to developers, similarly to what is currently done with mechanical meters.

iii. Stage 3 – Ongoing system operation, maintenance and expansion (Years 6 onwards, 25 years total)

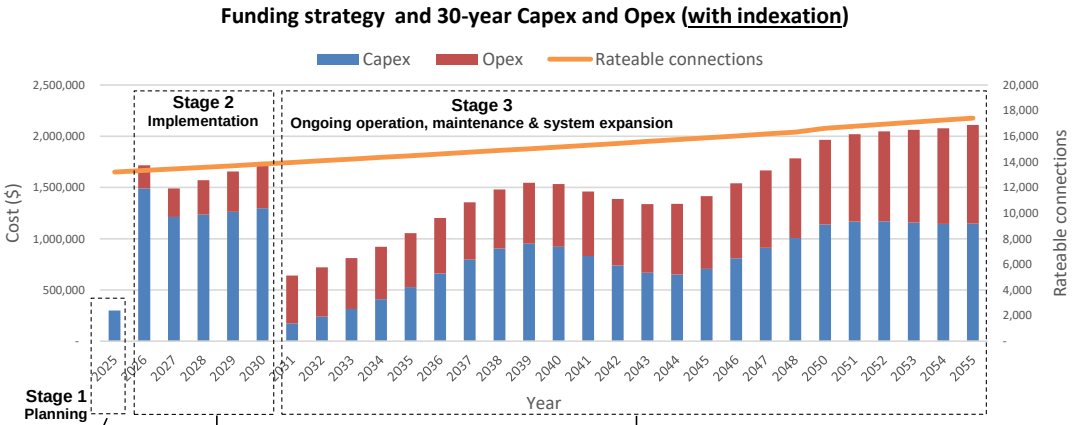
This involves the ongoing management of a stablished Digital Water Metering System, including its expansion in alignment with new development. **Capital** and **operational expenditures** for this stage are expected to be approx. **$12.3M** and **$10.6M** respectively (Net Present Value).

Funding options can include **a) cost savings** and **b) developer contributions**, similarly to those described for Stage 2 – System implementation. The scope of these will need to be defined in consultation with Council's Financial Services department.

However, it is expected that a **c) water access charge increase** will be required to sustain the Digital Water Metering System into the future. Present value average costs per rateable connection per year during this project stage (25 years) is:

- Capex / year / connection = $ 31
- Opex / year / connection = $ 27

Thus, an increase to water access charges of $ 58 per rateable connection per year would fund this project stage on its entirety. The increase may be less as the scope of developer contributions and cost savings is defined.



Comment from Manager Finance

From a Finance perspective, the concept of digital water meters is certainly supported and could be considered essential. The current processes around water billing and the amount of effort, and at times very poor customer outcomes because of such a slow and manual system cannot be underestimated. The project is not without substantial cost but as a utility, Council needs to get with the modern practices of billing. This report focuses somewhat on the financial costs that are important but the other intangible factors are also important such as reduced customer complaint over undetected water leaks (reputation) and preservation of water (environmental) or more accurate record of consumption.

In terms of its cost, whilst substantial, if the project proceeds then refinement of the cost impacts to ratepayers and the financial impact on the Water Fund can be managed pending on how the project is implemented, the technology employed and quantification of the benefits it could derive through a number of budget cycles.

Notwithstanding there may be a need to increase charges in the Utilities area, that needs to be considered also with a wider lens as to the requirements of the General Fund in the longer term and the impact upon ratepayers as a consideration in any future proposed Special Rate Variation (SRV) process should that be pursued. Pending the Executive Team decision with this report, the initial funding required could be a consideration in a future quarterly budget review or a consideration for the 2025/26 IP&R process.

1.5. Preliminary project plan

1.5.1 Project consultation

i. The outcomes in this report will be the basis of a summary report to be presented to the Water and Sewer Advisory Committee for feedback and direction. It will then be expected that a Community Consultation process will be required, in alignment with Council's Community Engagement Strategy. Outcomes from this process will be used to refine the project scope for its final approval by Council.

ii. Through project planning and delivery, collaboration across involved Council departments will be paramount for ensuring the successful implementation and ongoing operation of a Digital Water Metering System.

iii. Proactive engagement with RCC is necessary to leverage potential financial and governance efficiencies by aligning and/or partially integrating Digital Water Metering Systems.

1.5.2 Detailed Planning and Procurement

i. **Establish a Digital Water Metering Working Group** with representatives from the following Council departments and teams:

a. Utilities – Systems Planning
b. Utilities – Operations
c. Water Billing and Revenue
d. Business Systems and Technology
e. Customer Service
f. Other departments required on an ad-hoc basis (e.g. Media Communications, Building Services, Community Enforcement, etc.)

IMPORTANT NOTE: *Council should also involve a representative from RCC to ensure any opportunities for regional-level synergies/efficiencies are considered.*

ii. **Develop a Digital Water Metering Policy** where all new connections are required to have digital water meters. This policy should align to other relevant policies (e.g. Water Supply Connection Policy) and could be extended to include:

a. Category 2 Trade Waste renewals (where a daily volumetric restriction is applied).
b. Change-of-use applications.
c. Mechanical meter replacement program (for <>20mm connections)
d. An opt-out option for customers not wanting to have a digital meter. A manual meter read charge for customers opting out could be considered (e.g. RCC has implemented such charge).

IMPORTANT NOTE: *Fees and Charges will need to be reviewed in alignment with this policy, including cost of supplying digital meters for new connections (these are more expensive than mechanical meters), and a fee for manual meter reads if a property owner decides to op-out from having a digital meter.*

iii. **Develop a specification for a Digital Water Metering System**, in collaboration with relevant Council departments. **Attachment 2** provides a conceptual description of the system to help guide this process. The specification will include:

a. Roles and responsibilities across relevant Council departments.
b. Workflows (e.g. digital meter installations, meter removals, validation read, billing, customer engagement, integrations with key Council systems, etc.).
c. Specifications for the data base / data platform, including what information should it record and produce, and the cybersecurity requirements it should comply with.
d. Definition, prioritisation and specifications of all water supply catchments to be transitioned (e.g. catchment boundaries, number of connections, locations for bulk supply digital meters and pressure monitoring devices, etc.).

IMPORTANT NOTE: *The pilot highlighted the critical importance of having a clear, robust process to install digital meters. Diligent meter install records are key to ensure the quality of the data feeding the data portal, and the decision-support information it produces.*

iv. **Review the implementation budget, and secure required funds** to cover capital and on-going annual costs.

v. **Undergo the procurement process** following Council's Procurement Guidelines. With expected upfront costs of over $6 million over 5 years, Council may be required to call tenders before entering a contract with a service provider/s.

1.5.3 Implementation

The scope of the delivery will be guided by what is prescribed in the services contract granted to the successful tenderer. Also, based on the lessons learnt from the pilot's delivery, staff recommends that the below guiding principles are considered:

i. Project management and coordination should be done in-house to ensure Council builds ownership over the Digital Water Metering System.
ii. Digital meter install procedures need to be robust and managed diligently to ensure the quality of the data.
iii. Prioritise quality over cost when choosing a digital water meter device. The implementation budget has considered a conservative supply cost.
iv. The integration of workflows and systems is critical to the success of the Digital Water Metering System.
v. Communication and consultation efforts are of key importance and requires adequate resourcing.

RECOMMENDATION:

That the Executive Team:

a. Notes the outcomes of this report.

b. Provides feedback and direction to progress this proposal.

Attachments:

1 Digital Water Metering Project - Proposed 30-year budget - 22 Nov 2024, E2024/137613
2 Conceptual diagram - Digital Water Metering system governance and architecture, E2024/93422
3 Report 16/10/2024 Executive Team Meeting (Operational) Digital Water Metering Pilot - Outcomes and Recommendations, I2024/1130

Digital Water Metering Project: Proposed 30-year budget

					PREP.	IMPLEMENTATION					ONGOING O&M AND EXPANSION				
					Y0 2025	Y1 2026	Y2 2027	Y3 2028	Y4 2029	Y5 2030	Y6 2031	Y7 2032	Y8 2033	Y9 2034	Y10 2035
	Population forecast - Based on groth proyections				34,304	34,622	34,943	35,267	35,593	35,923	36,256	36,593	36,932	37,274	37,620
	Total ET - as per hydraulic modelling work				19,906	22,259	22,651	23,042	23,434	23,825	24,217	24,517	24,817	25,117	25,417
	Total water consumption - as per WaterOutlook Rous and Byron Water Balanace report (kL/year)				2,940,774	2,968,035	2,995,553	3,023,329	3,051,276	3,079,565	3,108,112	3,137,002	3,166,064	3,195,382	3,225,044
	kL/connection				223	223	223	223	223	223	223	223	223	223	223
	Total rateable connections - Based on 2021/22 - 2024/25 Revenue Policy				13,201.46	13,324	13,447	13,572	13,698	13,825	13,953	14,082	14,213	14,344	14,478
	Estimated 20mm connections - Approx 96% of total connections				12,673	12,791	12,909	13,029	13,150	13,272	13,395	13,519	13,644	13,771	13,898
	Estimated <>20mm connections - Approx 4% of total connections				528	533	538	543	548	553	558	563	569	574	579
	20mm connections converted to digital metering per year				-	2,652	2,653	2,654	2,655	2,657	123	125	125	126	128
	<>20mm connections converted to digital metering per year				-	111	111	111	111	111	5	5	5	5	5
	Overall connections converted per year				-	2,763	2,764	2,765	2,766	2,767	128	130	130	132	133
	Cumulative 20mm connections converted				-	2,652	5,305	7,960	10,615	13,272	13,395	13,519	13,644	13,771	13,898
	Cumulative <>20mm connections converted				-	111	221	332	442	553	558	563	569	574	579
	Cumulatiove overall connections converted				-	2,763	5,526	8,291	11,057	13,825	13,953	14,082	14,213	14,344	14,478
	Estimated bulk water digital meters at water reservoirs installed (20 sites)					20									
	Estimated pressure monitoring devices installed (1 per 150 water connections)					18	18	18	18	18	1	1	1	1	1
	Cumulatiove overall bulk meters and pressure monitoring devices installed					38	57	75	94	112	113	114	115	116	117
	COSTS	**COST CATEGORY**	**COST TYPE**	**TOTAL (NPV)**											
Project delivery	Planning, consultation and due diligence prior to implementation	Capex	Internal	300,000	300,000										
Project delivery	Design & Engineering (e.g. develop project specifications)	Capex	Internal	50,000		50,000									
Project delivery	Tender & Procurement Costs	Capex	Internal	50,000		50,000									
Project delivery	Project Management (5-year Project Manager position, Grade 11 - Skill step 3, at $109,275/year plus on-costs (25% of base rate))	Capex	Internal	682,969		136,594	136,594	136,594	136,594	136,594					
Project delivery	Capacity building and training (Trainer - 4 weeks at $150/hr during 1st year of implementation)	Capex	External	21,000		21,000									
Project delivery	Provider service assurance during 1st year of implementation	Capex	External	70,200		70,200									
Project delivery	Communication strategy and delivery (Consultant - 26 weeks at $100/hr, 40% in year 1 and 60% spread across year 2 to 5 of implementation)	Capex	External	91,000		36,400	13,650	13,650	13,650	13,650					
Ongoing management	Council Digital meter coordinator (1 FTE, Grade 6 - Skill step 3, at $73,624/year plus on-costs (25% of base rate))	Opex	Internal	2,760,900		92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030
Ongoing management	Addition resource - Billing/rates team (1 FTE, Grade 5 - Skill step 3, at $64,920/year plus on-costs (25% of base rate))	Opex	Internal	2,434,500		81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150
Supply and installation of new hardware	Digital meters - supply only - Assuming L&G w370 ($230/meter, 20mm connections)	Capex	External	3,844,477		609,998	610,253	610,508	610,677	611,017	28,296	28,636	28,806	29,060	29,400
Supply and installation of new hardware	Loggers - supply only ($200/meter, 20mm connections)	Capex	External	139,293		22,101	22,111	22,120	22,126	22,138	1,025	1,038	1,044	1,053	1,065
Supply and installation of new hardware	Install digital meters - baseline cost ($77/install)	Capex	External	1,287,064		204,217	204,302	204,387	204,444	204,558	9,473	9,587	9,644	9,729	9,843
Supply and installation of new hardware	Install digital meters - additional cost for medium complexity installs (25% of all connections, additional $72/install)	Capex	External	300,872		47,739	47,759	47,779	47,792	47,819	2,214	2,241	2,254	2,274	2,301
Supply and installation of new hardware	Install digital meters - additional cost for high complexity installs (15% of all connections, additional $297/install)	Capex	External	744,659		118,154	118,203	118,253	118,286	118,351	5,481	5,547	5,580	5,629	5,695
Supply and installation of new hardware	Service visit charge (5% of installs per year)	Capex	External	23,401		3,713	3,715	3,716	3,717	3,719	172	174	175	177	179
Supply and installation of new hardware	Install loggers- baseline cost ($30/install)	Capex	External	20,894		3,315	3,317	3,318	3,319	3,321	154	156	157	158	160
Supply and installation of new hardware	Install loggers - additional cost for medium complexity installs (25% of all connections, $15/install)	Capex	External	2,612		414	415	415	415	415	19	19	20	20	20
Supply and installation of new hardware	Install loggers - additional cost for high complexity installs (15% of all connections, $30/install)	Capex	External	3,134		497	497	498	498	498	23	23	23	24	24
Supply and installation of new hardware	Bulk water meters at water reservoirs (20 sites) - supply ($375/meter)	Capex	External	7,500		7,500									
Supply and installation of new hardware	Pressure monitoring devices (1 per 150 connections) - supply ($375/device)	Capex	External	43,529		6,907	6,910	6,912	6,914	6,918	320	324	326	329	333
Supply and installation of new hardware	Install bulk water meters at water reservoirs (20 sites, $77/install) - Installed in year 1	Capex	External	1,540		1,540	-	-	-	-	-	-	-	-	-
Supply and installation of new hardware	Install pressure monitoring devices (1 per 150 connections, $77/install) - Installed in aligment with digital meters/loggers roll-out	Capex	External	8,938		1,418	1,419	1,419	1,420	1,421	66	67	67	68	68
Supply and installation of new hardware	Sim cards - 1 per device ($7.2/sim)	Capex	External	126,343		20,168	20,032	20,041	20,046	20,057	929	940	946	954	965
Hardware replacements - supply and installation	Digital meters - supply only ($230/meter, 20mm connections) - includes 2 year warranty	Capex	External	7,875,695		-	-	10,666	25,436	45,747	73,398	110,528	149,225	197,731	255,415
Hardware replacements - supply and installation	Loggers - supply only ($215/meter, 20mm connections) - includes 2 year warranty	Capex	External	306,753		-	-	415	991	1,782	2,859	4,305	5,812	7,701	9,948
Hardware replacements - supply and installation	FREIGHT!!!!	Capex	External												
Hardware replacements - supply and installation	Install digital meters - baseline cost ($46/install) - Assume it will be done by Council staff, at 60% of contractor installation costs	Capex	Internal	1,598,552		1,103	2,643	4,786	7,754	11,835	16,337	22,325	30,099	39,843	51,432
Hardware replacements - supply and installation	Install loggers- baseline cost ($18/install) - Assume it will be done by Council staff, at 60% of contractor installation costs	Capex	Internal	25,951		18	43	78	126	192	265	362	489	647	835
Hardware replacements - supply and installation	Bulk water meters and pressure monitoring devices - supply ($375/device) - includes 2 year warranty	Capex	External	108,212		-	-	252	470	768	1,171	1,708	2,290	3,008	3,839
Hardware replacements - supply and installation	Install bulk water meters and pressure monitoring devices ($77/install) - Assume it will be done by Council staff, at 60% of contractor installation c	Capex	Internal	13,467		16	30	49	76	113	155	211	283	371	474
				-											
Software and network	System Setup & Configuration	Capex	External	50,000		50,000									
Software and network	Integration with other systems, commissioning, fine tuning	Capex	External	50,000		50,000									
Software and network	Software - Assuming Telstra solution (Telstra = 19/point) (Itron = 10.25/point) (Temetra/Cumulocity = 14.62)	Opex	External	8,273,943		53,221	106,083	158,968	211,868	264,797	267,248	269,729	272,224	274,741	277,288
Software and network	Security APN (40,320/year - Already included if using Telstra option)	Opex	External	-		-	-	-	-	-	-	-	-	-	-
Software and network	Data Per Year - Telstra NBIoT 1MB Per Year (Overage Extra)	Opex	External	3,849,561		24,762	49,357	73,962	98,574	123,200	124,341	125,495	126,656	127,827	129,012
Customer engagement web portal / mobile app	System set up (one-off) = $41,800.00	Capex	External	41,800		41,800									
Customer engagement web portal / mobile app	Integrategion set up (one off) = 32,780 (**NOT APPLICABLE** if Byron taps into Rous API)	Capex	External	-											
Customer engagement web portal / mobile app	Annual software licence	Opex	External	1,916,089		16,296	32,592	44,520	56,160	60,396	60,956	61,522	62,092	62,667	63,249
Customer engagement web portal / mobile app	Annual support desk service	Opex	External	429,000		14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300
Miscellaneous/Contingency during implementation (Y1=10%, Y2=8%, Y3=6%, Y4=4%, Y5=2%)		Capex	External	499,353		176,417	121,641	96,718	68,335	36,242					
				-											
	Total Capex (no indexation)			**18,389,207**	300,000	1,731,229	1,313,531	1,302,574	1,293,086	1,287,155	142,357	188,190	237,238	298,776	371,995
	Total Opex (no indexation)			**19,663,993**	-	281,758	375,512	464,930	554,082	635,873	640,024	644,226	648,452	652,715	657,029
	TOTAL COST (no indexation)			**38,053,200**	**300,000**	**2,012,987**	**1,689,044**	**1,767,504**	**1,847,168**	**1,923,028**	**782,381**	**832,415**	**885,690**	**951,492**	**1,029,024**
	Assumed indexation (3.5% in Year 1, and 2.5% after)				**0.0%**	**3.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**
	Total Capex (with indexation)			**18,389,207**	300,000	1,791,822	1,393,493	1,416,414	1,441,250	1,470,505	166,701	225,881	291,872	376,771	480,831
	Total Opex (with indexation)			**19,663,993**	-	291,620	398,371	505,564	617,570	726,451	749,473	773,253	797,784	823,105	849,258
	TOTAL COST (with indexation)			**38,053,200**	**300,000**	**2,083,442**	**1,791,864**	**1,921,978**	**2,058,820**	**2,196,956**	**916,175**	**999,134**	**1,089,656**	**1,199,876**	**1,330,089**
	BENEFITS (as TENTATIVE COST SAVINGS AND REVENUE that can subsidise the project)	**CATEGORY**		**TOTAL (NPV)**											
	Developers pay for supply and install of digital meters in new connections (i.e. new development)	s64		1,569,918		45,640	46,064	46,495	46,782	47,356	47,786	48,360	48,647	49,078	49,652
	Increased system capacity efficiency due to reduced non-revenue water (NRW). Current NRW = 12%. Digital metering could reduce NRW by 5% to 20%. A 12.5% reduction is assumed, resulting in NRW = 10.5% (= 1.5% reduction on total water demand). The water Equivelant Tenement (ET) equals 630 L / ET at a cost of $11,314 / ET. NRW reduction applies only to the portion of the network that has been transitioned to digital metering. The benefit is assumed to eventuate with 1 year delay.	s64		986,268		-	13,780	27,313	40,601	53,648	66,458	50,913	50,913	50,913	50,913
	Reduced cost of bulk water due to NRW gains (1.5% reduction on total water demand). Assumes Rous's current $2.34/kL price remains the same overtime; assumes all water supplied comes from Rous (for simplicity of analysis). Applies only to the portion of the network that has been transitioned to digital metering. The benefit is assumed to eventuate with 1 year delay	Cost saving		3,241,561		-	21,601	43,211	64,830	86,456	108,093	109,095	110,109	111,129	112,158
	Ceasing of mechanical meter reading service (cost was approx. $85K in 2024 and assumed to change proportinally to number of connections. As a conservative approach, it is assumed an exisisting connection scheduled for a digital meter install will still require manual reads for the first 2 billing cycles in the calendar year when the install happens. Manual meter readings stop at the end of Year 5)	Cost saving		2,674,603		8,983	17,971	26,962	35,955	44,953	90,740	91,584	92,432	93,288	94,154
	Reduced mechanical meter replacement (4% of meters are different to 20mm. Mechanical meters are usually replaced every 15 years. 60$/meter(based on Stores records) + 0.75hr at $31/hr for intallation)	Cost saving		2,301,647		14,720	29,445	44,177	58,913	73,657	74,340	75,031	75,726	76,427	77,137
	Increased water billing revenue (Water billing revenue in 2024/25 was $ 9,599,647. Industry suggests 4% increase. Assumed to be achieved once the system is fullly established (by year 6). During first 5 years (implementation stage) billing revenue increases grow gradually (0%, 0.8%, 1.6%, 2.4%, 3.2%). Revenue is assumed to grow proportionally to number of rateable connections.	Revenue gain		12,123,148		-	32,473	97,439	194,911	324,922	409,918	413,728	417,561	421,428	425,340
	TOTAL BENEFITS (no indexation)			**22,897,145**	-	69,343	161,334	285,596	441,992	630,992	797,335	788,711	795,388	802,262	809,353
	Remaining cost (after benefits are applied)			**15,156,056**	300,000	1,943,644.12	1,527,710	1,481,908	1,405,176	1,292,036	- 14,954	43,705	90,302	149,230	219,671
	Remaining cost per connection			**1,044**	23	145.88	114	109	103	93	- 1	3	6	10	15

	Y11 2036	Y12 2037	Y13 2038	Y14 2039	Y15 2040	Y16 2041	Y17 2042	Y18 2043	Y19 2044	Y20 2045	Y21 2046	Y22 2047	Y23 2048	Y24 2049	Y25 2050	Y26 2051	Y27 2052	Y28 2053	Y29 2054	Y30 2055
														132	132	132				
Population forecast - Based on groth proyections	37,968	38,320	38,676	39,034	39,396	39,761	40,130	40,502	40,877	41,256	41,639	42,025	42,414	42,807	43,204	43,605	44,009	44,417	44,829	45,244
Total ET - as per hydraulic modelling work	25,717	25,973	26,229	26,485	26,741	26,997	27,129	27,260	27,392	27,523	27,655	27,787	27,918	28,050	28,181	28,313	28,445	28,576	28,708	28,839
Total water consumption - as per WaterOutlook Rous and Byron Water Balanace report (kL/year)	3,254,877	3,285,053	3,315,571	3,346,262	3,377,295	3,408,585	3,440,218	3,472,109	3,504,256	3,536,747	3,569,580	3,602,671	3,636,018	3,669,709	3,703,743	3,738,119	3,772,753	3,807,729	3,843,049	3,878,625
kL/connection	223	223	223	223	223	223	223	223	223	223	223	223	223	223	223	223	223	223	223	223
Total rateable connections - Based on 2021/22 - 2024/25 Revenue Policy	14,612	14,747	14,884	15,022	15,161	15,302	15,444	15,587	15,731	15,877	16,024	16,173	16,322	16,474	16,627	16,781	16,936	17,093	17,252	17,412
Estimated 20mm connections - Approx 96% of total connections	14,027	14,157	14,289	14,421	14,555	14,689	14,826	14,963	15,102	15,242	15,383	15,526	15,670	15,815	15,961	16,110	16,259	16,410	16,562	16,715
Estimated <>20mm connections - Approx 4% of total connections	584	590	595	601	606	612	618	623	629	635	641	647	653	659	665	671	677	684	690	696
20mm connections converted to digital metering per year	129	130	132	132	134	135	136	137	139	140	141	143	144	145	147	148	149	151	152	153
<>20mm connections converted to digital metering per year	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Overall connections converted per year	134	135	137	138	139	140	142	143	144	146	147	149	150	151	153	154	155	157	159	160
Cumulative 20mm connections converted	14,027	14,157	14,289	14,421	14,555	14,689	14,826	14,963	15,102	15,242	15,383	15,526	15,670	15,815	15,961	16,110	16,259	16,410	16,562	16,715
Cumulative <>20mm connections converted	584	590	595	601	606	612	618	623	629	635	641	647	653	659	665	671	677	684	690	696
Cumulatiove overall connections converted	14,612	14,747	14,884	15,022	15,161	15,302	15,444	15,587	15,731	15,877	16,024	16,173	16,322	16,474	16,627	16,781	16,936	17,093	17,252	17,412
Estimated bulk water digital meters at water reservoirs installed (20 sites)																				
Estimated pressure monitoring devices installed (1 per 150 water connections)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cumulatiove overall bulk meters and pressure monitoring devices installed	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136
Planning, consultation and due diligence prior to implementation																				
Design & Engineering (e.g. develop project specifications)																				
Tender & Procurement Costs																				
Project Management (5-year Project Manager position, Grade 11 - Skill step 3, at $109,275/year plus on-costs (25% of base rate))																				
Capacity building and training (Trainer - 4 weeks at $150/hr during 1st year of implementation)																				
Provider service assurance during 1st year of implementation																				
Communication strategy and delivery (Consultant - 26 weeks at $100/hr, 40% in year 1 and 60% spread across year 2 to 5 of implementation)																				
Council Digital meter coordinator (1 FTE, Grade 6 - Skill step 3, at $73,624/year plus on-costs (25% of base rate))	92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030	92,030
Addition resource - Billing/rates team (1 FTE, Grade 5 - Skill step 3, at $64,920/year plus on-costs (25% of base rate))	81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150	81,150
Digital meters - supply only - Assuming L&G w370 ($230/meter, 20mm connections)	29,570	29,910	30,250	30,420	30,760	31,015	31,355	31,610	31,865	32,204	32,544	32,799	33,054	33,394	33,734	34,074	34,329	34,669	35,009	35,263
Loggers - supply only ($200/meter, 20mm connections)	1,071	1,084	1,096	1,102	1,114	1,124	1,136	1,145	1,155	1,167	1,179	1,188	1,198	1,210	1,222	1,235	1,244	1,256	1,268	1,278
Install digital meters - baseline cost ($77/install)	9,900	10,013	10,127	10,184	10,298	10,383	10,497	10,582	10,668	10,781	10,895	10,981	11,066	11,180	11,294	11,407	11,493	11,606	11,720	11,806
Install digital meters - additional cost for medium complexity installs (25% of all connections, additional $72/install)	2,314	2,341	2,367	2,381	2,407	2,427	2,454	2,474	2,494	2,520	2,547	2,567	2,587	2,613	2,640	2,667	2,687	2,713	2,740	2,760
Install digital meters - additional cost for high complexity installs (15% of all connections, additional $297/install)	5,728	5,793	5,859	5,892	5,958	6,007	6,073	6,123	6,172	6,238	6,304	6,353	6,402	6,468	6,534	6,600	6,649	6,715	6,781	6,830
Service visit charge (5% of installs per year)	180	182	184	185	187	189	191	192	194	196	198	200	201	203	205	207	209	211	213	215
Install loggers- baseline cost ($30/install)	161	163	164	165	167	169	170	172	173	175	177	178	180	181	183	185	187	188	190	192
Install loggers - additional cost for medium complexity installs (25% of all connections, $15/install)	20	20	21	21	21	21	21	21	22	22	22	22	22	23	23	23	23	24	24	24
Install loggers - additional cost for high complexity installs (15% of all connections, $30/install)	24	24	25	25	25	25	26	26	26	26	27	27	27	27	28	28	28	28	29	29
Bulk water meters at water reservoirs (20 sites) - supply ($375/meter)																				
Pressure monitoring devices (1 per 150 connections) - supply ($375/device)	335	339	343	344	348	351	355	358	361	365	368	371	374	378	382	386	389	393	396	399
Install bulk water meters at water reservoirs (20 sites, $77/install) - Installed in year 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Install pressure monitoring devices (1 per 150 connections, $77/install) - Installed in aligment with digital meters/loggers roll-out	69	70	70	71	72	72	73	73	74	75	76	76	77	78	78	79	80	81	81	82
Sim cards - 1 per device ($7.2/sim)	971	982	993	999	1,010	1,018	1,029	1,038	1,046	1,057	1,068	1,077	1,085	1,096	1,107	1,119	1,127	1,138	1,149	1,158
Digital meters - supply only ($230/meter, 20mm connections) - includes 2 year warranty	318,637	379,098	423,305	435,913	409,569	356,847	304,746	264,557	249,286	264,907	300,128	333,137	361,108	381,208	391,296	390,759	381,194	366,524	352,144	343,187
Loggers - supply only ($215/meter, 20mm connections) - includes 2 year warranty	12,411	14,766	16,487	16,979	15,952	13,899	11,870	10,304	9,710	10,318	11,690	12,975	14,065	14,848	15,241	15,220	14,847	14,276	13,716	13,367
FREIGHT!!!!																				
Install digital meters - baseline cost ($46/install) - Assume it will be done by Council staff, at 60% of contractor installation costs	64,132	76,278	85,159	87,693	82,402	71,813	61,349	53,278	50,211	53,350	60,427	67,059	72,678	76,717	78,745	78,638	76,718	73,773	70,886	69,088
Install loggers- baseline cost ($18/install) - Assume it will be done by Council staff, at 60% of contractor installation costs	1,041	1,238	1,382	1,424	1,338	1,166	996	865	815	866	981	1,089	1,180	1,245	1,278	1,277	1,245	1,198	1,151	1,122
Bulk water meters and pressure monitoring devices - supply ($375/device) - includes 2 year warranty	4,708	5,470	5,908	5,823	5,215	4,440	3,931	3,563	3,478	3,739	4,208	4,632	4,969	5,184	5,254	5,185	5,013	4,803	4,631	4,555
Install bulk water meters and pressure monitoring devices ($77/install) - Assume it will be done by Council staff, at 60% of contractor installation c	581	675	729	718	643	548	485	440	429	462	519	572	613	640	648	640	619	593	572	562
System Setup & Configuration																				
Integration with other systems, commissioning, fine tuning																				
Software - Assuming Telstra solution (Telstra = 19/point) (Itron = 10.25/point) (Temetra/Cumulocity = 14.62)	279,849	282,440	285,061	287,696	290,360	293,047	295,763	298,501	301,262	304,051	306,870	309,712	312,575	315,468	318,390	321,341	324,315	327,318	330,351	333,406
Security APN (40,320/year - Already included if using Telstra option)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Data Per Year - Telstra NBIoT 1MB Per Year (Overage Extra)	130,204	131,409	132,628	133,854	135,094	136,344	137,608	138,882	140,166	141,464	142,775	144,097	145,430	146,775	148,135	149,508	150,892	152,289	153,700	155,121
System set up (one-off) = $41,800.00																				
Integrategion set up (one off) = 32,780 (**NOT APPLICABLE** if Byron taps into Rous API)																				
Annual software licence	63,834	64,426	65,025	65,626	66,235	66,849	67,469	68,095	68,725	69,362	70,006	70,655	71,309	71,970	72,637	73,311	73,991	74,677	75,369	76,067
Annual support desk service	14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300	14,300
Miscellaneous/Contingency during implementation (Y1=10%, Y2=8%, Y3=6%, Y4=4%, Y5=2%)																				
Total Capex (no indexation)	451,852	528,445	584,470	600,338	567,487	501,515	436,757	386,820	368,178	388,468	433,359	475,302	510,887	536,693	549,893	549,728	538,080	520,188	502,699	491,915
Total Opex (no indexation)	661,367	665,755	670,194	674,657	679,169	683,720	688,320	692,957	697,632	702,357	707,132	711,944	716,794	721,693	726,642	731,641	736,678	741,764	746,900	752,074
TOTAL COST (no indexation)	**1,113,220**	**1,194,201**	**1,254,664**	**1,274,995**	**1,246,656**	**1,185,235**	**1,125,077**	**1,079,778**	**1,065,810**	**1,090,826**	**1,140,490**	**1,187,246**	**1,227,680**	**1,258,386**	**1,276,535**	**1,281,369**	**1,274,758**	**1,261,952**	**1,249,600**	**1,243,989**
Assumed indexation (3.5% in Year 1, and 2.5% after)	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**	**2.5%**
Total Capex (with indexation)	598,654	717,634	813,559	856,538	829,908	751,766	671,061	609,194	594,330	642,761	734,962	826,250	910,312	980,202	1,029,417	1,054,836	1,058,297	1,048,685	1,038,764	1,041,891
Total Opex (with indexation)	876,237	904,102	932,883	962,572	993,236	1,024,888	1,057,578	1,091,321	1,126,151	1,162,122	1,199,273	1,237,620	1,277,202	1,318,080	1,360,297	1,403,897	1,448,900	1,495,376	1,543,374	1,592,916
TOTAL COST (with indexation)	**1,474,891**	**1,621,736**	**1,746,442**	**1,819,110**	**1,823,144**	**1,776,654**	**1,728,639**	**1,700,515**	**1,720,481**	**1,804,883**	**1,934,235**	**2,063,870**	**2,187,513**	**2,298,281**	**2,389,714**	**2,458,733**	**2,507,197**	**2,544,061**	**2,582,138**	**2,634,808**
Developers pay for supply and install of digital meters in new connections (i.e. new development)	49,939	50,513	51,087	51,374	51,948	52,378	52,952	53,383	53,813	54,387	54,961	55,392	55,822	56,396	56,970	57,544	57,975	58,549	59,123	59,553
Increased system capacity efficiency due to reduced non-revenue water (NRW)	50,913	43,446	43,446	43,446	43,446	43,446	22,334	22,334	22,334	22,334	22,334	22,334	22,334	22,334	22,334	22,334	22,334	22,334	22,334	22,334
Reduced cost of bulk water due to NRW gains	113,199	114,246	115,305	116,377	117,454	118,543	119,641	120,752	121,871	122,999	124,140	125,292	126,454	127,624	128,807	130,001	131,208	132,424	133,651	134,891
Ceasing of mechanical meter reading service	95,025	95,906	96,797	97,693	98,599	99,513	100,436	101,367	102,306	103,254	104,213	105,179	106,152	107,136	108,130	109,133	110,144	111,165	112,197	113,235
Reduced mechanical meter replacement	77,850	78,572	79,302	80,036	80,778	81,526	82,283	83,046	83,815	84,592	85,377	86,169	86,966	87,772	88,586	89,408	90,237	91,073	91,918	92,769
Increased water billing revenue	429,274	433,254	437,279	441,326	445,419	449,546	453,718	457,924	462,164	466,449	470,779	475,143	479,541	483,985	488,473	493,007	497,575	502,188	506,846	511,538
TOTAL BENEFITS (no indexation)	816,200	815,936	823,216	830,251	837,644	844,952	831,365	838,805	846,302	854,015	861,804	869,509	877,270	885,247	893,300	901,428	909,472	917,733	926,068	934,320
Remaining cost (after benefits are applied)	297,020	378,264	431,448	444,743	409,012	340,283	293,712	240,973	219,508	236,810	278,686	317,738	350,410	373,139	383,235	379,941	365,285	344,219	323,531	309,668
Remaining cost per connection	20	26	29	30	27	22	19	15	14	15	17	20	21	23	23	23	22	20	19	18

Report No. 4.2 Ocean Shores STP Transfer Line Update Report

Directorate: Infrastructure Services

Report Author: Cameron Clark, Manager Utilities

File No: I2025/860

Summary:

Council has resolved to proceed to detailed design for infrastructure to transfer sewage flows from the OSSTP to the Brunswick Valley STP (BVSTP) which will enable 'load shedding' to the BVSTP to help relieve the dry weather loading at the OSSTP, particularly during peak holiday seasons or during high wet weather flow conditions and reduce the risk of environmental non-compliance.

Engineering multi criteria analysis and options assessment was undertaken to identify the best location for transfer line. Alignment 2 was chosen as the best route, for minimal environmental, social, cultural, financial, construction and operational requirements through a MCA process (appendix a).

Environmental Planning including Heritage assessments have been undertaken through different alignments, however Council requires final stages of planning and heritage works to be completed for alignment 2 (Approx 6 months), prior to detailed design.

Council staff and field experts recommend alignment two", as the preferred line utilising HDD construction technology (Appendix a).

Council staff to write to EPA and inform EPA of project update and associated timeline.

RECOMMENDATION:

That the Water and Sewer Advisory Committee notes the report.

Attachments:

1 GHD MCA OSSTP Transfer, E2025/31880 , page 130

Report

Background

Council resolved (Res 21-451) to proceed to detailed design for infrastructure to transfer sewage flows from the OSSTP to the Brunswick Valley STP (BVSTP) which will enable 'load shedding' to the BVSTP to help relieve the dry weather loading at the OSSTP, particularly during peak holiday seasons or during high wet weather flow conditions and reduce the risk of environmental non-compliance.

On 14 December 2023 council resolved to adopt the WSAC recommendations for council staff to start project initiation for Option 4R- for the partial transfer of sewage flows from the OSSTP to the BVSTP**.**

The project will involve the acquisition and establishment of a new easement underneath two properties between the OSSTP and the BVSTP,

- As adopted in the council resolution, Option 4R includes minor upgrades at the OSSTP and BVSTP to facilitate the transfer of sewage via the new pipeline and options for construction with and without a wet weather balancing pond.
- The proposed alignment maintains assets within BSC controlled land.
- The project is being monitored by the EPA and project attached to EPA licence.
- Upon completion planning approvals, detailed design and tender documentation will be prepared for construction which will require a range of insurance provisions in accordance with the NSW public Works MW 21 or GC21 form of contract.

Program Timeline

Date	Title / Description
23 Oct 2024	GHD were engaged to undertake an MCA of the proposed pipeline routes between the OSSTP and BVSTP to consider the efficiencies in the pipeline design that may be gained by using HDD technology. Previously the preferred route was selected on the assumption that the primary method of construction would be open trench excavation (OTE)
24 Oct 2024	A site visit was undertaken by key stakeholders from the design team (GHD), the planning consultant and two industry experts in consultation with BSC personnel to inspect the BVSTP, OSSTP and walk the proposed pipeline routes.
12 Nov 2024	Five draft pipeline alignment options were developed for consideration with the MCA (refer attached PDF). These options are based on a combination of OTE and HDD construction methodologies. HDD has been used across difficult terrain and OTE used where terrain is less constrained
26 Nov 2024	MCA matrix developed including the assessment criteria and weightings
3 Dec 2024	Pipeline alignment options finalised in consideration of key stakeholder comments and maps sent to two industry experts to develop indicative cost estimates for the alignments, and to provide details of construction requirements and challenges for

Date	Title / Description
	input into the MCA
12 Dec 2024	Planning and environmental advice received from consultant incorporated into the MCA document
20 Dec 2024	Indicative pricing advice received from industry experts for input into the MCA Report
6 -20 Feb 2025	Indicative pricing advice and final comments from key stakeholders incorporated into the MCA Report
20 -24 Feb 2025	MCA report and recommendations submitted to the BSC Sewer and Water Management Team for review before being presented to the BSC Executive Team for consideration and approval to proceed.
30 May 2025	Forecast date for the receipt of approval to proceed from the BSC Executive Team

Risk

A Multi Criteria Analysis (MCA) was undertaken of five potential pipeline alignment options. These options are based on a combination of Open Trench Excavation (OTE) and Horizontal Directional Drilling (HDD) construction methodologies. HDD has been used across difficult terrain and OTE used where terrain is less constrained. The risk-based analysis was undertaken in consultation with the planning, heritage and construction specialists

Planning Approvals Update

Minor upgrades of both the OSSTP and the BVSTP are anticipated to be required to address the existing operational issues and process bottlenecks, and the construction of a wet weather storage facility will be required at the BVSTP to cater for receival and balancing of the increased peak wet weather flows. An update on environmental assessments and planning approvals is as follows:

The Environmental and Heritage Planning consultant will be requested to update the Aboriginal cultural heritage assessment with the new approach as follows:

- Undertake the investigations/ consultation required to update the ACHAR with the alternative pipeline route – assumed to be alignment 2.

The biodiversity assessment will also be finalised with the preferred pipeline route and location of the BVSTP balancing pond.

Once the final alignment is approved it is proposed that the approvals process (including Part 5 and REF) would run in parallel with the detailed design.

Heritage

The Aboriginal Cultural Heritage Assessment Report (ACHAR) has progressed, however, further work still required for alignment 2.

Council have assumed that the adopted HDD route and new BVSTP balancing pond site will not impact on cultural heritage. However, assessments are still being carried out.

This is expected to take 14 weeks including the required RAP consultation. Council to arrange the required access to private property and any resident consultation.

Next Steps

1. The Project team proceeding forward with the recommended route alignment and complete the following: -

   a. Environmental assessment and

   b. Landholder consultation

Once stages a and b are complete, Council will then undertake detailed design prior to going to construction.

Strategic Considerations

Community Strategic Plan and Operational Plan

CSP Objective	CSP Strategy	DP Action	Code	OP Activity
5: Connected Infrastructure	5.5: Provide continuous and sustainable water and sewerage management	5.5.2: Wastewater management - Manage effluent in an ecologically sustainable way that ensures public health and protects and enhances the natural environment	5.5.2.11	Ocean Shores transfer to Brunswick Valley Sewerage Treatment Plant - process elements and transfer pipeline

Financial Considerations

Cost: Design cost estimates as follows:

1. OSSTP upgrade- $9mil minimum upgrade – (design cost $398,000)
2. BVSTP upgrade and augmentation including 20ML wet weather storage facility $16.4mill cost estimate (design cost- $200,000)
3. New HDD pipeline – ($15mil cost estimate) – (Geotech, survey, Design verification, review and optioneering - $185,000).

Note: Cost of design for transfer pipeline of $200,000 is in the budget for next OP/FY.

Consultation and Engagement

Who was consulted?	How did consultation occur? e.g. email, verbal etc	Comments/Feedback
EPA	Updates on project progress has been communicated to the EPA via memos on 10 Sep 2024 and 24 Dec 2024	No formal response received, other than acknowledgement.
Potential effected landholders	Preliminary discussions have been held with potential effected landholders for all MCA options reviewed	Request to meet on site to review the full scope of this project and what is involved in installation and ongoing inspections and maintenance
SEE Environmental Team	Phone and email correspondence	Approved environmental planning and systems process
Water and Sewer Advisory Committee	Report	Ongoing feedback throughout the project lifecycle

12649325-REP-001 MCA of Pipeline Alignments

Ocean Shores STP to Brunswick Valley STP Transfer

Byron Shire Council

19 February 2025

Project name		Ocean Shores STP to Brunswick Valley STP Transfer Pipeline					
Document title		12649325-REP-001 MCA of Pipeline Alignments | Ocean Shores STP to Brunswick Valley STP Transfer					
Project number		12649325					
File name		12649325-REP-001_A MCA of Pipeline Alignments.docx					
Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**		
			Name	**Signature**	**Name**	**Signature**	**Date**
S4	0	Adolfo Badini	Matthew Row	M Row *	Pip Ochre	P Ochre *	19/02/2025

GHD Pty Ltd | ABN 39 008 488 373|
Contact: Adolfo Badini, Senior Civil Engineer | GHD
145 Ann Street, Level 9
Brisbane, Queensland 4000, Australia
T +61 7 3316 3000 | **F** +61 7 3319 6038 | **E** bnemail@ghd.com | **ghd.com**

Note: * indicates signatures on original issue of report or last revision of report

→ The Power of Commitment

Contents

Table index

Figure index

Appendices

No table of contents entries found.

Attachments

1. Introduction

1.1 Background

Byron Shire Council (BSC) operates the Ocean Shores Sewage Treatment Plant (OSSTP) and the Brunswick Valley STP (BVSTP). Figure 1 below shows the site locations. Both STPs currently discharge to the nearby Brunswick River, at two different locations.

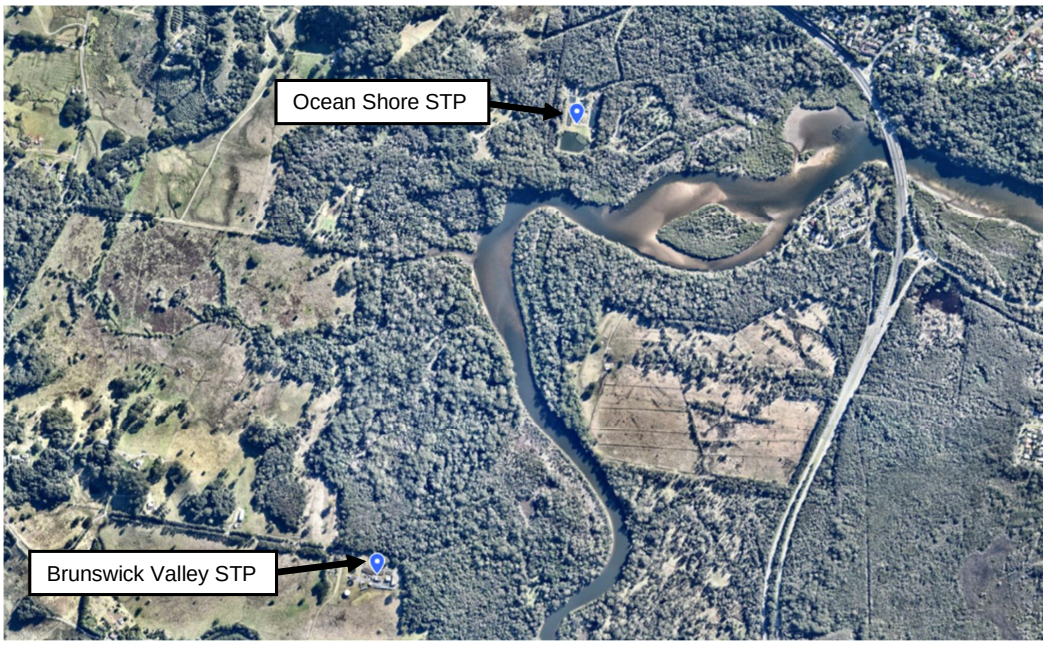


Figure 1 OSSTP and BVSTP Locations

The OSSTP is a relatively old plant which was originally built in the 1980s and operates under an older environmental license, which the NSW EPA has flagged being due for updating. The last significant upgrade was completed in 1995 and since that time the plant has had only minor capital works improvements. The ability of the plant to treat peak wet weather flows of more than three times average dry weather flow (ADWF) is severely limited by the process configuration and the existing equipment. The inability of the plant to adequately treat dry weather flows and loads during peak seasonal periods (e.g., around Christmas/ New Year or Easter holidays) has been demonstrated in recent years by effluent ammonia exceeding license requirements for river discharge.

The BVSTP is relatively new plant (~14 years old) that still has 'spare' dry weather capacity, when comparing theoretical (design) capacity to current Average Dry Weather Flows (ADWF).

Council has resolved to proceed to detailed design for infrastructure to transfer raw sewage flows from OSSTP to BVSTP which will enable 'load shedding' to the BVSTP to help relieve the dry weather loading at the OSSTP, particularly during peak holiday seasons or during high wet weather flow conditions and reduce the risk of environmental non-compliance.

Initially, it is proposed to divert the flows from one of the two sewage pump stations (SPS 5004) that currently feeds OSSTP to the BVSTP, via a modification and extension of its rising main (nominally OD280). This is expected to ease the hydraulic bottlenecks at OSSTP and increase the ADWF at BVSTP to around 2.2 ML/d, which is still within the original design ADWF of that plant.

Depending on growth projections, these modifications are expected to allow both STPs to operate for many years and potentially until 2055 (end of planning horizon, to date) until a decision is made at some future

date, to determine if the entirety of the OSSTP inflow should be transferred to BVSTP, whether OSSTP should be closed, or an alternative option considered.

Since full transfer from OSSTP to BVSTP is a potential future requirement, it was previously recommended[2] that an additional pipeline of larger diameter (nominally OD450) should also be installed between OSSTP and BVSTP, via the same easement as proposed for the SPS 5004 diversion, when the initial (partial diversion) pipeline is installed. Optionally, if BSC decides to retain and continue to utilise (an upgraded) OSSTP in future, then the transfer pipeline constructed for the transitional scenario (for SPS5004 transfer to BVSTP) could either be retained for operational flexibility, to manage raw wastewater flows and loads between the two plants into the future or be repurposed as a treated effluent / recycled water main linking the two sites.

Part of the original design[1] of the BVSTP included an effluent pipeline from BVSTP to OSSTP ("3rd pipeline") for supply of treated effluent (recycled water) from the BVSTP to the OSSTP (or the reverse), with the intention of developing local effluent reuse opportunities. This pipeline was never installed, but the easement / route was surveyed, investigated and reserved and geotechnical investigations were undertaken. This route is shown in Figure 2.

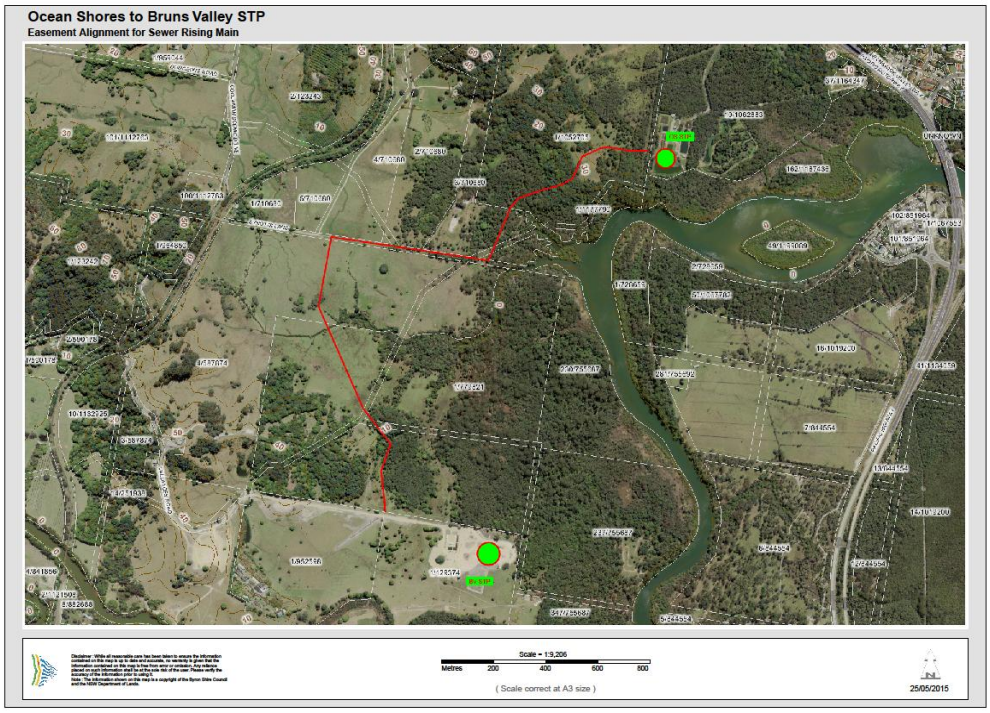


Figure 2 "3rd Pipeline" Easement

A later review of the proposed "3rd Pipeline" route easements found that part of the alignment traversed areas mapped as Coastal Wetland requiring development consent. Alternative routes were examined to avoid wetland areas on the assumption that the pipeline would be installed using an Open Trench Excavation (OTE) methodology. The proposed alternate pipeline routes are shown in Figure 3. Out of these routes, Route A was considered to have the lowest biodiversity impact and was selected as the preferred option.

[1] Refer to GHD Project: 4118795

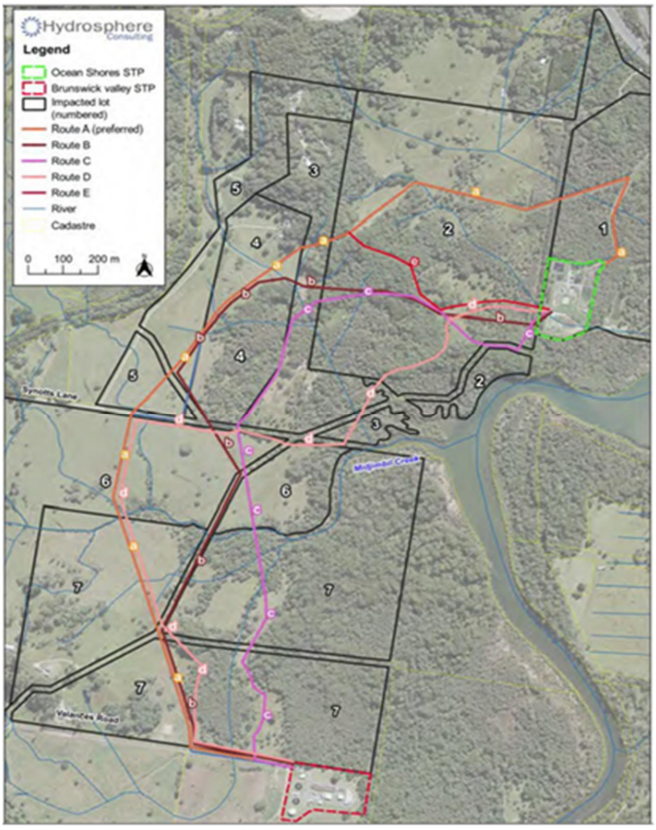


Figure 3 Proposed Pipeline Routes

GHD's later preliminary options study report[2] maintained the proposed alignment but proposed a combination of OTE and Horizontal Directional Drilling (HDD). The report did not provide a complete or detailed transfer pipeline CAPEX estimate, only a comparative price to the other options considered.

The proposed alignment was separated into five construction sections based on environmental advice provided by Hydrosphere and a high-level desktop review of the geography and other natural features of the site. OTE was adopted where site conditions were favourable, and HDD was proposed to be utilised through sections that are constrained due to potential constructability issues or environmentally sensitive areas.

A summary of the construction sections (Sections A to E) for the proposed pipeline(s) is shown in Figure 4.

[2] GHD reference 12573919-REP-0_Ocean Shores - Brunswick Valley sewage transfer and treatment Preliminary Report

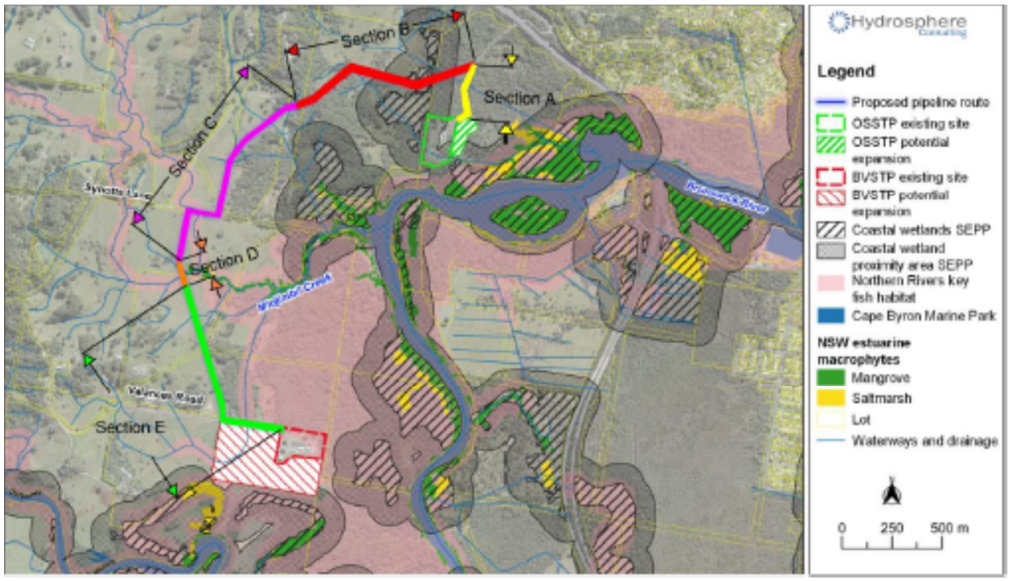


Figure 4 Pipeline alignment construction sections (route A)

During a recent optioneering meeting held on 6 September 2024, it was considered that further efficiencies in the pipeline design may be gained to modify the alignment with the use of HDD methodology to go directly underneath the coastal wetlands.

1.2 Purpose of this report

The purpose of this report is to:

- Present the various pipeline routes considered
- Itemise the criteria used to select the preferred pipeline route.
- Detail the weighing assigned to each of the criteria.
- Detail the results of a multiple criteria analysis (MCA) undertaken to determine the preferred pipeline route and which routes have merit to be developed further into detailed design.
- Provide justification of the preferred route.

1.3 Scope and limitations

This report: has been prepared by GHD for Byron Shire Council and may only be used and relied on by Byron Shire Council for the purpose agreed between GHD and Byron Shire Council as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Byron Shire Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.4 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

GHD has prepared the indicative cost estimates with the assistance of third parties as set out in Attachment 3, Attachment 4 and Attachment 5 using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD. The key assumptions are related to ground conditions which have not yet been evaluated by a comprehensive geotechnical investigation, and others described in Section 1.4. The Cost Estimate has been prepared for the purpose of cost comparison of pipeline options and must not be used for any other purpose.

The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the [works/project] can or will be undertaken at a cost which is the same or less than the Cost Estimate.

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

GHD has prepared this report on the basis of information provided by Byron Shire Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

After this report is complete, the next phases of the project (e.g., Concept / Detailed Design, upgrades of BVSTP and OSSTP etc.) and further environmental and planning approvals can be initiated. These next phases of the project lie outside the scope of this report.

This scope will only cover the pipeline route between the two STPs, the pipework and pipeline infrastructure inside the STPs will be covered in the next phases of the project.

1.4 Assumptions

This report assumes the following:

- Environmental and Statutory approvals will not significantly delay or stop the project.
- Geotechnical conditions will allow construction of pipelines by HDD and OTE methods, albeit with reasonable mitigating treatments for weak ground conditions. These might include absence of large rock floaters, and reasonably uniform and suitable geotechnical conditions for HDD construction, and trench improvement such as rock mattress, dewatering and temporary shoring for OTE construction.
- Clear and unimpeded access to the sites.
- Existing material is suitable for backfilling trenches and excavations.
- Existing topsoil is suitable for respreading after the pipeline installation is completed for stabilisation.
- Bulk earthworks or reshaping to existing topography is not required.

2. Site Visit

A review of options was conducted in a Teams Meeting held on 6 September 2024 to further understand the background to the various alignment options. This meeting was attended by representatives from BSC, GHD and Hydrosphere. At this meeting it was agreed that Horizontal Directional Drilling (HDD) installation methods should be considered (over Open Trench Excavation (OTE) installation methods) as these methods:

– Provide a more direct route between the two STPs shortening the overall pipeline length, which may reduce diameter and operational power requirements.
– Reduce potential installation risks posed by traversing heavily vegetated and/or weak, water-logged areas that would be impractical to traverse using OTE methods.

A site visit was conducted on 24 October 2024 to further explore the viability of using HDD methods and inspect the site conditions. Representatives from the following organisations attended:

– BSC
– GHD
– Hydrosphere (Environmental Consultant)
– UEA Pty Ltd (HDD contractor)
– Alder Constructions (Civil contractor)

UEA and Alder Constructions have completed similar works and are familiar with the challenges that may present for construction in this type of geology and site conditions.

2.1 HDD Commentary

Four sites (including the OSSTP and BVSTP) were visited as shown in Figure 5 below. These sites were selected as a result of the Teams Meeting review of potential sites for HDD launch or receival sites.

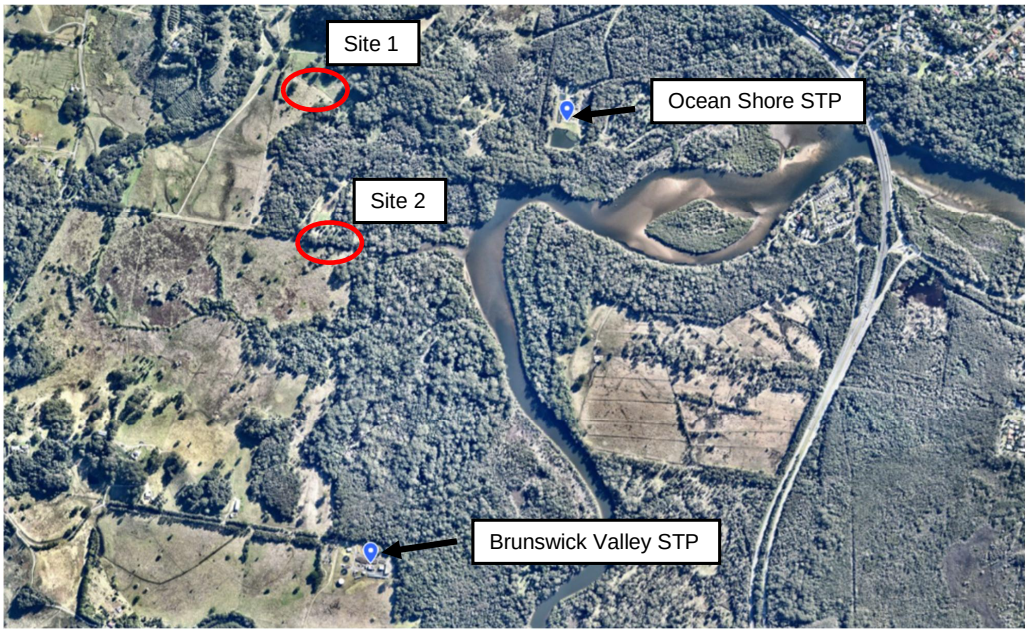


Figure 5 OS and BVSTP Locations

All sites were considered to be suitable for HDD launch and receival sites. Typical requirements for these sites are detailed in Sections 2.1.1 and 2.1.2.

There are a number of risks with HDD construction. These risks and their mitigations are detailed below:

- Rock Excavation - Most of the available existing geotechnical borelogs are not deep enough to inform the risks associated with HDD construction. Ideally geotechnical bores should be a minimum 8 metres deep and if rock is encountered extend 5 metres into bedrock and include strength and abrasion testing of the bedrock material.
- Geotechnical Conditions - Additional boreholes will be required in subsequent design phases. As an ideal minimum a borehole at each end of each HDD crossing and at 200 metre centres along the route, with one at or close to low points such as watercourses.
- Groundwater – required to be managed during the HDD process and potentially remediated after completion of the HDD process.
- Vibration – Required to be monitored and can result in damage to properties situated above the bore line/in proximity of the bore line, residents who believe works have created damage etc.

2.1.1 Launch Site

– 1,400 m^2 (40m x 35m) working area hardstand:
  - Entry pit
  - Concrete anchor for drilling machine
  - HDD maxi drilling machine
  - 12 m long site office
  - High pressure mud pump
  - Drilling fluid treatment plant
  - Drilling rods
  - 23.5t excavator
  - Sound barriers if required
  - Sediment containment
– All weather 5 m wide access track for movement of machinery and drilling rods. Traffic movements will occur at project establishment, demobilisation stages, and during operation. Typically, there would be daily articulated vehicle movements and heavy ridged truck movements at both stages of construction. Daily movements for cuttings disposal via vac truck, deliveries of diesel, staff transport and general deliveries. In addition, there will be daily passage of light vehicles to transport personnel and consumables, which would typically be two passes per day.
– Power supply will be via on site generators.
– Potable water will be required for the make up of drilling fluids as well as wash down of equipment. Typically this is drawn from hydrant points on site or can be tankered to site. It has been assumed that water is available on site.

2.1.2 Receival Site

– 1,400 m^2 (40m x 35m) working area hardstand, housing:
  - Exit pit
  - Fluid scalper/recycling system
  - Drilling fluid pumps if using a return line, or tanker standing area if using a tanker
  - 23.5t excavator
  - Potentially a HDD rig will be required to help manage the tail string
  - Sediment containment
– Pipe welding and stringing can be undertaken along a grassed paddock or the road edge with no special requirements.

- Ideally, strings would be completed in one single string for ease of pull back. Given site and environmental restrictions the pipe may need to be welded up in a number of strings resulting in internal beads remaining at joints between strings. This is not a major issue but can be of concern for some clients and extends the pipe installation process as a number of 'Golden Welds' would be required.
- Based on a brief assessment, pipe can be welded for the OSSTP along Smokey Valley Way or Synotts Lane for the Northern bore and then along Vallances Road or Synotts Lane for the Southern bore. All locations are considered appropriate and can be assessed based on HDD methodology and landowner requirements.
- All-weather 5m wide access track for movement of machinery and pipes. Traffic movements will occur at project establishment, demobilisation stages, and during operation. Typically, there would be daily articulated vehicle movements and heavy ridged truck movements at both stages of construction. Daily movements for pipe delivery in 12m lengths on a semi-trailer, deliveries of diesel, staff transport and general deliveries. In addition, there will be daily passage of light vehicles to transport personnel and consumables, which would typically be two passes per day.
- Power supply will be via on-site generators.
- Water supply via tankers and site-based storage tanks.

2.2 OTE Commentary

OTE construction will utilise power generators at the site compound and the work sites. Potable water for washing, cleaning, etc be provided from an IBC unit, which will be filled as needed from a portable water supplier.

OTE requires a clearway about 15m wide along the length of the proposed pipeline. This width is required to house:

- 20 tonne excavator excavating the trench
- Tippers
- Smooth drum roller
- Trench roller
- 5 m wide access road clear of excavator. Access track will comprise 150mm CBR 45, 200mm rock bridging layer and geofabric lining.
- topsoil and spoil heaps
- pipe strings
- pipe welding area
- Construction water for dust suppression or moisture conditioning will be via water cart/trailer, which will be filled up at BSC filling points or metered standpipes from BSC mains. If there is a filling point at the STP then it can also be utilised.
- All weather 5m wide access track for movement of machinery and pipes. Significant traffic movements will occur at project establishment and demobilisation stages. Typically, there would be multiple articulated vehicle movements and heavy ridged truck movements at both stages of construction.
- OTE requires movement of trucks to bring in rock bedding and embedment material every second day with tandem tippers.
- Pipes and fittings will also be transferred to the work zone from the site compound laydown on a flatbed truck once a week.
- In addition, there will be daily passage of light vehicles to transport personnel and consumables, which would typically be one or two passes per day.

All excess spoil resulting from earthworks operations, services trenches, etc will be disposed off-site.

There are a number of risks with the OTE construction that include:

- Rock Excavation - this can be minimised by reviewing the test pit information. If there is rock on the OTE alignment, early geotechnical investigation and survey could potentially help to determine how much rock will require to be excavated.
- Trench Improvement - this can also be de-risked by having early geotechnical investigation.
- Dewatering - there was substantial spear dewatering and treatment on a recent Alder Constructions project in Byron. Hence, knowing the potential level of groundwater and the water quality (groundwater versus baseline quality of area) would be beneficial in managing this risk.
- Traffic control and management – may be required for road crossings.

2.3 Site Visit Results

2.3.1 OSSTP site

At the OSSTP site, an area within the dried biosolids storage area was identified as a suitable site to use for a HDD launch or receival site. Water and power should be readily available at this site. There is ready access to this site and pipe may be strung along the road into the STP if this site is used as a receival site. The pipe string may need to be made in two strings if there is insufficient space with a hot weld to join strings during installation. A hardstand will be constructed which can be removed or left in place at the end of construction.

Some disruption to site operations will be inevitable at the project establishment and demobilisation phases. It is expected most disruptions will be from movement of vehicles bringing machines and materials to and from site. The operational area for the HDD works would be self-contained and result in minimal disruption to site operations. Liaison with plant operators and coordination of traffic movements with plant operations will be required to minimise these disruptions.

It is expected that existing roads and access tracks within the STP site would be used for movement of vehicles. Tracks adjacent to ponds will not be used to minimise risk of damaging the pond containment bunds.

2.3.2 Site 1 – Private Property

Site 1 is located on the side boundary to the rear of an existing private property. This property has a well-maintained grassed surface which would require careful reinstatement if impacted. Two suitable areas were identified at this site. One was within the private property in a flat south-east corner of the property. The other site would be in the adjoining property. An access track would need to be constructed from Synotts Road along the northern side of the property boundary across the grassed surface if the site selected is inside the private property. The access track could run on the southern side of the boundary in the adjoining undeveloped cleared site.

Site 1 would ideally be used as a common launch site to run HDD east and south. This would reduce the setup cost to move the drilling machine to a second location. However, this site could also be used as a receival site for one or both HDD drives. The hardstand and access tracks could be removed or left in place at the end of construction. Access to the air release valve required at this site would require access, therefore retaining the access track would be advantageous to BSC. Some pipe stringing room is available at this site should it become a receival site, but several strings would be required with hot welding during construction.

2.3.3 Site 2 – End of Synotts Lane

Site 2 is located off the end of Synotts Lane on a rough non-graded track that provides access to adjoining properties. This site is close to the Northern Rivers Key Fish Habitat (KFH) area however it should be possible to located the construction activities west clear of the KFH. There is sufficient area to setup a launch or receival site. Some local clearing and/or trimming of vegetation may be required at this site.

Site 2 would ideally be used as a launch site to run HDD north and south. This would reduce the setup cost to move the drilling machine to a second location. However, this site could also be used as a receival site for one or both HDD drives. A hardstand and access track could be removed or left in place at end of

construction. The access track improvement should be a benefit to track users. Additional construction area may need to be negotiated from adjoining properties and the improvement to the access track used for bargaining this agreement. Some pipe string room is available at this site should it become a receival site. A number of strings may be required with hot welding during construction.

2.3.4 BVSTP Site

During the site visit it was considered that the HDD should terminate outside the STP site to minimise disruption to the plant operations. There is ready access to the site and pipe may be strung along Vallances Road into the STP or in adjacent vacant land if this site is used as a receival site. A hardstand will be constructed which can be removed or left in place at end of construction.

3. Pipeline Alignments Considered

A number of alignment options have been developed for the MCA review to determine the preferred alignment. There are several constraints that impact pipeline alignments, some of these include:

- Areas mapped as Coastal Wetlands in the Resilience and Hazards SEPP
- Northern Rivers Key fish habitat
- Mangroves
- Low lying potentially weak ground with elevated groundwater
- Creeks and gullies
- Cultural heritage sites
- Ridge west of the OSSTP
- Easements and road corridors
- Private and Crown land

A mix of HDD and OTE methods have been used in developing these options. At this stage there is limited geotechnical data available along the proposed pipeline alignments. Geotechnical data collected for the original pipeline design completed in 2008 has been used. The location of the available geotechnical boreholes is generally remote from the proposed pipeline alignment options. Most of this data is limited to 3 metres deep which is suitable for OTE methods but not deep enough for HDD methods. Qualitative local area knowledge and visual review of geology in road cuttings has also been used.

Common to all alignment options are biodiversity credits to offset impacts to the natural fauna and flora. At this early stage of the project development it is not possible to accurately determine these costs. An assessment has been made of these costs for each alignment option for the purposes of comparison. These draft estimates do not reflect the actual costs expected once a full assessment has been made.

3.1 Biodiversity Credits

A Biodiversity Development Assessment Report (BDAR) Progress Report[3] included estimates of credits, data for the preferred OTE pipeline route A (Figure 3) was entered into the BAM-C to provide an indication of credits potentially required, however details were not finalised as estimates of vegetation condition were made for areas not able to be surveyed at that time. Credits for that route were estimated as $700,000-$750,000. If adjusted to current credit costs, this could be significantly more. The original estimate was approximate, and some credit costs have increased significantly in the last couple of years.

Without more detailed survey and BAM-C calculations, it is difficult to provide a good estimate but based on the expected impact for each option relative to that route, suggested credit allowances are given in the discussions of each alignment option below.

These costs do not consider common costs associated with all options such as BVSTP upgrades.

3.2 Alignment 1

Alignment 1 is shown in Attachment 1 and includes three HDD sections (HDD1, HDD2, and HDD3) between the OSSTP and Site 1, Sites 1 and 2, and Site 2 and the BVSTP, respectively. The section between the OSSTP and Site 1 (HDD1) runs under a ridge which is expected to be rock which will increase drilling costs. The other two sections are low lying with potentially weak ground conditions and elevated groundwater where HDD will reduce damage to the environment compared to OTE methods. Access tracks would remain for pipeline maintenance and access to air valves and scours. HDD would typically require a shorter construction period than OTE.

Site 2 is located in the Synotts Lane corridor. The eastern end of this corridor is zoned as crown land and the section west is BSC land. The pipelines and construction works should be located clear of the crown

[3] Biodiversity Assessment Method Summer Surveys, Ocean Shores to Brunswick Valley STP Wastewater Transfer, 30th May 2023, by Biodiversity Assessments & Solutions Pty Ltd

land as obtaining a Crown licence to undertake the work will take potentially 6-12 months. The key fish habitat area should also be avoided at Site 2.

Given the low impact proposed at HDD sites 1 and 2, it would be unlikely that either location would qualify as a PAD (Potential Archaeological Deposit) however this would need to be confirmed in the field once a preferred option has been determined.

It is understood that the land at the southern end of HDD3 is BSC-controlled land and would not require special approvals for new pipeline or construction activities.

The HDD lengths are between 500 and 1100 metres which are within capability of a maxi drilling rig.

An indicative list of activity unit durations for HDD construction is shown in Table 1:

Table 1 HDD Activity Unit Durations

Activity	Duration
Mobilisation of HDD maxi rig and support equipment	10 days
Pilot, Reaming and Installation of 280mm in Rock up to 80 mPa	30 m /day
Pilot, Reaming and Installation of 450mm in Rock up to 80 mPa	22 m / day
Relocation of maxi rig and support equipment between HDD sites	10 days
Demobilisation of HDD rig and support equipment	10 days

On this basis HDD construction durations for Alignment 1 are shown in Table 2:

Table 2 Alignment 1 HDD Activity Durations

Activity	Days
Mobilisation to Site 1	10
HDD1, Install OD280 pipe = 857/30	29
HDD1, Install OD450 pipe = 857/22	39
Relocation from Site 1 to Site 2	10
HDD2, Install OD280 pipe = 534/30	18
HDD2, Install OD450 pipe = 534/22	25
HDD3, Install OD280 pipe = 1069/30	36
HDD3, Install OD450 pipe = 1069/22	49
Demobilisation	10
Total	**216**

This equals 31 working weeks based on a 7 day per week duration.

The estimated duration of 31 weeks includes on-site construction of the HDD sections of Alignment 1, excluding pre-construction requirements and wet weather delay. An additional 6-month lead time for HDD tooling purchase and to ensure availability is required. The total construction time is therefore 31 + 24 = 55 weeks.

Alignment 1 does not have OTE construction but would require construction of civil works including access tracks and hardstands. It was assumed this would be done in the 6 month lead time for HDD tooling purchase therefore the total estimated construction duration is 55 weeks excluding pre-construction requirements and wet weather delay.

3.2.1 Cultural heritage

Consultation, site surveys and preparation of an Aboriginal Cultural Heritage Assessment Report (ACHAR) has been undertaken for the preferred OTE alignment route A (Figure 3). HDD disturbs the land at the exit/entry sites, therefore, another round of consultation will be required to present any new proposals and

update the documentation. This can be done in parallel with design and REF and if there are no issues, should be completed within 6 months.

3.2.2 Biodiversity credits

Alignment 1 is not likely to require a BDAR on its own, so potentially no offset cost. If a BDAR is required (potentially opted in if BSC prefers or if significant vegetation removal is required at BVSTP, or there is a potential impact on threatened species), then Alignment 1 would be potentially slightly more costly than Alignment 2 as there is an additional disturbance site, even though it is in a cleared area. Vegetation will not necessarily require offsetting, but some species might. The project team has assumed a biodiversity credit allowance for Alignment 1 of $70,000

3.3 Alignment 2

Alignment 2 is shown in Attachment 1 and includes two HDD sections between the OSSTP and Site 2 (HDD4), and between Site 2 and the BVSTP (HDD3). The section between the OSSTP and Site 2 (HDD4) runs under a ridge near the elbow in the Brunswick River which is expected to be rock and will increase drilling costs. It is expected that there will be weak materials both sides of this ridge. Appropriate methods may be required including a bore liner on the eastern side to allow the weak material drill head to be replaced with a rock drill head without the bore collapsing. The rock drill head would then be replaced once through the rock. The second section is low lying with potentially weak ground conditions and elevated groundwater where HDD reduces damage to the environment compared to OTE methods. HDD would likely require air release valves at Site 2 and at the OSSTP and BVSTP sites. Access tracks to these areas would remain for access to air release valves.

Refer to Alignment 1 comments in Section 3.2 in relation to works in Site 2, southern end of HDD3, and cultural heritage at HDD entry/exit sites.

The HDD lengths are between 950 and 1100 metres which are within capability of a maxi drilling rig.

Based on the unit durations outlined in Section 3.2 the HDD construction durations for Alignment 2 are shown in Table 3:

Table 3 Alignment 2 HDD Activity Durations

Activity	Days
Mobilisation to Site 2	10
HDD3, Install OD280 pipe = 1069/30	36
HDD3, Install OD450 pipe = 1069/22	49
HDD4, Install OD280 pipe = 942/30	32
HDD4, Install OD450 pipe = 942/22	43
Demobilisation	10
Total	**180**

This equals 26 working weeks based on a 7 day per week duration.

The estimated duration of 26 weeks includes for on-site construction of the HDD sections of alignment 2, excluding pre-construction requirements and wet weather delay. An additional 6 month lead time for HDD tooling purchase and to ensure availability is required. The total construction time is therefore 26 + 24 = 50 weeks.

Alignment 2 does not have OTE construction but would require construction of civil works including access tracks and hardstand. It was assumed this would be done in the 6 month lead time for HDD tooling purchase therefore the total estimated construction duration is 50 weeks excluding pre-construction requirements and wet weather delay.

3.3.1 Goetechnical Investigations

Anecdotally, it appears that the ground conditions along HDD4 may vary and potentially include rock under the ridge and weak materials adjacent to the ridge. This alignment also runs under watercourses and gullies. Geotechnical investigations to confirm ground conditions would assist in determining the construction method and machinery to use for this drill and therefore reduce project risk. Ground survey of the creek beds would assist in pipeline grading to provide sufficient clearance to reduce risk of frac-out of drilling fluids.

An assessment of the potential impact on the mapped coastal wetlands/KFH, waterways and groundwater dependent ecosystems (connectivity, hydrogeology etc.) would be required to undertake these investigations.

There are some existing test pits and boreholes that are close to the alignment as shown on Figure 2, but they are all shallow depths (3m) apart from BH47 which is 10.45m deep. In relation to access to this area for survey and geotechnical investigations:

- Access to Private property along the route may present access issues.
- Geotechnical investigations should be exempt development (no need for consent or environmental assessment) if it avoids SEPP coastal wetland, KFH and mangrove areas.
- Is likely to be wet ground for access and the vegetation is thick in that area (heavily forested sclerophyll forest) around the cleared ridge. Access to the area has not been established. See aerial clip below.

Figure 6 Area southwest of OSSTP

3.3.2 Biodiversity Credits

Alignment 2 is not likely to require a BDAR on its own, so potentially no offset cost. If a BDAR is required (potentially opted in if BSC prefers or if significant vegetation removal is required at BVSTP, or there is a

potential impact on threatened species)., then Alignment 1 would be potentially slightly more than Alignment 2 as there is an additional disturbance site, even though it is in a cleared area. Vegetation will not necessarily require offsetting, but some species might. The project team has assumed a biodiversity credit allowance of $50,000 for Alignment 2.

3.4 Alignment 3

Alignment 3 is shown in Attachment 1 and includes one HDD section between the OSSTP and Site 2 (HDD4), and combined HDD and OTE sections between Site 2 and the BVSTP (HDD5, OTE1 and OTE2). The section between the OSSTP and Site 2 (HDD4) is described for Alignment 2. The second section is low lying with potentially weak ground conditions and elevated groundwater. OTE has been selected in areas clear of high value vegetation and would likely require construction access tracks, wide trenches for shoring boxes, and trench bed improvement. Access tracks would remain for pipeline maintenance and access to air valves and scours. A relatively short HDD section has been allowed to traverse a waterway and thick vegetated areas.

Refer to Alignment 1 comments in Section 3.2 in relation to works in Site 2, and cultural heritage at HDD entry/exit sites.

Refer to Alignment 2 comments in Section 3.3 in relation to groundwater impacts from HDD construction.

It is understood that the land at the southern end of OTE2 is BSC-controlled land and would not require special approvals for new pipeline or construction activities.

South from Synotts Lane, the OTE1 route crosses into private property and runs through a freshwater wetland, crosses Midjimbil Creek (HDD5) and then OTE2 through freshwater wetlands, mangrove forests, thick coastal floodplain wetlands and key fish habitat to Valances Road.

Based on the unit durations outlined in Section 3.2 the HDD construction durations for Alignment 3 are shown in Table 4:

Table 4 Alignment 3 HDD Activity Durations

Activity	Days
Mobilisation to Site 2	10
HDD4, Install OD280 pipe = 942/30	32
HDD4, Install OD450 pipe = 942/22	43
Relocation from Site 2 to HDD5	10
HDD5, Install OD280 pipe = 211/30	7
HDD5, Install OD450 pipe = 211/22	10
Demobilisation	10
Total	**122**

The estimated duration of 18 weeks includes for on-site construction of the HDD sections of alignment 3, excluding pre-construction requirements and wet weather delay. An additional 6 month lead time for HDD tooling purchase is required. The total construction time is therefore 18 + 24 = 42 weeks.

Alignment 3 has OTE construction with an estimated duration of 27 weeks. As the OTE team will be responsible for construction of access tracks and hardstands it is assumed that the OTE and HDD teams will operate sequentially, therefore the total estimated construction duration is 69 weeks excluding pre-construction requirements and wet weather delay.

Significant biodiversity impacts and significant offsets expected. This option might not be considered viable as there are alternative routes.

Also, OTE1 and OTE2 may require some additional cultural heritage investigations given proximity to the creek, but again would need to be confirmed in the field.

The HDD lengths are between 200 and 950 metres which are within capability of a ‘maxi‘ drilling rig.

3.4.1 Biodiversity Credits

Biodiversity credits cannot be determined with much accuracy until a proposal/ BDAR is put to the NSW Government but they can be estimated with additional species survey. If the project can be kept as Part 5 (minimal biodiversity impact), credits should not be a requirement. The OTE routes would have the highest credits and would require a BDAR but would be relatively insignificant when compared to the total project cost.

In addition to construction access, it is understood that OTE options require a permanent maintenance corridor/easement (approximately 5m wide) for all areas constructed via trench excavation. Therefore, there would still be a permanent biodiversity impact to be offset.

Alignment 3 has the highest offset cost depending on proximity to the forest etc and if surveys are not able to be completed, the costs will increase. The project team has assumed a biodiversity credit allowance of $1,500,000 for Alignment 3.

3.5 Alignment 4

Alignment 4 is shown in Attachment 1 and includes one HDD section between the OSSTP and Site 1 (HDD1), and a combined OTE and HDD construction between Site 1 and the BVSTP (OTE3, OTE4 and HDD6). HDD6 runs under Midjimbil Creek and under a site of heritage value where ground disturbance is not permitted (based on the outcomes of the original ACHAR).

The section between the OSSTP and Site 1 (HDD1) is described for Alignment 1. The second section is low lying with potentially weak ground conditions and elevated groundwater conditions. OTE has been selected in areas clear of high vegetation and would require construction access tracks, wide trenches for shoring boxes, and trench bed improvement. Access tracks would remain for pipeline maintenance and access to air valves and scours. The second section avoids crossing environmentally sensitive areas.

Refer to Alignment 1 comments in Section 3.2 in relation to works in Site 1, and cultural heritage at HDD entry/exit sites.

OTE3 crosses low lying wet areas (1.6-2.0mAHD) and follows a cleared paddock across two drainage lines then runs through a paddock with remnant freshwater wetland species amongst pasture species, before entering Synotts Lane, then traverses through the edge of a Hoop pine rainforest before crossing an agricultural drain (with regrowth mangroves) before HDD6 under Midjimbil Creek and the cultural heritage site in a ridge / saddle to the south. OTE3 traverses disturbed cattle paddocks with some remnant freshwater wetland species. OTE4 traverses south across cattle paddocks to Valances Road.

Based on the unit durations outlined in Section 3.2 the HDD construction durations for Alignment 4 are shown in Table 5:

Table 5 Alignment 4 HDD Activity Durations

Activity	Days
Mobilisation to Site 1	10
HDD1, Install OD280 pipe = 857/30	29
HDD1, Install OD450 pipe = 857/22	39
Relocation from Site 1 to HDD6	10
HDD6, Install OD280 pipe = 634/30	21
HDD6, Install OD450 pipe = 634/22	29
Demobilisation	10
Total	**148**

The estimated duration of 26 weeks includes on-site construction of the HDD sections of alignment 4, excluding pre-construction requirements and wet weather delay. An additional 6 month lead time for HDD tooling purchase and to ensure avaliability is required. The total construction time is therefore 22 + 24 = 46 weeks.

Alignment 4 has OTE construction with an estimated duration of 38 weeks. As the OTE team will be responsible for construction of access tracks and hardstands it is assumed that the OTE and HDD teams will operate sequentially, therefore the total estimated construction duration is 84 weeks excluding pre-construction requirements and wet weather delay.

It is understood that the land at the southern end of OTE4 is BSC-controlled land and would not require special approvals for new pipeline or construction activities.

The HDD lengths are between 650 and 850 metres which are within capability of a maxi drilling rig.

Refer to Alignment 2 comments in Section 3.3 in relation to groundwater impacts from HDD construction.

3.5.1 Biodiversity Credits

Some biodiversity impacts would likely need to be offset.

Refer to Alignment 3 comments in Section 3.4 in relation to Biodiversity credits associated with OTE construction.

Alignment 4 could have a higher offset cost than Alignment 5 as it traverses more low-lying country, but it depends on what vegetation/ habitat is being impacted in the OTE3 segment. The project team has assumed a biodiversity credit allowance of $400,000.

3.6 Alignment 5

Alignment 5 is shown in Attachment 1 and includes one HDD section between the OSSTP and Site 2 (HDD4), and combined OTE and HDD construction between Site 2 and the BVSTP (OTE4, OTE5, OTE6, and HDD6). HDD6 runs under Midjimbil Creek and the southern end under a site of heritage value where ground disturbance is not allowable.

The section between the OSSTP and Site 2 (HDD4) is described for Alignment 2. The second section is low lying with potentially weak ground conditions and elevated groundwater. OTE has been selected in areas clear of high vegetation and would require construction access tracks, wide trenches for shoring boxes, and trench bed improvement. Access tracks would remain for pipeline maintenance and access to air valves and scours. The second section avoids crossing environmentally sensitive areas.

Refer to Alignment 1 comments in Section 3.2 in relation to works in Site 2, and cultural heritage at HDD entry/exit sites.

Refer to Alignment 4 comments in Section 3.5 in relation to works south of Synotts Lane including OTE6, HDD6, and OTE4.

It is understood that the land at the southern end of OTE4 is BSC-controlled land and would not require special approvals for new pipeline or construction activities.

The HDD lengths are between 650 and 950 metres which are within the capability of a maxi drilling rig.

Refer to Alignment 2 comments in Section 3.3 in relation to groundwater impacts from HDD construction.

Based on the unit durations outlined in Section 3.2 the HDD construction durations for Alignment 5 are shown in Table 6:

Table 6 Alignment 5 HDD Activity Durations

Activity	Days
Mobilisation to Site 2	10
HDD4, Install OD280 pipe = 942/30	32
HDD4, Install OD450 pipe = 942/22	43
Relocation from Site 2 to HDD6	10
HDD6, Install OD280 pipe = 634/30	21
HDD6, Install OD450 pipe = 634/22	29
Demobilisation	10

Activity	Days
Total	**155**

The estimated duration of 23 weeks includes on-site construction of the HDD sections of alignment 5, excluding pre-construction requirements and wet weather delay. An additional 6 month lead time for HDD tooling purchase and to ensure availability is required. The total construction time is therefore 23 + 24 = 47 weeks.

Alignment 5 has OTE construction with an estimated duration of 34 weeks. As the OTE team will be responsible for construction of access tracks and hardstands it is assumed that the OTE and HDD teams will operate sequentially, therefore the total estimated construction duration is 81 weeks excluding pre-construction requirements and wet weather delay.

3.6.1 Biodiversity Credits

Refer to Alignment 3 comments in Section 3.4 in relation to Biodiversity credits associated with OTE construction.

Alignment 5 has a common leg with Alignment 4 south of Synotts Lane and less OTE than Alignment 4, therefore the biodiversity impacts, and hence offsets required, should be lower. The project team has assumed a biodiversity credit allowance of $350,000 for Alignment 5.

4. MCA criteria

MCA criteria are either quantitative or qualitative. The MCA criteria were developed from a list of requirements of the MCA listed at the end of the Ocean Shores Transfer Pipeline, fortnightly progress meeting minutes, dated 15/10/2024 (Meeting No 5). The qualitative criteria utilise a ranked scoring system, for this report. The scoring system used is a rating between 0 and 10 as detailed in Table 7.

Table 7 Qualitative Criteria Guide

Rating	Criteria
0	Significantly negative
1	Very negative
2	Negative
3	Slightly negative
4	Little negative impact
5	No Impact
6	Little positive impact
7	Slightly positive
8	Positive
9	Very positive
10	Significantly Positive

The following sections detail the criteria adopted for the MCA.

4.1 Economic

4.1.1 Minimises capital costs

This is a quantitative criteria type and includes the following CAPEX items:

– Costs for pipeline construction using assumed ground conditions.
– Costs for temporary works required as part of the construction.
– Costs to obtain biodiversity credits to offset the biodiversity lost as part of the project.

Costs which are common (or similar) to all options are excluded, this includes:

– land resumptions
– obtaining easements
– connections and reconfigurations of existing plant at the STPs

Therefore, the costs determined are not representative of the actual costs and should only be used for comparison of the various options.

The cost estimates are based on assuming pipeline diameters are the same for all pipeline options. Refer to Section 4.1.2 for a discussion in relation to impacts of pipe size of costs.

Capital costs have been scored based on the estimated comparative cost of each pipeline option normalised on a scale of 0 to 10.

4.1.2 Minimises operational costs

This is a quantitative criteria type and is based on the power consumption costs for operating the pipeline.

Power consumption will generally be related to pumping head which in turn is related to pipeline length assuming pipes sizes are the same for all options. Therefore, the operational costs have been scored based on the total pipeline length of each pipeline option.

Costs which are minimal or common (or similar) to all options are excluded, this includes maintenance costs.

Operational costs have been scored based on the length of each pipeline option normalised on a scale of 0 to 10.

4.2 Environmental

4.2.1 Minimises assessment and approval requirements

This is a qualitative criteria type and accounts for the risks to project duration and cost due to the uncertainty around environmental approvals and assessments. This criterion is rated based on the scoring guide shown in Table 7.

Routes should be preferred that:

– Do not traverse environmentally sensitive areas as described in Section 3 which may trigger assessment and approvals that may delay or halt the project.
– Do not require a Biodiversity Development Assessment Report (BDAR) which will take longer to obtain approvals due to the need to undertake site surveys and additional documentation, specifically if these impacts are not on BSC land. BDARs are expected to be required on the OTE options. The BDAR (for OTE options at least) would be sent to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for review (this process is likely to take a few more months).
– Impact underground / groundwater / hydrology in the area. This is likely to favour OTE options rather than HDD options due to the excavation depth.

Environmental factors which are common to all routes are not factored into this criterion.

4.2.2 Minimises requirement for easements

This is a quantitative criteria type and accounts for the risks to project duration and cost due to the uncertainty around obtaining easements.

Routes should be preferred that minimise traversing of private land (noting that this will be the same regardless of installation methodology). Pipelines which follow road corridors e.g. Synotts Lane and Valances Road have been assumed to run inside the road corridor and not require an easement.

This criterion has been scored based on the length of each pipeline option that is located in freehold land normalised on a scale of 0 to 10.

4.2.3 Minimises impact on sensitive biodiversity (flora and fauna)

This is a qualitative criteria type and accounts for the risks to the project due to the pipeline proximity to sensitive biodiversity. Often the costs and impact on these areas are difficult to quantify. This criterion is rated based on the scoring guide shown in Table 7. This item does not cover the environmental approvals or offsets (i.e. biodiversity credits) required only the potential impact on these areas.

Generally, HDD installation minimises biodiversity impacts in comparison to OTE as OTE installation requires a cleared easement along the pipeline length while HDD only requires cleared areas at, and to, the entrance and exit locations.

OTE sections will also expose Acid Sulphate Soils (ASS) soils which will oxidise and produce sulphuric acid. Treatment of the acid sulphate soil with lime will be required. There is a potential for uncontrolled release of acid into the environment, therefore routes should be preferred that avoid areas of ASS.

4.2.4 Minimises impact of temporary works on environment (access roads, working areas)

This is a qualitative criteria type and accounts for the impact of temporary works on the environment which includes:

- Temporary access tracks to work sites.

- Hardstands at launch and receival sites for HDD, and other working areas, and along the full length of OTE sections.
- Site offices and materials storage areas.
- Erection and maintenance of a site fences along and around worksites and OTE pipeline alignments with fauna exclusion fencing (this will impact movement of fauna across the OTE sections during the construction phase).

Most of this work needs to be removed at the end of construction and the surface remediated close to pre-existing conditions. This criterion is rated based on the scoring guide shown in Table 7.

4.3 Social

4.3.1 Minimises impact on cultural heritage

This is a qualitative criteria type and accounts for the potential impacts of the project and operation on cultural heritage areas. Negative impacts on cultural heritage would be significantly detrimental for the heritage custodians, project, BSC, consultants and contractor. The impacts would include:

– Cultural loss
– Historical loss
– Reputational damage
– Project delays and cost impacts

This criterion is rated based on the scoring guide shown in Table 7.

The project area contains a culturally significant site as shown on Alignments 4 and 5. HDD is proposed to traverse this area to ensure no surface disturbance. There may also be additional culturally significant sites. Pipelines with minimal surface disturbance will have less likelihood of impacting cultural heritage areas.

4.3.2 Minimises impact on landowners during operation (easements impacting future development)

This is a qualitative criteria type and accounts for the ongoing impact to the pipeline easements and operations and maintenance operations which will be required. This criterion is rated based on the scoring guide shown in Table 7.

Easements are not desirable due to impact on land values and development potential; therefore routes should be preferred that require less easements and which have easements which are adjacent to existing easements or property boundaries.

Pipelines require air release valves at local high points and scour point at local low points. These will require some maintenance and inspections. HDD typically requires much fewer air release valves than OTE pipelines and does not generally require scour points. Air release and scour valves are normally housed in chambers that finish about 0.6 to 1.0m above the ground surface. Routes will be preferred which have less air and scour valves.

4.3.3 Minimises impact on landowners during construction (access to properties, air and noise pollution)

This is a qualitative criteria type and accounts for the impact during construction on the surrounding landowners. This criterion is rated based on the scoring guide shown in Table 7.

Routes should be preferred that cause less disruption to the local community and landowners.

HDD should cause less air and noise pollution compared to OTE. Stringing pipe for HDD may cause some disruption to property access, and OTE may isolate portions of land while work proceeds. Transport of imported bedding material required for OTE, especially if needing bridging material will cause noise and dust due to traffic in addition to the normal typical construction impacts.

4.4 Technical

4.4.1 Reliability and operational risk including ability to monitor condition of pipe and repair

This is a qualitative criteria type and accounts for the operational and social risk associated with a pipeline failure. This criterion is rated based on the scoring guide shown in Table 7.

Pipeline failure will potentially impact sewage treatment including effluent quality and may result in loss of containment and raw sewage entering the environment. Routes which minimise operational risk and are easier to access and repair if required are preferred. Typically, the burial depth of OTE installed pipe is shallow compared to HDD pipe, therefore:

- Damage, degradation and failure may be more easily detected.
- Repairs and inspections are typically easier to undertake
- The installation is more vulnerable to damage by third parties (i.e. from future excavations, farm activities, etc.)

Failure of HDDs in UEA's experience is relatively low with correct mitigations including:

- The use of properly manufactured pipe
- Competent ticketed HDPE welding contractors =
- A stringent testing regime

Operational phase procedures can be implemented to detect pipeline failures including flow and pressure monitoring. These procedures can be applied to both OTE and HDD installed pipelines.

4.4.2 Contingency options if SRM fails

This is a qualitative criteria type and accounts for:

- Route factors which reduce downtime during a pipeline failure.
- Allow for inexpensive or easy alternate flow paths or partial operation in the event of a pipeline failure.

This criterion is rated based on the scoring guide shown in Table 7.

The pipeline is planned to be a dual pipeline; therefore, flow could conceivably be diverted away from the failed main to the alternate main until repairs are completed. However, this will reduce transfer capacity and will have greatest impact in the future scenario of full transfer of flows from OSSTP to BVSTP. An OTE installed pipeline is shallower and more easily drained, therefore repairs would be easier to complete than for a HDD pipeline.

Contingency options for HDD would be to minimise the risk of failure by:

– Using a higher-class pipe
– Undertaking weld pre-qualification in accordance with WSAA, WSA 01 – 2004-3.1.
– All welding operators should be qualified and regularly recertified to PMBWELD 301 (Butt Welding Polyethylene Pipelines).
– A haul rope could be installed in the OD450 pipe to allow another pipe to be winched into it should the OD280 pipeline fail.
– Cross connections between the two pipelines at both ends of each HDD section would allow for maintenance, contingency or redundancy purposes.

4.4.3 Design life of pipeline materials

This is a qualitative criteria type and accounts for routes and installations which have limited design lives or require earlier refurbishment than alternate routes. This criterion is rated based on the scoring guide shown in Table 7.

All pipelines should offer a similar design life of 100 years. Valves including gate valves, air release valves, etc should provide a 25-year life. The OTE sections may have more air release valves and scours than HDD sections however both installation types will require air and scour valves.

4.4.4 Overall delivery time (approvals, procurement, construction, commissioning)

This is a quantitative criteria type and accounts for risks associated with extended project delivery times. Minimising project delivery time is advantageous to:

- Minimise risk to BSC in the event of future high sewage flows or failure of a key operational process at the OSSTP.
- Minimise community and landowner impact of construction works
- Minimise future cost escalations and risk of project overruns.

Options which minimise time required for approvals, procurement, construction and commissioning aspects should be rated higher.

Factors considered in this criterion include the following:

- Obtaining environmental approvals for OTE would increase delivery time when compared to HDD routes.
- Procurement of materials should be similar for OTE and HDD.
- OTE may require rock bridging material and bedding materials which should be readily available.
- OTE has project duration risks such as cultural finds, surface and groundwater management which are also potentially significant.
- Construction time for HDD should be shorter than for OTE and commissioning time would be similar.
- As HDD is a more specialised construction method than OTE, particularly for the longer drive lengths exceeding 1,000 metres, there is likely a reduction in the number of contractors that can complete this work compared to OTE construction. The larger “maxi” rigs required to complete the longer HDD drive lengths may also be difficult to secure at the required time due to commitments on conflicting projects. This may impact overall delivery times for HDD installations, therefore routes which utilise OTE may have lower project duration risk when compared to HDD installations (specifically HDD installations where the HDD length is significant).

Delivery time have been scored based on the estimated construction time of each pipeline option normalised on a scale of 0 to 10. This was considered valid as the approvals, procurement and commissioning durations of each of the routes was considered to be comparable.

4.4.5 Minimise required footprint / land impact for construction

This is a qualitative criteria type and accounts for risks associated with having larger impacted construction areas. This criterion is rated based on the scoring guide shown in Table 7.

Minimising the required footprint / land impact is advantageous to:

- Reduced farming area quarantined during construction,
- Reduce clearing of vegetation,
- Reduce stripping of topsoil,
- Reduced reinstatement costs for re-spreading topsoil and re-grassing/vegetation,
- Reduced potential for scouring and impact on water quality in the environment, etc

Options which minimise the required footprint / land impact should be rated higher.

Typically, HDD will require about 1,400 to 2,000 square metres at each launch and receival site. The parallel HDD lines (underground) would be designed with a 5 m horizontal separation (centreline to centreline) to allow sufficient spacing for left and right deviation and reduction on the likelihood of frac out between bores.

OTE installation will require an approximately 15 m wide construction corridor along the pipelines, including 10m width for trench construction with excavation, material stockpiling, machinery movement and 5m for access track to cart material and spoil. HDD will require space for the pipe stringing; however these do not require prepared platforms and will rest on the existing cleared surface.

4.4.6 Ability to obtain geotechnical data and reduce project risk

This is a qualitative criteria type and accounts for risks associated with having limited geotechnical data prior to design / construction. This criterion is rated based on the scoring guide shown in Table 7.

Typically, a method of reducing risk of construction issues in pipeline installation is to undertake geotechnical inspection (drilling and sampling ground/soil) in the proposed pipeline locations. The inspection results can provide the pipeline designers and installers information to prevent issues and optimise the design / installation process.

The ground conditions in the area between the two STPs is generally low lying, flood prone and expected to contain weak ground conditions with elevated ground water, and on private land therefore access to some areas is restricted or difficult.

Selecting options for which geotechnical data can be safely and easily obtained is advantageous in order to:

– Reduce the risk of finding adverse ground conditions during installation and the flow on cost and time impacts.
– Optimise the pipe route to avoid areas which are not as suitable for pipe installation.

Obtaining geotechnical data may be challenging especially after wet weather as many areas are low lying and flood prone. HDD requires deeper boreholes (about 8m deep) to establish conditions at lower elevations. Some areas are also environmentally sensitive which may require environmental approvals to undertake bore hole drilling.

Obtaining additional boreholes for OTE sections is expected to cost in the vicinity of $6,500 per day for a drilling rig and technician in firm ground conditions. If the pipe alignment is in a swampy area, a posi track drilling rig with a Moorooka crawler carrier may be required. This arrangement would cost in the vicinity of $9,000 per day.

The drilling rig should complete 2-3 holes per day if drilling 3-4 metres in not too stiff ground. A Principal geotechnical engineer may require $4,000-$6000 for the report and assessment.

Therefore, depending on the alignment and the required level of information for designing the pipe, there could be 8-9 boreholes required for each OTE alignment option. The cost for an alignment could be in the vicinity of $50,000 to $60,000.

4.4.7 Favourable geotechnical conditions for proposed construction methodology (soft ground, elevated groundwater, ASS, rock)

This is a qualitative criteria type and accounts for risks associated with having poor ground conditions and the cost and time impact of unknown factors due to poor ground conditions. This criterion is rated based on the scoring guide shown in Table 7.

Some proposed pipeline sections are located in low lying areas with expected weak ground conditions and elevated groundwater. Based on pipelines constructed in similar areas it is expected that, comparable to other typical pipelines, conditions will not be favourable for OTE and require a bridging layer, dewatering, support shields, etc.

It is expected that Acid Sulphate Soils (ASS) will be present in most areas which will require lime treatment of backfill and groundwater. Figure 6 in Attachment 2 shows potential extents of ASS based on NSW state government sources shown on the figure.

Treatment and disposal of ASS for HDD construction is a relatively minimal risk based on the HDD fluids utilised and the addition of Soda Ash to help increase pH of fluids. Where drilled cuttings are needed to be treated with lime to manage ASS and stabilise this is something that can be managed at a site level. Mixing lime with cuttings is a common practice with HDD sites utilising a recycling system. Premobilisation geotechnical testing can help determine the extent of potential ASS.

Construction estimates for the OTE sections have assumed weak ground conditions that would warrant a bridging layer under the pipeline embedment that would consist of a 0.3m thick rock layer (100 to 150mm size rock) wrapped in geofabric. Allowances have also been made in the OTE estimates for dewatering, trench wall support and treatment of ASS in trench backfill and spoil material.

HDD methods and machinery used will need to match expected ground conditions. Establishing the existing ground conditions may be difficult as access for borehole drilling may not be possible in some areas. Seismic refraction and/or ground resistivity may be valuable to determine ground conditions.

5. Multiple Criteria Analysis Score

An MCA analysis of the pipeline alignment options was carried out to determine which pipeline alignments have merit to be developed further into detailed design. Additional geotechnical and ground survey will be required to confirm the preferred alignment.

The basis of the scoring for each MCA criteria is in Section 4 with the results and justifications detailed in the following sections.

5.1 MCA Weighting

Below is a summary of the weighting for each of the criteria using two scenarios to test sensitivity to score weightings, these were agreed upon by BSC:

- Scenario 1 includes a heavier economic weighting (30%) than Scenario 2 (10%).
- Scenario 2 has a heavier environmental weighting (37%) than Scenario 1 (24%).

Criteria weighing for Scenarios 1 and 2 are listed in Table 8.

Table 8 MCA Weighting

No	Criteria	Crit. Type	Analysis Type	Weight	
			Scenario	1	2
1	Minimises capital costs incl biodiversity credits	Economic	Quantitative	20%	5%
2	Minimises operational costs	Economic	Quantitative	10%	5%
3	Minimises assessment and approval requirements	Environmental	Qualitative	7%	7%
4	Minimises requirement for easements	Environmental	Quantitative	5%	5%
5	Minimises impact on sensitive biodiversity (flora and fauna)	Environmental	Qualitative	6%	15%
6	Minimises impact of temporary works on environment (access roads, working areas)	Environmental	Qualitative	6%	10%
7	Minimises impact on cultural heritage	Social	Qualitative	5%	10%
8	Minimises impact on landowners during operation (easements impacting future development)	Social	Qualitative	5%	5%
9	Minimises impact on landowners during construction (access to properties, air and noise pollution)	Social	Qualitative	3%	5%
10	Reliability and operational risk including ability to monitor condition of pipe and repair	Technical	Qualitative	5%	5%
11	Contingency options if SRM fails	Technical	Qualitative	5%	5%
12	Design life of pipeline materials	Technical	Qualitative	5%	5%
13	Overall delivery time (approvals, procurement, construction, commissioning)	Technical	Quantitative	5%	5%
14	Minimise required footprint for construction (laydown, access, pipe stringing, etc)	Technical	Qualitative	3%	3%
15	Ability to obtain geotechnical data and reduce project risk	Technical	Qualitative	5%	5%
16	Favourable geotechnical conditions for proposed construction methodology (soft ground, elevated groundwater, ASS, rock)	Technical	Qualitative	5%	5%
			Total	**100%**	**100%**

5.2 Detailed Scoring and Comments

Each alignment option has been scored against each MCA criteria and the results presented in Table 9. Favourable options have higher scores.

Table 9 Alignment Scores and Commentary

No	Criteria	Score for Alignment					Comments/Reasoning
		1	2	3	4	5	
1	Minimises capital costs incl biodiversity credits	4.33	5.44	5.51	4.83	4.89	Based on indicative estimate of cost to construct. Refer to Attachment 5[4].
2	Minimises operational costs	4.95	5.87	5.61	4.13	4.32	Based on pipeline length as power consumption would be proportional to length[4]. Other OPEX costs would be minimal and similar for all pipelines.
3	Minimises assessment and approval requirements	9	9	1	2	3	Minimum 6 months approx. to update approvals documentation. Significant impact to biodiversity in OTE1, OTE2, OTE3 and OTE6 which will require species survey, BDAR and increased time, cultural heritage investigations, etc
4	Minimises requirement for easements	4.6	5.66	5.33	4.05	5.36	Easements will be required over full length of pipeline except Vallances Road and Synotts Lane. Score based on length of easements.
5	Minimises impact on sensitive biodiversity (flora and fauna)	7	8	6	4	4.5	OTE sections have a greater impact on areas of likely biodiversity. The depth of the pipeline under the wetland area and the geological conditions (soil types, water table) will need to be determined before the impact on groundwater dependent ecosystems (GDE) can be assessed. OTE sections may impact groundwater but due to their relatively shallow depth the impact is not expected to be as significant as for HDD sections. If the pipeline is deep enough (i.e. HDD) and in consolidated material, the risk should be low. This would mainly affect Alignments 2, 3 and 5 that contain HDD4. These would be scored lower on groundwater impacts than Alignment 1. For these HDD sections, the design would need to ensure minimal impact on GDEs. HDD5 and HDD6 would have similar but lower risk therefore Alignment 4 also has a small risk as they do not pass under mapped coastal wetland areas, noting that impact on GDEs has not been assessed. Alignment 1 is expected to be the lowest risk for groundwater impacts on GDEs.
6	Minimises impact of temporary works on environment (access roads, working areas)	8.5	9	2.5	2.5	2	Minimal disturbance at entry and exit sites for HDD. Scores based on the number of HDDs and OTE sections.
7	Minimises impact on cultural heritage	9	9	2.5	3	2.7	HDD has much less ground disturbance than OTE. All HDD entry/ exit pit sites and OTE sections may require additional cultural heritage investigations
8	Minimises impact on landowners during operation (easements impacting future development)	2	2	1.5	1.5	2	Easements in vicinity of Site 1, north and south of Synotts Lane and north and south of Site 2 are within private property
9	Minimises impact on landowners during construction (access to properties, air and noise pollution)	3	3.5	2	1.5	2	Traffic impacts to Sites used and along OTE routes The section of Alignment 3 south of Synotts Lane includes OTE and HDD construction across low lying terrain with potentially weak ground conditions. This section would be adversely impacted by wet weather and flooding. Construction in this area is expected to be risky for OTE construction and for transporting heavy drilling rigs and equipment for the HDD crossing. Flooding will cause program delays for construction and additional costs for rectification of damaged access tracks, etc. Weak ground conditions may result in additional costs to construct bridging layers from imported rock, geofabric and geogrids. Rectification and additional works for flooding and weak ground conditions may lead to environmental and social impacts from siltation, disposal of unsuitable material, manufacture and transporting additional materials, etc.
10	Reliability and operational risk including ability to monitor condition of pipe and repair	3	3	3.5	3.5	3.5	Deep HDD sections will be difficult to maintain however will typically be less likely to be damaged. Design and construction measures can be used to minimise risks.
11	Contingency options if SRM fails	3	3	3.5	3.5	3.5	HDD sections to utilise second main as backup, use higher class pipe and other construction measures can be used to minimise risks.
12	Design life of pipeline materials	8	8	7.5	7.5	7.5	Pipeline should provide 100y life, valves should provide 25 y life. HDD has fewer air and scour valves.
13	Overall delivery time (approvals, procurement, construction, commissioning)	5.94	6.31	4.91	3.81	4.03	Estimated construction duration. HDD requires significantly less land access requirements, which may reduce time to negotiate approvals and establishment time for construction.
14	Minimise required footprint for construction (laydown, access, pipe stringing, etc)	8	8	2	1.5	1.5	Work areas at HDD entry and exit pits, with some area for stringing pipe. Work areas also along OTE sections
15	Ability to obtain geotechnical data and reduce project risk	2.5	1.5	1.5	3	2	Dense vegetation and waterways on routes over HDD1, HDD2 and HDD4 and key fish habitat over OTE1, OTE 2, HDD3 and HDD5. Potentially weak ground over some sections. There is a risk with Alignments 1 and 2 with unknown geotechnical conditions. The ridge to the west of the OSSTP is expected to contain rock at shallow depth and the adjoining areas alongside the Brunswick River and tributary watercourses are expected to contain weak alluvial materials to an unknown depth. HDD 4 which is included in Alignment 2 traverses the ridge and is expected to encounter rocky and weak materials. HDD drill heads are optimised to operate in either rock or non-solid material. The drill may commence in weak material and when it encounters the rock ridge a sleeve may be required to support the bore to allow the drill rods to be removed and the drill head replaced for a rock type. Deep boreholes are required along the proposed HDD alignments to determine geotechnical conditions. It may be difficult to access some sections of the pipeline alignments due to vegetation cover, weak ground conditions, environmental barriers/approvals, etc. This risk appears to be greater with section HDD4 of Alignment 2 which traverses thick forest along the side of the Brunswick River. Less disruptive Seismic Refraction Tomography (SRT) and/or Electrical Resistivity Imaging (ERI) should be considered where access for boreholes is restricted.

[4] It may be possible in following detailed design phases to reduce the pipe diameter of the pipelines. This will reduce CAPEX and increase power costs to run the pumps depending on the combination of system pressures and pump efficiency. The pipe diameters will be optimised in the following design phases and account for both CAPEX and OPEX. The pipe sizes used in the MCA for all options were developed in the previous "3rd pipeline" option which more closely matches Pipeline Option 5. Likely pipe size reduction is greater for pipeline options that are shorter than Alignment 5. All pipeline options are shorter apart from Option 4 which is approximately 100 m longer.

No	Criteria	Score for Alignment					Comments/Reasoning
		1	2	3	4	5	
16	Favourable geotechnical conditions for proposed construction methodology (soft ground, elevated groundwater, ASS, rock)	8.5	8	2	2.5	2	HDD1 is potentially in rock which increases cost and construction time, balance of HDD sections should be favourable for HDD. HDD4 runs close to and under watercourses which may have problematic geotech, balance of HDD sections should be favourable for HDD. HDD4 runs close to and under watercourses which may have problematic geotech, balance has OTE in weak and ASS ground. Geotechnical conditions for HDD6 should be favourable for HDD.

5.3 MCA Score Summary

A summary of the scores for each criterion is listed in Table 10 and Table 11, including a total for each pipeline alignment option. Favourable options have higher scores.

Table 10 MCA Weighed Scores – Scenario 1

No	Criteria	Alignment				
		1	2	3	4	5
1	Minimises capital costs incl biodiversity credits	0.87	1.09	1.10	0.97	0.98
2	Minimises operational costs	0.50	0.59	0.56	0.41	0.43
3	Minimises assessment and approval requirements	0.63	0.63	0.07	0.14	0.21
4	Minimises requirement for easements	0.23	0.28	0.27	0.20	0.27
5	Minimises impact on sensitive biodiversity (flora and fauna)	0.42	0.48	0.36	0.24	0.27
6	Minimises impact of temporary works on environment (access roads, working areas)	0.51	0.54	0.15	0.15	0.12
7	Minimises impact on cultural heritage	0.45	0.45	0.13	0.15	0.14
8	Minimises impact on landowners during operation (easements impacting future development)	0.10	0.10	0.08	0.08	0.10
9	Minimises impact on landowners during construction (access to properties, air and noise pollution)	0.09	0.11	0.06	0.05	0.06
10	Reliability and operational risk including ability to monitor condition of pipe and repair	0.15	0.15	0.18	0.18	0.18
11	Contingency options if SRM fails	0.15	0.15	0.18	0.18	0.18
12	Design life of pipeline materials	0.40	0.40	0.38	0.38	0.38
13	Overall delivery time (approvals, procurement, construction, commissioning)	0.30	0.32	0.25	0.19	0.20
14	Minimise required footprint for construction (laydown, access, pipe stringing, etc)	0.24	0.24	0.06	0.05	0.05
15	Ability to obtain geotechnical data and reduce project risk	0.13	0.08	0.08	0.15	0.10
16	Favourable geotechnical conditions for proposed construction methodology (soft ground, elevated groundwater, ASS, rock)	0.43	0.40	0.10	0.13	0.10
Total		**5.58**	**5.99**	**3.98**	**3.62**	**3.74**
Ranking		**2**	**1**	**3**	**5**	**4**

Table 11 MCA Weighed Scores – Scenario 2

No	Criteria	Alignment				
		1	2	3	4	5
1	Minimises capital costs incl biodiversity credits	0.22	0.27	0.28	0.24	0.24
2	Minimises operational costs	0.25	0.29	0.28	0.21	0.22
3	Minimises assessment and approval requirements	0.63	0.63	0.07	0.14	0.21
4	Minimises requirement for easements	0.23	0.28	0.27	0.20	0.27
5	Minimises impact on sensitive biodiversity (flora and fauna)	1.05	1.20	0.90	0.60	0.68
6	Minimises impact of temporary works on environment (access roads, working areas)	0.85	0.90	0.25	0.25	0.20
7	Minimises impact on cultural heritage	0.90	0.90	0.25	0.30	0.27

No	Criteria	Alignment				
		1	2	3	4	5
8	Minimises impact on landowners during operation (easements impacting future development)	0.10	0.10	0.08	0.08	0.10
9	Minimises impact on landowners during construction (access to properties, air and noise pollution)	0.15	0.18	0.10	0.08	0.10
10	Reliability and operational risk including ability to monitor condition of pipe and repair	0.15	0.15	0.18	0.18	0.18
11	Contingency options if SRM fails	0.15	0.15	0.18	0.18	0.18
12	Design life of pipeline materials	0.40	0.40	0.38	0.38	0.38
13	Overall delivery time (approvals, procurement, construction, commissioning)	0.30	0.32	0.25	0.19	0.20
14	Minimise required footprint for construction (laydown, access, pipe stringing, etc)	0.24	0.24	0.06	0.05	0.05
15	Ability to obtain geotechnical data and reduce project risk	0.13	0.08	0.08	0.15	0.10
16	Favourable geotechnical conditions for proposed construction methodology (soft ground, elevated groundwater, ASS, rock)	0.43	0.40	0.10	0.13	0.10
Total		**6.16**	**6.48**	**3.67**	**3.33**	**3.46**
Ranking		**2**	**1**	**3**	**5**	**4**

6. Conclusion

6.1 Preferred Route

Based on the evaluation criteria and weightings presented in this report the top three options are ranked in Table 12 for both Scenario 1 (Heavier economic weighting) and Scenario 2 (Heavier environmental weighting). Alignment 2 was scored the highest for both Scenario 1 and Scenario 2.

Table 12 Ranked MCA Alignment Options[5]

Scenario	1			2		
Ranking	**1st**	**2nd**	**3rd**	**1st**	**2nd**	**3rd**
Pipeline Alignment	2	1	3	2	1	3
Summed Weighted Score						
Economic Criteria	1.68	1.37	1.66	0.56	0.47	0.56
Environmental Criteria	1.93	1.79	0.85	3.01	2.76	1.49
Social Criteria	0.66	0.64	0.27	1.18	1.15	0.43
Technical Criteria	1.74	1.80	1.23	1.74	1.80	1.23
Total Score	**6.01**	**5.60**	**4.01**	**6.49**	**6.18**	**3.71**

Alignment 2 utilises HDD construction for the entire length of the installation. In addition to the higher scoring in the summary table above, Alignment 2 is also 450 m shorter than Alignment 1 and 130 m shorter than Alignment 3. This may result in a smaller (and less expensive pipe) being able to be utilised. This factor has not been accounted for in the MCA scoring[4].

6.2 Next Steps

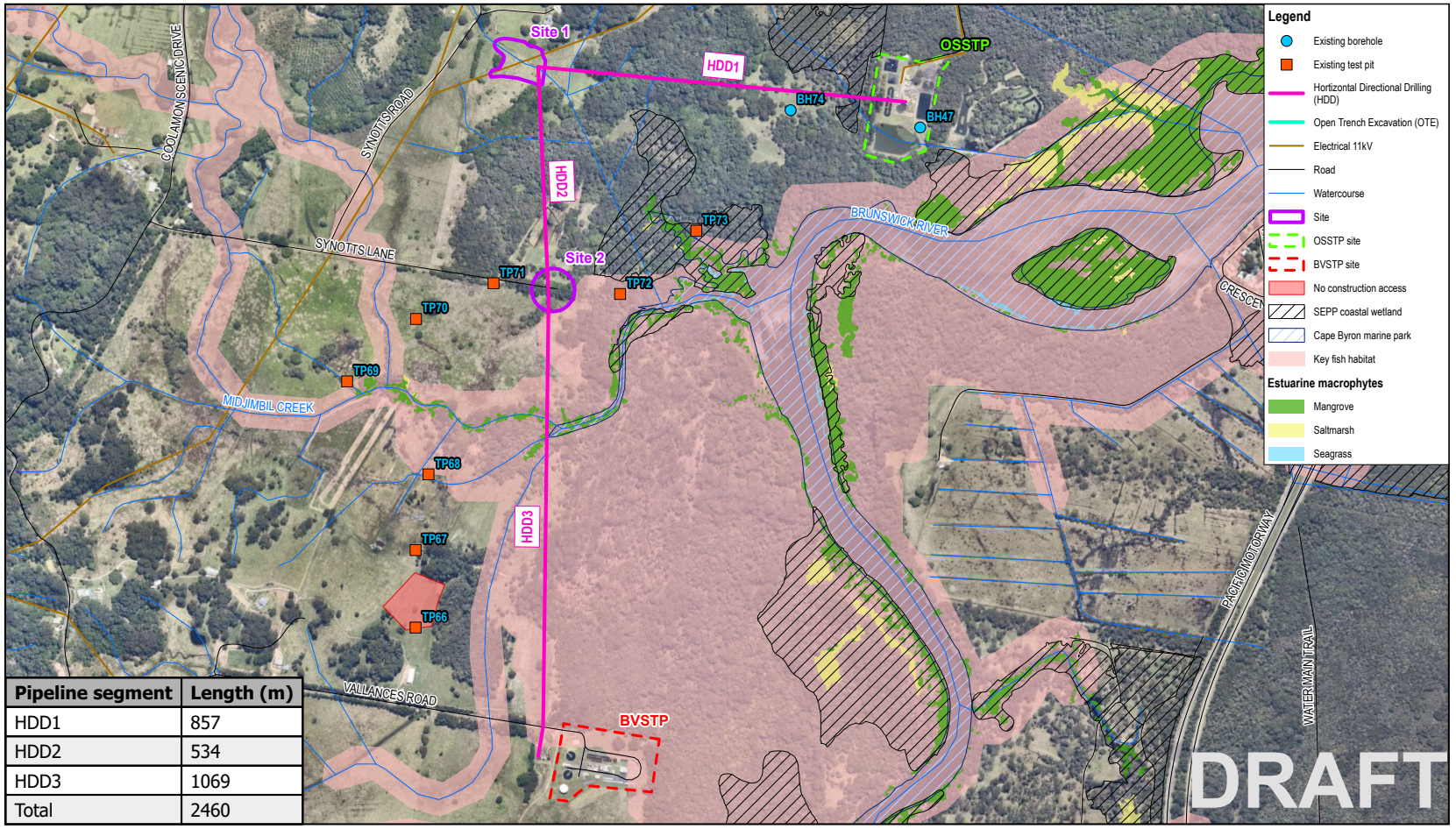
The next phases of the project (e.g., Concept / Detailed Design, upgrades of BVSTP and OSSTP etc.) and further environmental and planning approvals should be initiated. A geotechnical investigation of the proposed pipeline route should be conducted. This will aid in determining geotechnical conditions including strength of materials, level of bedrock which will allow drilling appropriate methods and pipeline profiles to be developed and thereby reduce (but not eliminate) risks to the project of cost and program escalation. This may include a combination of boreholes, Seismic Refraction Tomography (SRT), and Electrical Resistivity Imaging (ERI). Hydrogeological assessment is required to assess impact on GDEs including coastal wetlands, i.e. no impact on groundwater flows or quality.

[5] The values shown in this table are rounded. Therefore there are slight differences between Table 12 and Table 10 and Table 11 scores.

Attachments

Attachment 1

Alignment Options



Pipeline segment	Length (m)
HDD1	857
HDD2	534
HDD3	1069
Total	2460

Paper Size ISO A4

0 100 200 300 400

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

GHD

Byron Shire Council
Ocean Shores STP to Brunswick Valley
STP Transfer Pipelines

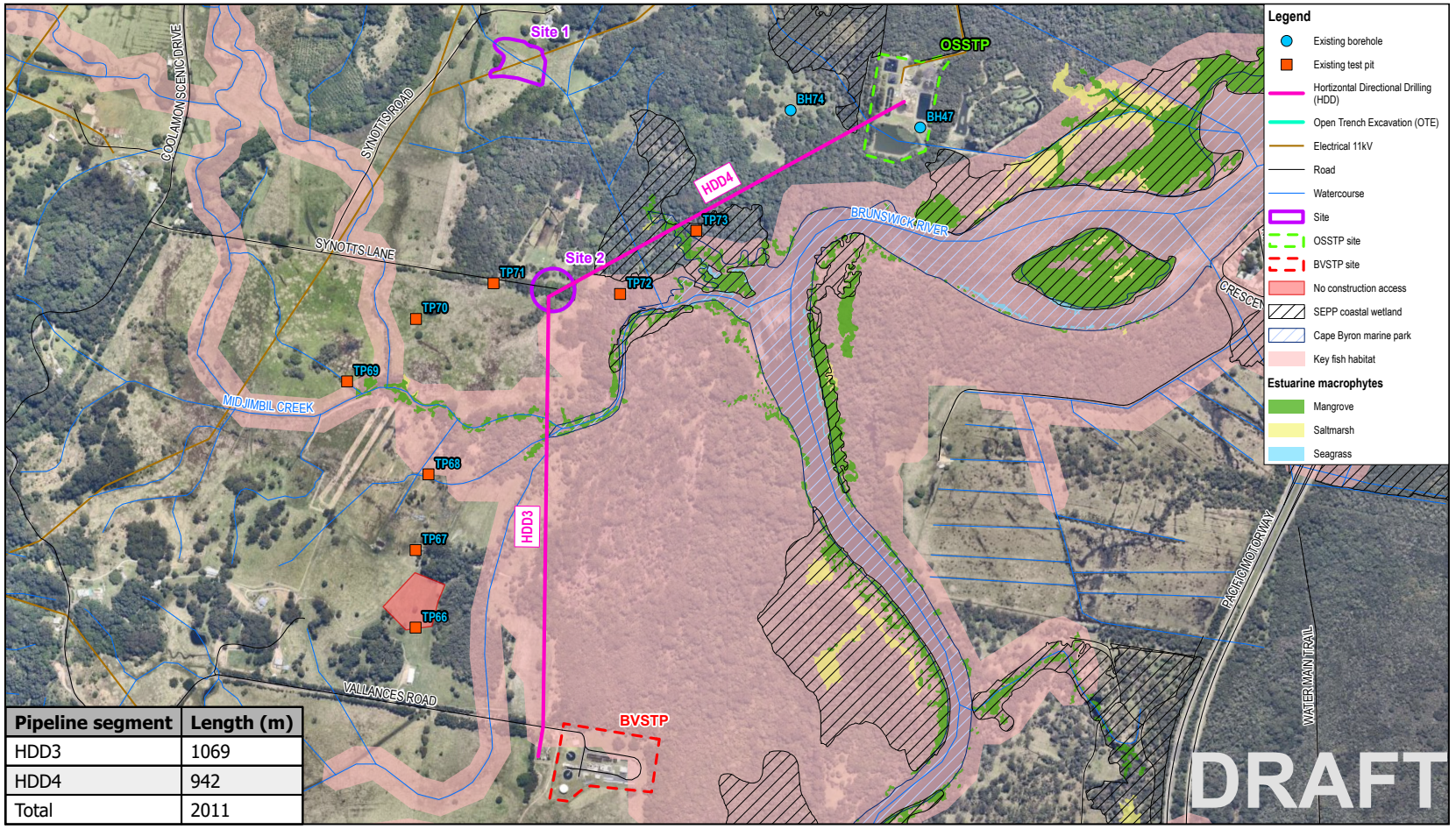
Project No. 12649325
Revision No. B
Date 5/12/2024

Alignment option 1

FIGURE 1

\\ghdnet\ghd\AU\Brisbane\Projects\41\12649325\GIS\Maps\Deliverables\12649325_Figures\12649325_Figures.aprx - 12649325_014_AlignmentOption_all
Print date: 05 Dec 2024 - 09:27

Data source: BSC: Coastal wetland, BVSTP existing site, OSSTP existing site, No construction access (2023); GHD: existing borehole (2024), existing test pit (2024), HDD sections, OTE sections, sites (2024); Hydrosphere: Threatened species (2024); Essential Energy: Electrical 11kv (2024); NSW Gov: Road, Watercourse, Town, ASS (2024); DCCEEW: Threatened species, Estuarine Macrophytes,Cape Byron marine park (2023); nearmap.com: : Imagery (2024). Created by: fxu



Pipeline segment	Length (m)
HDD3	1069
HDD4	942
Total	2011

Paper Size ISO A4

0 100 200 300 400

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

GHD

Byron Shire Council
Ocean Shores STP to Brunswick Valley
STP Transfer Pipelines

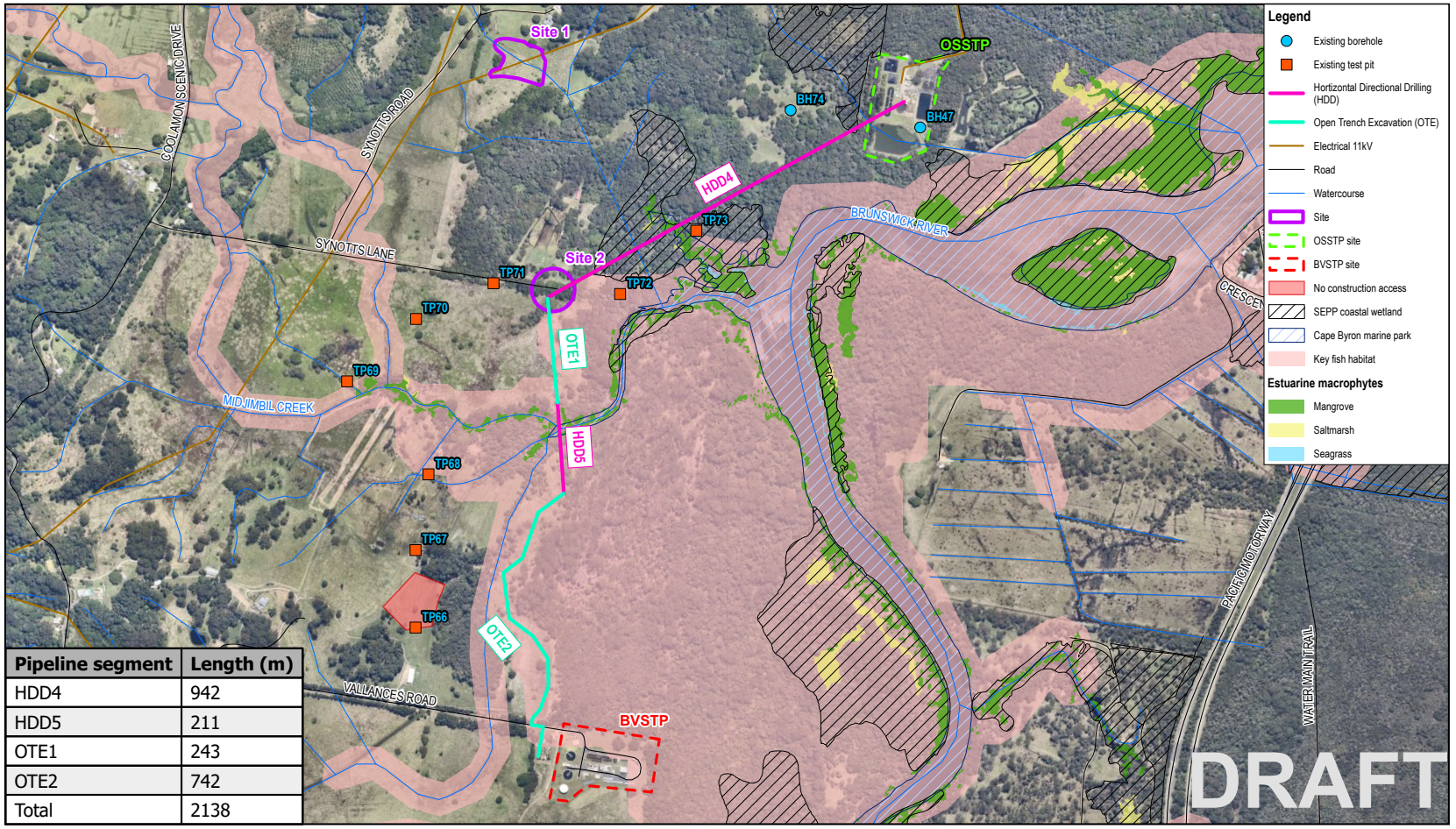
Project No. 12649325
Revision No. B
Date 5/12/2024

Alignment option 2

FIGURE 2

\\ghdnet\ghd\AU\Brisbane\Projects\41\12649325\GIS\Maps\Deliverables\12649325_Figures\12649325_Figures.aprx - 12649325_014_AlignmentOption_all
Print date: 05 Dec 2024 - 09:27

Data source: BSC: Coastal wetland, BVSTP existing site, OSSTP existing site, No construction access (2023); GHD: existing borehole (2024), existing test pit (2024), HDD sections, OTE sections, sites (2024); Hydrosphere: Threatened species (2024); Essential Energy: Electrical 11kv (2024); NSW Gov: Road, Watercourse, Town, ASS (2024); DCCEEW: Threatened species, Estuarine Macrophytes,Cape Byron marine park (2023); nearmap.com: : Imagery (2024). Created by: fxu



Pipeline segment	Length (m)
HDD4	942
HDD5	211
OTE1	243
OTE2	742
Total	2138

Paper Size ISO A4

0 100 200 300 400

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

GHD

Byron Shire Council
Ocean Shores STP to Brunswick Valley
STP Transfer Pipelines

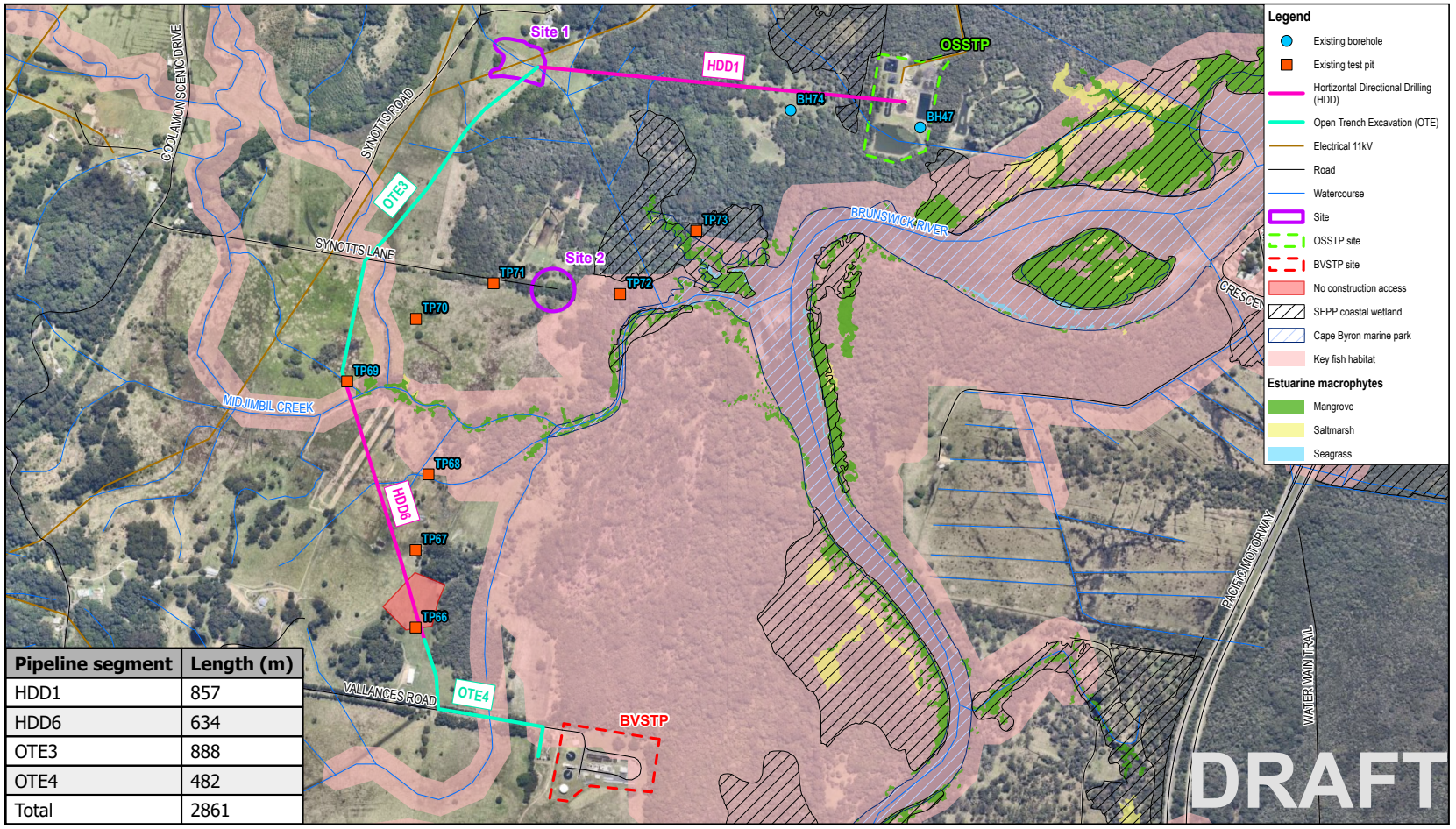
Project No. 12649325
Revision No. B
Date 5/12/2024

Alignment option 3

FIGURE 3

\\ghdnet\ghd\AU\Brisbane\Projects\41\12649325\GIS\Maps\Deliverables\12649325_Figures\12649325_Figures.aprx - 12649325_014_AlignmentOption_all
Print date: 05 Dec 2024 - 09:27

Data source: BSC: Coastal wetland, BVSTP existing site, OSSTP existing site, No construction access (2023); GHD: existing borehole (2024), existing test pit (2024), HDD sections, OTE sections, sites (2024); Hydrosphere: Threatened species (2024); Essential Energy: Electrical 11kv (2024); NSW Gov: Road, Watercourse, Town, ASS (2024); DCCEEW: Threatened species, Estuarine Macrophytes,Cape Byron marine park (2023); nearmap.com: : Imagery (2024). Created by: fxu



Pipeline segment	Length (m)
HDD1	857
HDD6	634
OTE3	888
OTE4	482
Total	2861

Paper Size ISO A4

0 100 200 300 400

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

GHD

Byron Shire Council
Ocean Shores STP to Brunswick Valley
STP Transfer Pipelines

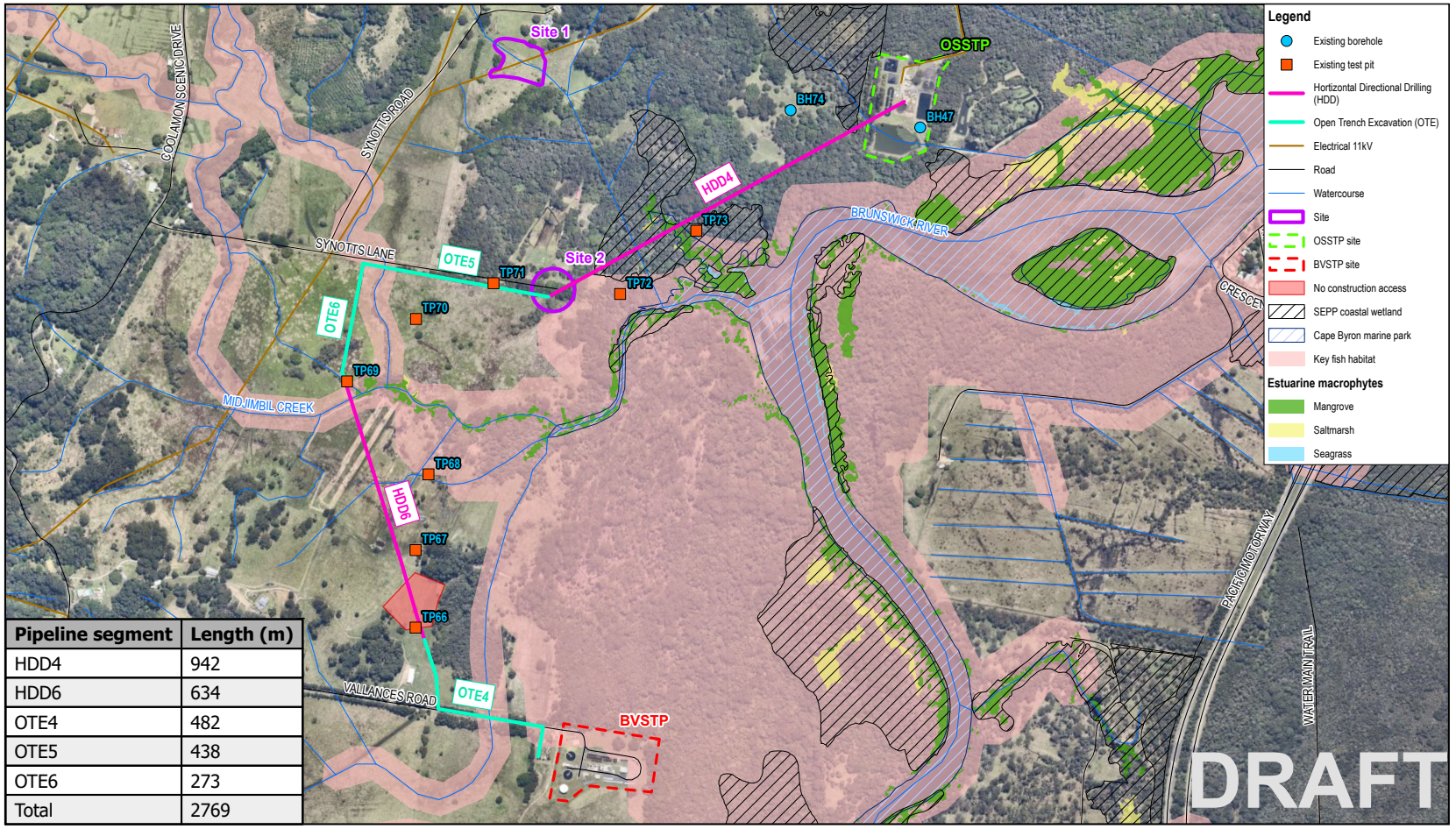
Project No. 12649325
Revision No. B
Date 5/12/2024

Alignment option 4

FIGURE 4

\\ghdnet\ghd\AU\Brisbane\Projects\41\12649325\GIS\Maps\Deliverables\12649325_Figures\12649325_Figures.aprx - 12649325_014_AlignmentOption_all
Print date: 05 Dec 2024 - 09:27

Data source: BSC: Coastal wetland, BVSTP existing site, OSSTP existing site, No construction access (2023); GHD: existing borehole (2024), existing test pit (2024), HDD sections, OTE sections, sites (2024); Hydrosphere: Threatened species (2024); Essential Energy: Electrical 11kv (2024); NSW Gov: Road, Watercourse, Town, ASS (2024); DCCEEW: Threatened species, Estuarine Macrophytes,Cape Byron marine park (2023); nearmap.com: : Imagery (2024). Created by: fxu



Pipeline segment	Length (m)
HDD4	942
HDD6	634
OTE4	482
OTE5	438
OTE6	273
Total	2769

Paper Size ISO A4

0 100 200 300 400

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

Byron Shire Council
Ocean Shores STP to Brunswick Valley
STP Transfer Pipelines

Project No. 12649325
Revision No. B
Date 5/12/2024

Alignment option 5

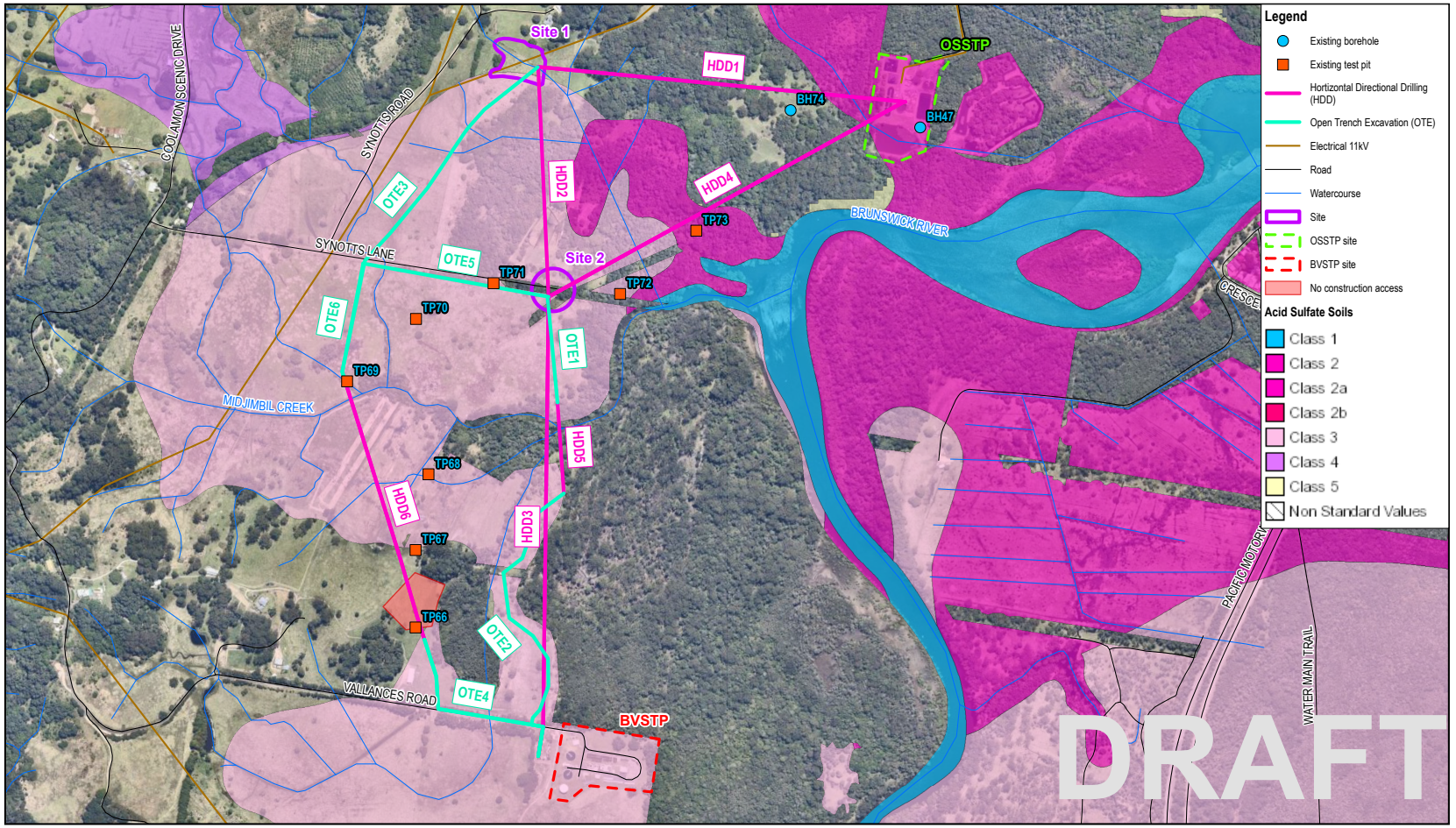
FIGURE 5

\\ghdnet\ghd\AU\Brisbane\Projects\41\12649325\GIS\Maps\Deliverables\12649325_Figures\12649325_Figures.aprx - 12649325_014_AlignmentOption_all
Print date: 05 Dec 2024 - 09:27

Data source: BSC: Coastal wetland, BVSTP existing site, OSSTP existing site, No construction access (2023); GHD: existing borehole (2024), existing test pit (2024), HDD sections, OTE sections, sites (2024); Hydrosphere: Threatened species (2024); Essential Energy: Electrical 11kv (2024); NSW Gov: Road, Watercourse, Town, ASS (2024); DCCEEW: Threatened species, Estuarine Macrophytes,Cape Byron marine park (2023); nearmap.com: : Imagery (2024). Created by: fxu

Attachment 2

Acid Sulphate Soils



Paper Size ISO A4

0 100 200 300 400

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

GHD

Byron Shire Council
Ocean Shores STP to Brunswick Valley
STP Transfer Pipelines

Project No. 12649325
Revision No. A
Date 5/12/2024

Acid sulfate soils

FIGURE 6

\\ghdnet\ghd\AU\Brisbane\Projects\41\12649325\GIS\Maps\Deliverables\12649325_Figures\12649325_Figures.aprx - 12649325_015_AcidSulfateSoil_RevA
Print date: 05 Dec 2024 - 09:25

Data source: BSC: Coastal wetland, BVSTP existing site, OSSTP existing site, No construction access (2023); GHD: existing borehole (2024), existing test pit (2024), HDD sections, OTE sections, sites (2024); Hydrosphere: Threatened species (2024); Essential Energy: Electrical 11kv (2024); NSW Gov: Road, Watercourse, Town, ASS (2024); WMS: nearmap.com: : Imagery (2024). Created by: fxu

Attachment 3

Alder Constructions Indicative Estimates

ALDER
BUILDING COMMUNITIES

Tuesday 17th December 2024

Mr. Adolfo Badini
Technical Director – Water Systems
GHD
145 Ann Street Brisbane
QLD 4000 Australia

Dear Adolfo,

Re: Indicative Cost Estimate – Rev 2

STP Transfer Pipelines, Ocean Shores STP To Brunswick Valley

Alder Constructions are pleased to submit our Indicative Cost Estimate for the above-mentioned project in accordance with the documentation provided and the clarifications in our offer for following Open Trench Excavation (OTE) Options:

OTE Alignment Option 3 (excluding GST)	**$2,911,919.00**
OTE Alignment Option 4 (excluding GST)	**$4,054,226.00**
OTE Alignment Option 5 (excluding GST)	**$3,461,967.00**

1 ASSUMPTIONS

In the development of our Indicative Cost Estimate, we have made the following assumptions:

1.1. Clear and unimpeded access to the site.

1.2. All inspections by independent consultants (eg RPEQ, etc) will be co-ordinated by the contractor, but the cost of these independent consultants will be at the Client's expense.

1.3. Existing material is suitable for backfilling trenches.

1.4. Existing topsoil is suitable for respreading after the pipeline installation is completed for stabilisation.

07 5514 4900
mail@aldercon.com.au
aldergroup.com.au

Head Office (Gold Coast)
116 Siganto Drive, Helensvale QLD 4212
PO Box 1531, Oxenford QLD 4210

Brisbane Office
1/153 Racecourse Road,
Ascot QLD 4007

Ballina Office
Suite 1, 95-101 River Street,
Ballina NSW 2478

ALDER
BUILDING COMMUNITIES

1.5. Our cost estimate reflects the items included in the Bill of Quantities and clarifications stated herein only.

1.6. The pipelines will be PE100 OD280 and PE100 OD450 in separate trench with adequate separation for benching.

1.7. The pipelines are maximum 2 metre depth to invert.

1.8. No bulk earthworks or reshaping to existing topography.

1.9. We have used the following assumptions for the estimated quantities in the Bill of Quantities:

1.9.1. Environmental control corridor: 20 metres

1.9.2. Construction corridor: 15 metres (i.e. 10 metre for trench construction with excavation, material stockpiling, machinery movement, and 5 metre for access track to cart material and spoil).

1.9.3. Access track will comprise 150mm CBR 45, 200mm rock bridging layer and geofabric lining.

1.9.4. No special compliance with ecological assessment is required. Flora and Fauna Assessment and Report is to be completed by the Principal.

1.9.5. No trench stop and trench bulkhead is required.

1.9.6. Alder has assessed the required conventional machinery and workforce for the pipeline construction to be as followed:

- 20T Excavators
- Tippers
- Pipelayer
- PE welder and equipment
- General labour
- Smooth drum roller
- Trench roller
- Trench shorings
- 4 inch dewatering pumps

2 ALLOWANCES

In the development of our Indicative Cost Estimate, we have made the following allowances:

2.1. We have assessed the programme and the estimated duration for on-site construction, excluding pre-construction requirements and wet weather delay as follows:

2.1.1. OTE Alignment Option 3: 27 weeks

2.1.2. OTE Alignment Option 4: 38 weeks

2.1.3. OTE Alignment Option 5: 34 weeks

2.2. Erection and maintaining of a site fence along the OTE alignment with fauna exclusion fencing.

2.3. Acid sulphate treatment to trench 15kg/m3.

07 5514 4900
mail@aldercon.com.au
aldergroup.com.au

Head Office (Gold Coast)
116 Siganto Drive, Helensvale QLD 4212
PO Box 1531, Oxenford QLD 4210

Brisbane Office
1/153 Racecourse Road,
Ascot QLD 4007

Ballina Office
Suite 1, 95-101 River Street,
Ballina NSW 2478

2.4. Temporary generators and portable water to site compound.

2.5. Traffic control and management for road crossings.

2.6. All excess spoil resulting from earthworks operations, services trenches, etc will be disposed off site.

3 EXCLUSIONS

We have excluded the following items from our Indicative Cost Estimate:

3.1. The payment of any supply Authority fees, headworks and PIP charges, including any payments for connection fees.

3.2. Geotechnical investigation.

3.3. The Portable Long Service and Workplace Health & Safety levy (Q Leave).

3.4. Removal, relocation or modification of existing services.

3.5. Handling, treatment or removal of asbestos and contaminated material.

3.6. Removal or excavation of any rock or rock like material.

3.7. Sewer tankering or diversion management.

3.8. No well point (or spear) dewatering.

3.9. Chemical treatment for dewatering i.e. we have allowed for de-silting to tail water only.

3.10. Delay caused by Force Majeure including the effects of Pandemic.

Alder's Indicative Cost Estimate does not consider the below:

a) Contingencies
b) Cost escalation

If you have any queries or wish to discuss any element of our Indicative Cost Estimate in more detail, please do not hesitate to contact myself on the details provided below.

Yours sincerely,
Alder Constructions

Adam Taylor
General Manager - Civil and Infrastructure
M: 0487 921 711
E: adam.taylor@aldercon.com.au

07 5514 4900
mail@aldercon.com.au
aldergroup.com.au

Head Office (Gold Coast)
116 Siganto Drive, Helensvale QLD 4212
PO Box 1531, Oxenford QLD 4210

Brisbane Office
1/153 Racecourse Road,
Ascot QLD 4007

Ballina Office
Suite 1, 95-101 River Street,
Ballina NSW 2478

ALDER

INDICATE COST ESTIMATE - Rev 2

Name:	**STP Transfer Pipelines, Ocean Shores STP To Brunswick Valley, Byron**
Date:	**Tuesday, 17 December 2024**
Client:	**GHD**
Ref:	**OPXXX - STP Transfer Pipelines Byron**

Summary of Schedules

Open Trench Excavation - Alignment Option 3	$	2,911,919.00
Open Trench Excavation - Alignment Option 4	$	4,054,226.00
Open Trench Excavation - Alignment Option 5	$	3,461,967.00

Bill of Quantities

Item	Description	Unit	Quantity	Rate	Amount
1.0	**Preliminaries**				
1.001	Establishment	Item	1	28,000.00	$ 28,000.00
1.002	Demobilisation	Item	1	16,000.00	$ 16,000.00
1.003	Management plans	Item	1	6,000.00	$ 6,000.00
	Total - Preliminaries				**$ 50,000.00**
2.0	**Open Trench Excavation - Alignment Option 3**	*m*	*985*	*$ 2,905.50*	
2.001	Site facilities and management	m	985	230.00	$ 226,550.00
2.002	Envionmental management plan and implementation	m2	19,700	4.00	$ 78,800.00
2.003	Surveys	m	985	36.00	$ 35,460.00
2.004	Erosion and sediment control	m2	19,700	3.00	$ 59,100.00
2.005	Access track 5m, A34 geofabrics, 150mm CBR45, 200mm rock	m	985	547.00	$ 538,795.00
2.006	Clearing and grubbing	m2	14,775	2.00	$ 29,550.00
2.007	Stripping topsoil to stockpile (assuming 100mm)	m3	1,478	11.00	$ 16,258.00
2.008	Disposal of excess spoil, including spoil from trench base improvement	m3	807	135.00	$ 108,945.00
2.009	Respread topsoil	m3	1,478	27.00	$ 39,906.00
2.01	Hydromulching	m2	14,775	3.00	$ 44,325.00
2.011	ASS soil treatment to trench, 15kg/m3	m3	946	50.00	$ 47,280.00
2.012	OTE 1 (243m)				
a.	OD280	m	243	335.00	$ 81,405.00
b.	OD450	m	243	545.00	$ 132,435.00
2.013	OTE 2 (742m)				
a.	OD280	m	742	335.00	$ 248,570.00
b.	OD450	m	742	545.00	$ 404,390.00
2.014	Bends including thrust blocks (PQ)				
a.	11.25-45 deg horizontal				
i.	OD280	ea	14	1,435.00	$ 20,090.00
ii.	OD450	ea	14	1,550.00	$ 21,700.00
b.	11.25-45 deg vertical for creek crossing				
i.	OD280	ea	0	-	$ -
ii.	OD450	ea	0	-	$ -
2.015	Air Valve Type 1 including McBern Ground Mounted Odor Filter (PQ)				
a.	OD280	Ea	2	17,840.00	$ 35,680.00
b.	OD450	Ea	2	24,435.00	$ 48,870.00
2.016	Air Valve Type 2 including McBern Ground Mounted Odor Filter (PQ)				
a.	OD280	Ea	3	18,590.00	$ 55,770.00
b.	OD450	Ea	3	25,180.00	$ 75,540.00
2.017	Dewatering	m	1,970	15.00	$ 29,550.00
2.018	Trench base improvement	m	1,970	100.00	$ 197,000.00
2.019	Trench wall support	m	1,970	45.00	$ 88,650.00
2.020	Extra-over for crossing Vallances Road x 2 lines	m	20	2,895.00	$ 57,900.00
2.021	Extra-over for crossing creeks/watercourse x 2 lines	m			
2.022	Compaction testing and pressure testing	m	1,970	20.00	$ 39,400.00
2.023	Connection	Provisional Sum	1	100,000.00	$ 100,000.00
	Total - Open Trench Excavation - Alignment Option 3				**$ 2,861,919.00**

Bill of Quantities

Item	Description	Unit	Quantity	Rate	Amount
3.0	**Open Trench Excavation - Alignment Option 4**	m	1,370	*$ 2,922.79*	
3.001	Site facilities and management	m	1,370	230.00	$ 315,100.00
3.002	Envionmental management plan and implementation	m2	27,400	4.00	$ 109,600.00
3.003	Surveys	m	1,370	36.00	$ 49,320.00
3.004	Erosion and sediment control	m2	27,400	3.00	$ 82,200.00
3.005	Access track 5m	m	1,370	547.00	$ 749,390.00
3.006	Clearing and grubbing	m2	13,700	2.00	$ 27,400.00
3.007	Stripping topsoil to stockpile	m3	1,370	11.00	$ 15,070.00
3.008	Disposal of excess spoil	m3	984	135.00	$ 132,786.00
3.009	Respread topsoil	m3	1,370	27.00	$ 36,990.00
3.01	Hydromulching	m2	13,700	3.00	$ 41,100.00
3.011	ASS soil treatment to trench, 15kg/m3	m3	1,315	50.00	$ 65,760.00
3.012	OTE 3 (888m)				
a.	OD280	m	888	335.00	$ 297,480.00
b.	OD450	m	888	545.00	$ 483,960.00
3.013	OTE 4 (482m)				
a.	OD280	m	482	335.00	$ 161,470.00
b.	OD450	m	482	545.00	$ 262,690.00
3.014	Bends including thrust blocks (PQ)				
a.	11.25-45 deg horizontal				
i.	OD280	ea	7	1,435.00	$ 10,045.00
ii.	OD450	ea	7	1,550.00	$ 10,850.00
b.	11.25-45 deg vertical for creek crossing				
i.	OD280	ea	4	1,435.00	$ 5,740.00
ii.	OD450	ea	4	1,550.00	$ 6,200.00
3.015	Air Valve Type 1 including McBern Ground Mounted Odor Filter (PQ)				
a.	OD280	Ea	3	17,840.00	$ 53,520.00
b.	OD450	Ea	3	24,435.00	$ 73,305.00
3.016	Air Valve Type 2 including McBern Ground Mounted Odor Filter (PQ)				
a.	OD280	Ea	5	18,590.00	$ 92,950.00
b.	OD450	Ea	5	25,180.00	$ 125,900.00
3.017	Dewatering	m	2,740	15.00	$ 41,100.00
3.018	Trench base improvement	m	2,740	100.00	$ 274,000.00
3.019	Trench wall support	m	2,740	45.00	$ 123,300.00
3.02	Extra-over for crossing Vallances Road x 2 lines & Synotts Lane x 2 lines	m	40	2,895.00	$ 115,800.00
3.021	Extra-over for crossing creeks/watercourse x 2 lines	m	240	360.00	$ 86,400.00
3.022	Compaction testing and pressure testing	m	2,740	20.00	$ 54,800.00
3.023	Connection	Provisional Sum	1	100,000.00	$ 100,000.00
	Total - Open Trench Excavation - Alignment Option 4				**$ 4,004,226.00**

Bill of Quantities

Item	Description	Unit	Quantity	Rate	Amount
4.0	**Open Trench Excavation - Alignment Option 5**	m	1,193	*$ 2,859.99*	
4.001	Site facilities and management	m	1,193	230.00	$ 274,390.00
4.002	Envionmental management plan and implementation	m2	23,860	4.00	$ 95,440.00
4.003	Survey	m	1,193	36.00	$ 42,948.00
4.004	Erosion and sediment control	m2	23,860	3.00	$ 71,580.00
4.005	Access track 5m	m	1,193	547.00	$ 652,571.00
4.006	Clearing and grubbing	m2	11,930	2.00	$ 23,860.00
4.007	Stripping topsoil to stockpile	m3	1,193	11.00	$ 13,123.00
4.008	Disposal of excess spoil	m3	690	135.00	$ 93,150.00
4.009	Respread topsoil	m3	1,193	27.00	$ 32,211.00
4.01	Hydromulching	m2	11,930	3.00	$ 35,790.00
4.011	ASS soil treatment to trench, 15kg/m3	m3	1,145	50.00	$ 57,264.00
4.012	OTE 4 (482m)				
a.	OD280	m	482	335.00	$ 161,470.00
b.	OD450	m	482	545.00	$ 262,690.00
4.013	OTE 5 (438m)				
a.	OD280	m	438	335.00	$ 146,730.00
b.	OD450	m	438	545.00	$ 238,710.00
4.014	OTE 6 (273m)				
a.	OD280	m	273	335.00	$ 91,455.00
i.	OD450	m	273	545.00	$ 148,785.00
ii.					
b.	Bends including thrust blocks (PQ)				
i.	11.25-45 deg horizontal				
ii.	OD280	ea	8	1,435.00	$ 11,480.00
	OD450	ea	8	1,550.00	$ 12,400.00
4.015	11.25-45 deg vertical for creek crossing				
a.	OD280	ea	4	1,435.00	$ 5,740.00
b.	OD450	ea	4	1,550.00	$ 6,200.00
4.016	Air Valve Type 1 including McBern Ground Mounted Odor Filter (PQ)				
a.	OD280	Ea	2	17,840.00	$ 35,680.00
b.	OD450	Ea	2	24,435.00	$ 48,870.00
4.017	Air Valve Type 2 including McBern Ground Mounted Odor Filter (PQ)				
4.018	OD280	Ea	5	18,590.00	$ 92,950.00
4.019	OD450	Ea	5	25,180.00	$ 125,900.00
4.02	Dewatering	m	2,386	15.00	$ 35,790.00
4.021	Trench base improvement	m	2,386	100.00	$ 238,600.00
	Trench wall support	m	2,386	45.00	$ 107,370.00
4.022					
	Extra-over for crossing Vallances Road x 2 lines	m	20	2,895.00	$ 57,900.00
4.023	Extra-over for crossing creeks/watercourse x 2 lines	m	120	360.00	$ 43,200.00
	Compaction testing and pressure testing	m	2,386	20.00	$ 47,720.00
	Connection	Provisional Sum	1	100,000.00	$ 100,000.00
	Total - Open Trench Excavation - Alignment Option 5				**$ 3,411,967.00**

Attachment 4

UEA Indicative Estimates

UEA Ref: Q11556

20/12/2024

GHD
Level 3, GHD Tower, 24 Honeysuckle Dr,
Newcastle NSW 2300
+61 7 3316 3662
adolfo.badini@ghd.com

Re: Ocean Shore HDD

Dear Adolfo,

In response to your recent enquiry, UEA Pty Ltd ("UEA") appreciates the opportunity to provide an estimation for the above-mentioned project.

1. Clarification of Scope of Works

Our Scope of Works is associated with construction work as detailed at our on site visit and in your correspondence and attached documentation. A high-level review has been completed of the supplied plans and geotechnical information with further follow up information required as detailed below. Brief commentary has been offered for the five figure drawing options with a preference given to the two long HDD solution Figure 2 based on HDD preference alone. Other factors including access, landowner permissions, pipeline hydraulics and required methodology will also need to be considered.

Please refer to the following supplied information in relation to this quote:

- UEA Pricing and Scope document
- Extra Over rates
- Scope split

UEA has priced for ground conditions **up to 80 Mpa** on all bores as this is harder than ground that the geotechnical data indicates given the limited depth of the current geotechnical boreholes and the absence of BH's along some of the HDD alignments. Extra over rates may apply where ground conditions are harder than 80 Mpa. Also to note is the possible requirement for the installation of Steel Conductor casing to Rock as a means or reduce Frac Out risk and ensure longevity of the pipeline at depth contained within Rock.
UEA have allowed for a combination of PDC and rock roller tooling based on our assessment of the available geotechnical information.

Due to limited geotechnical information, if it is determined during the detailed design phase that steel casing is required at any crossing location, additional pricing can be provided based on the required size and installation method.

Civil Specification requirements

As per other clients Civil Specification requirements UEA's supplied rate allows for the design review items as outlines in the "UEA Pricing and Scope document". Given the nature of Maxi Rig pipe installations, the complexity of the bores and the increasing client expectations the requirements listed are in excess of Basic Civil Specification requirements.

Please also note the following specific requirements:

- Client to supply all weather access track and suitable hardstand drill pad (generally 40metres x 35 metres or as can be agreed) at entry point and exit point – we will have a tail string rig and cleaning systems on exit also.
- Specialist ParaTrack2 Gyro Steering tool tracking allowed for.
- The second pilot bore/Second HDD will be utilised as a drilling fluid return line. This will be within the second HDD and then utilised for the product pipe install once reamed out to final size.
- Please refer to the "UEA Pricing and Scope Document" for all site specific and scope split requirements.

HDD review and options Figure 1-5

- Bore design, profile and alignment still needs to be finalised subject to the requirements of the chosen HDPE pipe, pressure class and allowance for internal beads.
- All things pipe Welding and Stringing by GHD/Client as current HDPE welding and stringing locations and options unknown. Once options can be discussed and agreed this can be priced.
- Pipe installation timing is an approximate only based on limited information to date.

Figure 1

- This HDD option with three bores is achievable and allows for the pipeline to be located away from the Brunswick River.
- Access to Site 1 will need to be explored given the long driveway and resident access requirements.
- Set up would be expected at the OSSTP and Site two with drilling either way from these sites.
- Access required to both sides of the bores

Figure 2

- This HDD option with two bores is achievable and preferred as it limits the number of bores, allows set up at either end of the HDD's and is the most direct route between the OSSTP and BVSTP.
- Set up would be expected at the OSSTP and Site two with drilling either way from these sites.

- Access required to both sides of the bores with pipe welding and stringing possible from both STP's
- Geotechnical assessment will need review and consideration.

Figure 3

- This HDD option with one Major and one Minor HDD is achievable although access for 'HDD5' is questionable given the long stretches of low lying land.
- Set up could be at the OSSTP or Site 2 with drilling either way from these sites.
- HDD5 would need to be completed with a smaller HDD rig and equipment which is readily available in the area. Truck access is still required to either side of the bore for equipment, pipe and spoil disposal. This could be very difficult if weather conditions are not favourable.

Figure 4

- This HDD option with two bores is achievable and allows for the pipeline to be located away from the Brunswick River.
- Access off of Vallances Road will be difficult based on site conditions and low lying water at surface.
- Set up could be at the OSSTP or Site 1 with drilling either way from these sites.
- HDD6 would need to be completed with a Maxi HDD rig and equipment. Truck access is still required to either side of the bore for equipment, pipe and spoil disposal. This could be very difficult if weather conditions are not favourable. Semi trailer access tracks to either end of this bore would be considered prohibitively expensive.

Figure 5

- This HDD option with two bores is achievable although has the same issues as detailed for Figure 4 above.
- Set up would be expected at the OSSTP and Site two with drilling either way from these sites.
- Access off of Vallances Road will be difficult based on site conditions and low lying water at surface.
- HDD6 would need to be completed with a Maxi HDD rig and equipment. Truck access is still required to either side of the bore for equipment, pipe and spoil disposal. This could be very difficult if weather conditions are not favourable. Semi trailer access tracks to either end of this bore would be considered prohibitively expensive.

1.1 Insurances

As part of UEA's submission for the required scope the following insurances can only be offered:

Insurance Type	**Limit**
General/Public Liability	$20 million
Workers Compensation	unlimited
Motor Vehicle	$30 million road risk
Plant and Equipment	Insured value
Contract Works	Not provided

Professional Indemnity	$5 million
Pollution Liability	Not provided

Contract works is not offered due to the high cost of the premiums. If the client requires these insurances a price for the project can be supplied.

1.2 Terms & Conditions

UEA's pricing remains firm for sixty (60) days from the 20/12/2024. Should construction be delayed past the agreed commencement date, UEA reserve the right to review the quoted price for construction.
All prices quoted are exclusive of GST.
We offer payment terms of thirty (30) days from the date of invoice unless otherwise agreed as part of the contract. Work may be invoiced progressively on a percentage complete basis as agreed between GHD and a UEA representative, unless otherwise specified in an agreed contract.

1.3 Ground Conditions

UEA has based its offer on the geotechnical information provided to date. Price provided is lump sum covering the ground conditions stated in the pricing table. HDD conductor casing has been excluded at this early stage of the project review. Once ground conditions are known and bore designs refined then we can advise on any possible casing requirements.

1.4 Existing Services

UEA's offer assumes that the client has located all services crossing the bore path at design stage and relocated any potential service conflict. Where the bore must be increased in length to avoid a potential service clash an extra over rate for the additional metres will need to be applied. Please refer to our inclusions & exclusions with regards service location responsibility.

1.5 Environmental or Heritage Issues

If GHD is aware of any specific environmental and/or heritage issues regarding the proposed construction works, please advise UEA immediately so that the necessary changes can be made to our offer.

1.6 Variation to UEA Price

UEA's supplied price is an agreement between UEA and GHD and is NOT based on any back-to-back terms with GHD. Where a variation is encountered GHD will be responsible for accepting and paying the variation in full.
In the instance a back-to-back arrangement is required then UEA would require a copy of the head contract and all terms and conditions would have to be agreed upon before undertaking any works.
UEA has been diligent in providing this offer. Where some works must be undertaken outside of the scope it will be subject to a variation. In **ALL** cases written confirmation of the acceptance of the agreed extra work must be received prior to this work commencing. Indicative rates for certain works have been supplied as part of – "UEA Pricing and Scope" document.

Kind Regards,

Jonathan de Vos
Operations Manager
jdevos@uea.com.au

Please use below rates for HDDs as required across all Figure Options 1-5

	Budget Cost
Design Verification, Review and Optioneering - 1-3 Maxi bores	$62,562.00
Mobilisation of HDD Maxi Rigs and Support equipment to site. Set up and establishment on First HDD site.	$250,000.00
Remobilisation of HDD Maxi rig between sites	$166,000.00
Demobilisation of all HDD equipment from site, HSEQ, QA and WAE information	$166,000.00
Pilot Bore, Ream and Installation of **OD 450mm** HDPE pipe - **Per Meter**	$2,845.00
Pilot Bore, Ream and Installation of **OD 280mm** HDPE pipe - **Per Meter**	$1,905.00

From: Jonathan de Vos
To: Adolfo Badini
Cc: Matthew Row; Adam Mills
Subject: RE: HDD inputs for MCA
Date: Tuesday, 21 January 2025 5:50:09 PM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png

Hi Adolfo,

Regards,

Jonathan de Vos
Operations Manager
UEA Pty Ltd

Please note we are now located at :
1990 Elizabeth Drive, Badgerys Creek 2555

PO Box 94 Kemps Creek NSW 2178

0409736005
0296724456
jdevos@uea.com.au

From: Adolfo Badini <Adolfo.Badini@ghd.com>
Sent: Tuesday, 7 January 2025 4:37 PM
To: Jonathan de Vos <jdevos@uea.com.au>
Cc: Matthew Row <Matthew.Row@ghd.com>; Adam Mills <AMMills@ghd.com>
Subject: RE: HDD inputs for MCA

Hi Jonathan;

I have reviewed a bit further and see there are costs for a number of associated items that need to be allowed. We are after indicative costs for comparison of options at this early stage. The documentation reads like a lump sum quote in parts, which is not the intention at this stage. Once the preferred alignment is selected we will proceed with more detailed design and investigations.

Would you be able to assist with indicative costs for the following items from the GHD scope in the Scope Split worksheet:

1. Supply, unload, weld, testing (pre and post), handle during pullback, including supply of rollers and slings. Management of breakover, repair to fencing and traffic control around pipe string etc - all pipe side activities. This should include supply of the pipe material and stringing. There are a number of items to consider within this price that I would like to clarify without wanting to go over the top. Traffic Control is an objective point that may blow out to $100k if not carefully considered and planned. I will call to clarify before submitting a price for each pipe size string.

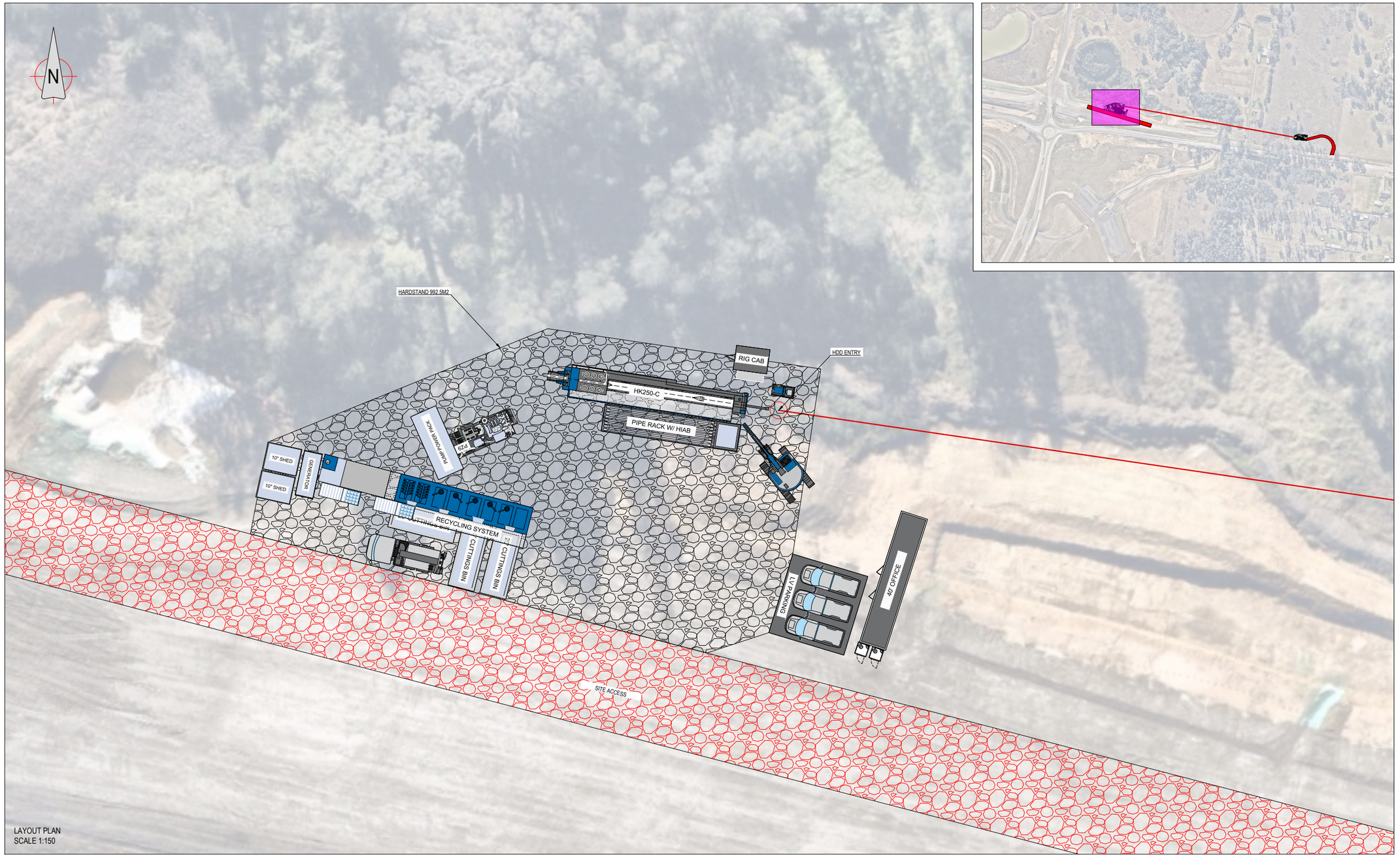
   280mm PN20 Supply and unloading on site - $119.00/meter
   450mm PN20 Supply and unloading on site - $308.00/meter

   Weld, String and Test 280mm PN20 – $136.11/meter
   Weld, String and Test 450mm PN20 - $259.28/meter

2. Bouyancy Control including removal of water upon completion The water fill line and buoyancy fill line is an easy install at the time of pipe welding and stringing. Pricing will be allowed in the above. At the completion of installation and pressure testing, water will remain within the pipe.
3. All pressure testing - $9500 per HDD. This allows for a NATA accredited Hydrostatic pressure test.
4. All pipeline pigging scope – Based on other pressure pipelines, pigging is typically not required. Should this be a requirement, calculations of the external buckling force will be needed to determine if the pipe can sustain itself without being fluid filled. For budget pricing allow $25,000 per bore to pig each HDD excluding any disposal of water from site.
5. Noise control/barriers – These would be a cost plus basis given the unknown nature of the works. Given the site locations and the usual set up within residential areas without noise control barriers we believe these to be an unlikely requirement.
6. Contamination - management, removal and tipping costs – Contamination at this site would likely be historical either Asbestos or site won issues. This would be managed as a cost plus basis. HDD material is very likely VENM and as such allowed for in the supplied rates.
7. Design, supply and welding of pulling heads – These are already owned by UEA and as such costs are included in the rates already supplied.

Typical costs for most items and recent costs for supply of pipe would be sufficient.

Regards
Adolfo Badini



NOTES:
1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. DATUM: UTM84 ZONE 56, AHD.

LEGEND:
- HDD ALIGNMENT
- SITE ACCESS
- HARDSTAND
- MUD RETURN LINE

REVISION	DESCRIPTION	DATE	DRAWN	CHECK	APP'D	CHECK	APP'D
				CONTRACTOR		OWNER	
A	ISSUED FOR INFORMATION	23.11.23	MH	CH	JdV		

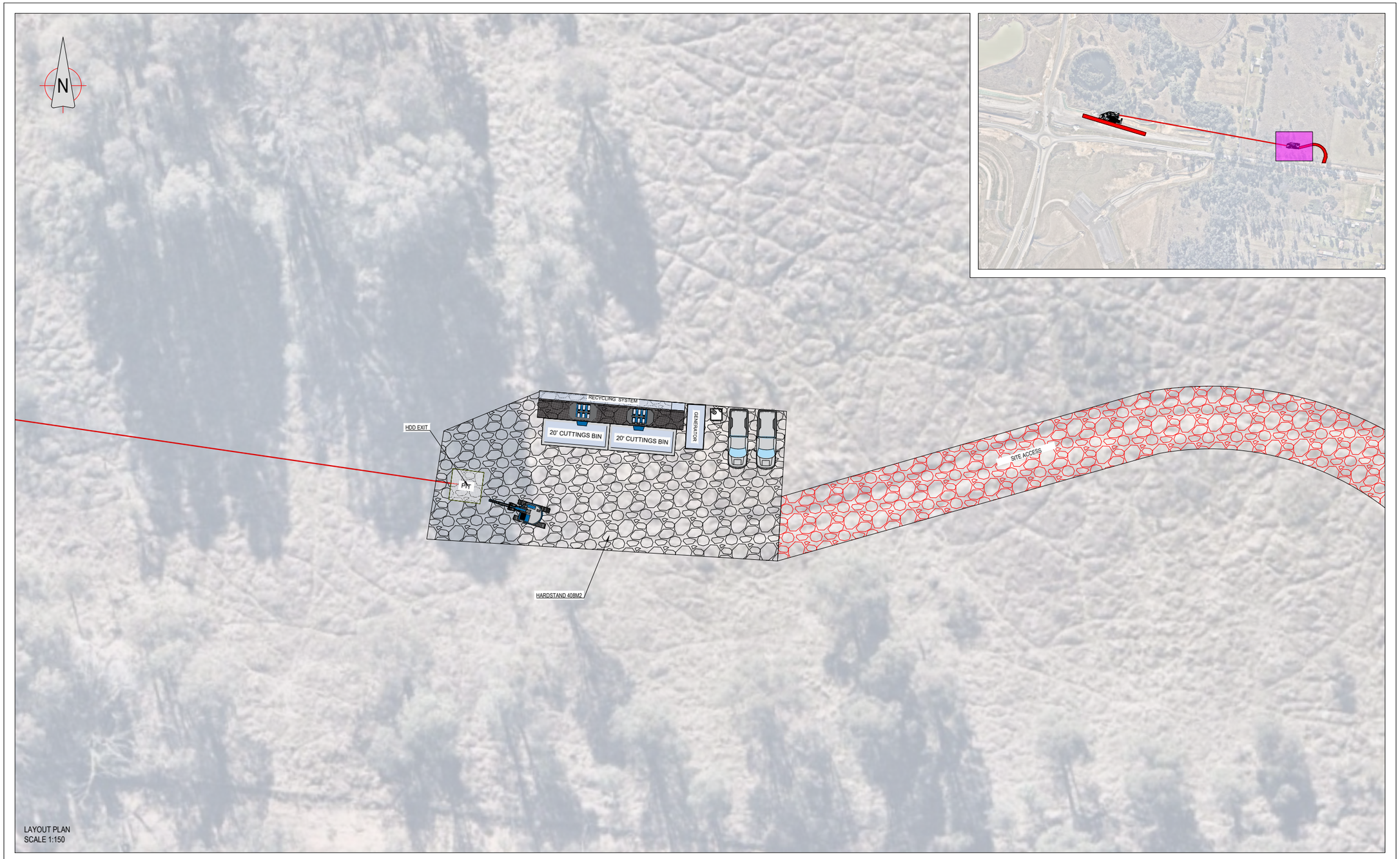
UEA

PROJECT: POTABLE WATER BADGERYS CREEK

TITLE: LAYOUT - HDD01 ENTRY

DRAWING No.: 420-ENG-DWG-001

STATUS: FOR INFORMATION



NOTES:
1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. DATUM: UTM84 ZONE 56, AHD.

LEGEND:
- HDD ALIGNMENT
- SITE ACCESS
- HARDSTAND

REVISION	DESCRIPTION	DATE	DRAWN	CHECK	APP'D	CHECK	APP'D
				CONTRACTOR		OWNER	
A	ISSUED FOR INFORMATION	23.11.23	MH	CH	JdV		

PROJECT: POTABLE WATER BADGERYS CREEK

TITLE: LAYOUT - HDD01 EXIT

DRAWING No.: 420-ENG-DWG-002

STATUS: FOR INFORMATION

Attachment 5

Summary Cost Estimates

GHD PROJECT NUMBER: 12649325
OCEAN SHORES STP TO BRUNSWICK VALLEY STP TRANSFER PIPELINE
COST ESTIMATE OF ALIGNMENT 1

Item	Description	Unit	Quantity	Rate	Amount
1.0	**Preliminaries**				**$ 58,000**
1.1	Establishment	Item	1	$ 30,000	$ 30,000
1.2	Demobilisation	Item	1	$ 20,000	$ 20,000
1.3	Management plans	Item	1	$ 8,000	$ 8,000
2.0	**Horizontal Directional Drilling - Setup**				**$ 1,978,390**
2.1	Site facilities and management at ends of HDD	ea	4	$ 15,000	$ 60,000
2.2	Environmental management plan and implementation for ends of HDD	ea	4	$ 12,000	$ 48,000
2.3	Surveys	m	2,460	$ 30.00	$ 73,800
2.4	Erosion and sediment control	ea	4	$ 9,000	$ 36,000
2.5	Access track 5m, A34 geofabrics, 150mm CBR45, 200mm rock	m	550	$ 547.00	$ 300,850
2.6	Working pad at ends of HDD 5m, A34 geofabrics, 150mm CBR45, 200mm rock	m^2	5,600	$ 109.40	$ 612,640
2.7	Traffic control	Item	1	$ 50,000	$ 50,000
2.8	Clearing and grubbing	m^2	1,050	$ 2.00	$ 2,100
2.9	Stripping topsoil to stockpile (assuming 100mm)	m^3	440	$ 11.00	$ 4,840
2.10	Respread topsoil	m^3	440	$ 27.00	$ 11,880
2.11	Hydromulching	m^2	4,400	$ 3.00	$ 13,200
2.12	ASS soil treatment to Entry/Exit pits, 15kg/m^3	m^3	160	$ 50.00	$ 8,000
2.13	ASS soil treatment to spoil from drill cuttings, (assume covered in instal rate)	m^3	0	$ -	$ -
2.14	Mobilisation of HDD Maxi Rigs and Support equipment to site. Set up and establishment on First HDD site (Site 1)	Item	1	$ 250,000	$ 250,000
2.15	Remobilisation of HDD Maxi rig between sites (to Site 2)	Item	1	$ 166,000	$ 166,000
2.16	Demobilisation of all HDD equipment from site, HSEQ, QA and WAE information	Item	1	$ 166,000	$ 166,000
2.17	Air Valves including odour filter - for OD280	ea	4	$ 18,590	$ 74,360
2.18	Air Valves including odour filter - for OD450	ea	4	$ 25,180	$ 100,720
3.0	**HDD1 (857m)**				**$ 4,907,100**
3.1	Design Verification, Review and Optioneering - 1-3 Maxi bores	Item	1	$ 62,562	$ 62,562
3.2	Supply and unload OD280 PN20 pipe	m	857	$ 119.00	$ 101,983
3.3	Supply and unload OD450 PN20 pipe	m	857	$ 308.00	$ 263,956
3.4	Weld, string, and test OD280 PN20 pipe	m	857	$ 136.11	$ 116,646
3.5	Weld, string, and test OD450 PN20 pipe	m	857	$ 259.28	$ 222,203
3.6	Pilot Bore, Ream and Installation of OD280 pipe	m	857	$ 1,905	$ 1,632,585
3.7	Pilot Bore, Ream and Installation of OD450 pipe	m	857	$ 2,845	$ 2,438,165
3.8	Pressure testing	ea	2	$ 9,500	$ 19,000
3.9	Pigging	ea	2	$ 25,000	$ 50,000
4.0	**HDD2 (534m)**				**$ 3,107,218**
4.1	Design Verification, Review and Optioneering - 1-3 Maxi bores	Item	1	$ 62,562	$ 62,562
4.2	Supply and unload OD280 PN20 pipe	m	534	$ 119.00	$ 63,546
4.3	Supply and unload OD450 PN20 pipe	m	534	$ 308.00	$ 164,472
4.4	Weld, string, and test OD280 PN20 pipe	m	534	$ 136.11	$ 72,683
4.5	Weld, string, and test OD450 PN20 pipe	m	534	$ 259.28	$ 138,456
4.6	Pilot Bore, Ream and Installation of OD280 pipe	m	534	$ 1,905	$ 1,017,270
4.7	Pilot Bore, Ream and Installation of OD450 pipe	m	534	$ 2,845	$ 1,519,230
4.8	Pressure testing	ea	2	$ 9,500	$ 19,000
4.9	Pigging	ea	2	$ 25,000	$ 50,000
5.0	**HDD3 (1069m)**				**$ 6,088,447**
5.1	Design Verification, Review and Optioneering - 1-3 Maxi bores	Item	1	$ 62,562	$ 62,562
5.2	Supply and unload OD280 PN20 pipe	m	1,069	$ 119.00	$ 127,211
5.3	Supply and unload OD450 PN20 pipe	m	1,069	$ 308.00	$ 329,252
5.4	Weld, string, and test OD280 PN20 pipe	m	1,069	$ 136.11	$ 145,502
5.5	Weld, string, and test OD450 PN20 pipe	m	1,069	$ 259.28	$ 277,170
5.6	Pilot Bore, Ream and Installation of OD280 pipe	m	1,069	$ 1,905	$ 2,036,445
5.7	Pilot Bore, Ream and Installation of OD450 pipe	m	1,069	$ 2,845	$ 3,041,305
5.8	Pressure testing	ea	2	$ 9,500	$ 19,000
5.9	Pigging	ea	2	$ 25,000	$ 50,000
6.0	**Connection**				**$ 100,000**
6.1	Connection	Prov Sum	1	$ 100,000	$ 100,000
7.0	**Biodiversity credits**				**$ 70,000**
7.1	Biodiversity credits	Prov Sum	1	$ 70,000	$ 70,000

TOTAL **$ 16,309,155**

https://projectsportal.ghd.com/sites/pp14_10/oceanshoresstptobrun/ProjectDocs/12649325-EST-001_A_Summary Cost Estimates.xlsx

GHD PROJECT NUMBER: 12649325
OCEAN SHORES STP TO BRUNSWICK VALLEY STP TRANSFER PIPELINE
COST ESTIMATE OF ALIGNMENT 2

Item	Description	Unit	Quantity	Rate	Amount
1.0	**Preliminaries**				**$ 58,000**
1.1	Establishment	Item	1	$ 30,000	$ 30,000
1.2	Demobilisation	Item	1	$ 20,000	$ 20,000
1.3	Management plans	Item	1	$ 8,000	$ 8,000
2.0	**Horizontal Directional Drilling - Setup**				**$ 1,443,310**
2.1	Site facilities and management at ends of HDD	ea	3	$ 15,000	$ 45,000
2.2	Environmental management plan and implementation for ends of HDD	ea	3	$ 12,000	$ 36,000
2.3	Surveys	m	2,011	$ 30.00	$ 60,330
2.4	Erosion and sediment control	ea	3	$ 9,000	$ 27,000
2.5	Access track 5m, A34 geofabrics, 150mm CBR45, 200mm rock	m	350	$ 547.00	$ 191,450
2.6	Working pad at ends of HDD 5m, A34 geofabrics, 150mm CBR45, 200mm rock	m^2	4,200	$ 109.40	$ 459,480
2.7	Traffic control	Item	1	$ 50,000	$ 50,000
2.8	Clearing and grubbing	m^2	850	$ 2.00	$ 1,700
2.9	Stripping topsoil to stockpile (assuming 100mm)	m^3	280	$ 11.00	$ 3,080
2.10	Respread topsoil	m^3	280	$ 27.00	$ 7,560
2.11	Hydromulching	m^2	2,800	$ 3.00	$ 8,400
2.12	ASS soil treatment to Entry/Exit pits, 15kg/m^3	m^3	120	$ 50.00	$ 6,000
2.13	ASS soil treatment to spoil from drill cuttings, (assume covered in instal rate)	m^3	0	$ -	$ -
2.14	Mobilisation of HDD Maxi Rigs and Support equipment to site. Set up and establishment on First HDD site (Site 2)	Item	1	$ 250,000	$ 250,000
2.15	Demobilisation of all HDD equipment from site, HSEQ, QA and WAE information	Item	1	$ 166,000	$ 166,000
2.16	Air Valves including odour filter - for OD280	ea	3	$ 18,590	$ 55,770
2.17	Air Valves including odour filter - for OD450	ea	3	$ 25,180	$ 75,540
3.0	**HDD3 (1069m)**				**$ 6,088,447**
3.1	Design Verification, Review and Optioneering - 1-3 Maxi bores	Item	1	$ 62,562	$ 62,562
3.2	Supply and unload OD280 PN20 pipe	m	1,069	$ 119.00	$ 127,211
3.3	Supply and unload OD450 PN20 pipe	m	1,069	$ 308.00	$ 329,252
3.4	Weld, string, and test OD280 PN20 pipe	m	1,069	$ 136.11	$ 145,502
3.5	Weld, string, and test OD450 PN20 pipe	m	1,069	$ 259.28	$ 277,170
3.6	Pilot Bore, Ream and Installation of OD280 pipe	m	1,069	$ 1,905	$ 2,036,445
3.7	Pilot Bore, Ream and Installation of OD450 pipe	m	1,069	$ 2,845	$ 3,041,305
3.8	Pressure testing	ea	2	$ 9,500	$ 19,000
3.9	Pigging	ea	2	$ 25,000	$ 50,000
4.0	**HDD4 (942m)**				**$ 5,380,753**
4.1	Design Verification, Review and Optioneering - 1-3 Maxi bores	Item	1	$ 62,562	$ 62,562
4.2	Supply and unload OD280 PN20 pipe	m	942	$ 119.00	$ 112,098
4.3	Supply and unload OD450 PN20 pipe	m	942	$ 308.00	$ 290,136
4.4	Weld, string, and test OD280 PN20 pipe	m	942	$ 136.11	$ 128,216
4.5	Weld, string, and test OD450 PN20 pipe	m	942	$ 259.28	$ 244,242
4.6	Pilot Bore, Ream and Installation of OD280 pipe	m	942	$ 1,905	$ 1,794,510
4.7	Pilot Bore, Ream and Installation of OD450 pipe	m	942	$ 2,845	$ 2,679,990
4.8	Pressure testing	ea	2	$ 9,500	$ 19,000
4.9	Pigging	ea	2	$ 25,000	$ 50,000
5.0	**Connection**				**$ 100,000**
5.1	Connection	Prov Sum	1	$ 100,000	$ 100,000
6.0	**Biodiversity credits**				**$ 50,000**
6.1	Biodiversity credits	Prov Sum	1	$ 50,000	$ 50,000

TOTAL **$ 13,120,510**

https://projectsportal.ghd.com/sites/pp14_10/oceanshoresstptobrun/ProjectDocs/12649325-EST-001_A_Summary Cost Estimates.xlsx

GHD PROJECT NUMBER: 12649325
OCEAN SHORES STP TO BRUNSWICK VALLEY STP TRANSFER PIPELINE
COST ESTIMATE OF ALIGNMENT 3

Item	Description	Unit	Quantity	Rate	Amount
1.0	**HDD Preliminaries**				**$ 58,000**
1.1	Establishment	Item	1	$ 30,000	$ 30,000
1.2	Demobilisation	Item	1	$ 20,000	$ 20,000
1.3	Management plans	Item	1	$ 8,000	$ 8,000
2.0	**OTE Sections**				**$ 2,911,919**
2.1	OTE sections (Alder Constructions Estimate)	Item	1	$ 2,911,919	$ 2,911,919
3.0	**Horizontal Directional Drilling - Setup**				**$ 1,758,160**
3.1	Site facilities and management at ends of HDD	ea	4	$ 15,000	$ 60,000
3.2	Environmental management plan and implementation for ends of HDD	ea	4	$ 12,000	$ 48,000
3.3	Surveys	m	1,153	$ 30.00	$ 34,590
3.4	Erosion and sediment control	ea	4	$ 9,000	$ 36,000
3.5	Access track 5m, A34 geofabrics, 150mm CBR45, 200mm rock	m	250	$ 547.00	$ 136,750
3.6	Working pad at ends of HDD 5m, A34 geofabrics, 150mm CBR45, 200mm rock	m^2	5,600	$ 109.40	$ 612,640
3.7	Traffic control	Item	1	$ 50,000	$ 50,000
3.8	Clearing and grubbing	m^2	750	$ 2.00	$ 1,500
3.9	Stripping topsoil to stockpile (assuming 100mm)	m^3	200	$ 11.00	$ 2,200
3.10	Respread topsoil	m^3	200	$ 27.00	$ 5,400
3.11	Hydromulching	m^2	2,000	$ 3.00	$ 6,000
3.12	ASS soil treatment to Entry/Exit pits, 15kg/m^3	m^3	160	$ 50.00	$ 8,000
3.13	ASS soil treatment to spoil from drill cuttings, (assume covered in instal rate)	m^3	0	$ -	$ -
3.14	Mobilisation of HDD Maxi Rigs and Support equipment to site. Set up and establishment on First HDD site (Site 2)	Item	1	$ 250,000	$ 250,000
3.15	Remobilisation of HDD Maxi rig between sites (to HDD5)	Item	1	$ 166,000	$ 166,000
3.16	Demobilisation of all HDD equipment from site, HSEQ, QA and WAE information	Item	1	$ 166,000	$ 166,000
3.17	Air Valves including odour filter - for OD280	ea	4	$ 18,590	$ 74,360
3.18	Air Valves including odour filter - for OD450	ea	4	$ 25,180	$ 100,720
4.0	**HDD4 (942m)**				**$ 5,380,753**
4.1	Design Verification, Review and Optioneering - 1-3 Maxi bores	Item	1	$ 62,562	$ 62,562
4.2	Supply and unload OD280 PN20 pipe	m	942	$ 119.00	$ 112,098
4.3	Supply and unload OD450 PN20 pipe	m	942	$ 308.00	$ 290,136
4.4	Weld, string, and test OD280 PN20 pipe	m	942	$ 136.11	$ 128,216
4.5	Weld, string, and test OD450 PN20 pipe	m	942	$ 259.28	$ 244,242
4.6	Pilot Bore, Ream and Installation of OD280 pipe	m	942	$ 1,905	$ 1,794,510
4.7	Pilot Bore, Ream and Installation of OD450 pipe	m	942	$ 2,845	$ 2,679,990
4.8	Pressure testing	ea	2	$ 9,500	$ 19,000
4.9	Pigging	ea	2	$ 25,000	$ 50,000
5.0	**HDD5 (211m)**				**$ 1,307,336**
5.1	Design Verification, Review and Optioneering - 1-3 Maxi bores	Item	1	$ 62,562	$ 62,562
5.2	Supply and unload OD280 PN20 pipe	m	211	$ 119.00	$ 25,109
5.3	Supply and unload OD450 PN20 pipe	m	211	$ 308.00	$ 64,988
5.4	Weld, string, and test OD280 PN20 pipe	m	211	$ 136.11	$ 28,719
5.5	Weld, string, and test OD450 PN20 pipe	m	211	$ 259.28	$ 54,708
5.6	Pilot Bore, Ream and Installation of OD280 pipe	m	211	$ 1,905	$ 401,955
5.7	Pilot Bore, Ream and Installation of OD450 pipe	m	211	$ 2,845	$ 600,295
5.8	Pressure testing	ea	2	$ 9,500	$ 19,000
5.9	Pigging	ea	2	$ 25,000	$ 50,000
6.0	**Connection**				**$ -**
6.1	Connection (cost incl in OTE estimate)	Prov Sum	1	$ -	$ -
7.0	**Biodiversity credits**				**$ 1,500,000**
7.1	Biodiversity credits	Prov Sum	1	$ 1,500,000	$ 1,500,000
				TOTAL	**$ 12,916,169**

https://projectsportal.ghd.com/sites/pp14_10/oceanshoresstptobrun/ProjectDocs/12649325-EST-001_A_Summary Cost Estimates.xlsx

GHD PROJECT NUMBER: 12649325
OCEAN SHORES STP TO BRUNSWICK VALLEY STP TRANSFER PIPELINE
COST ESTIMATE OF ALIGNMENT 4

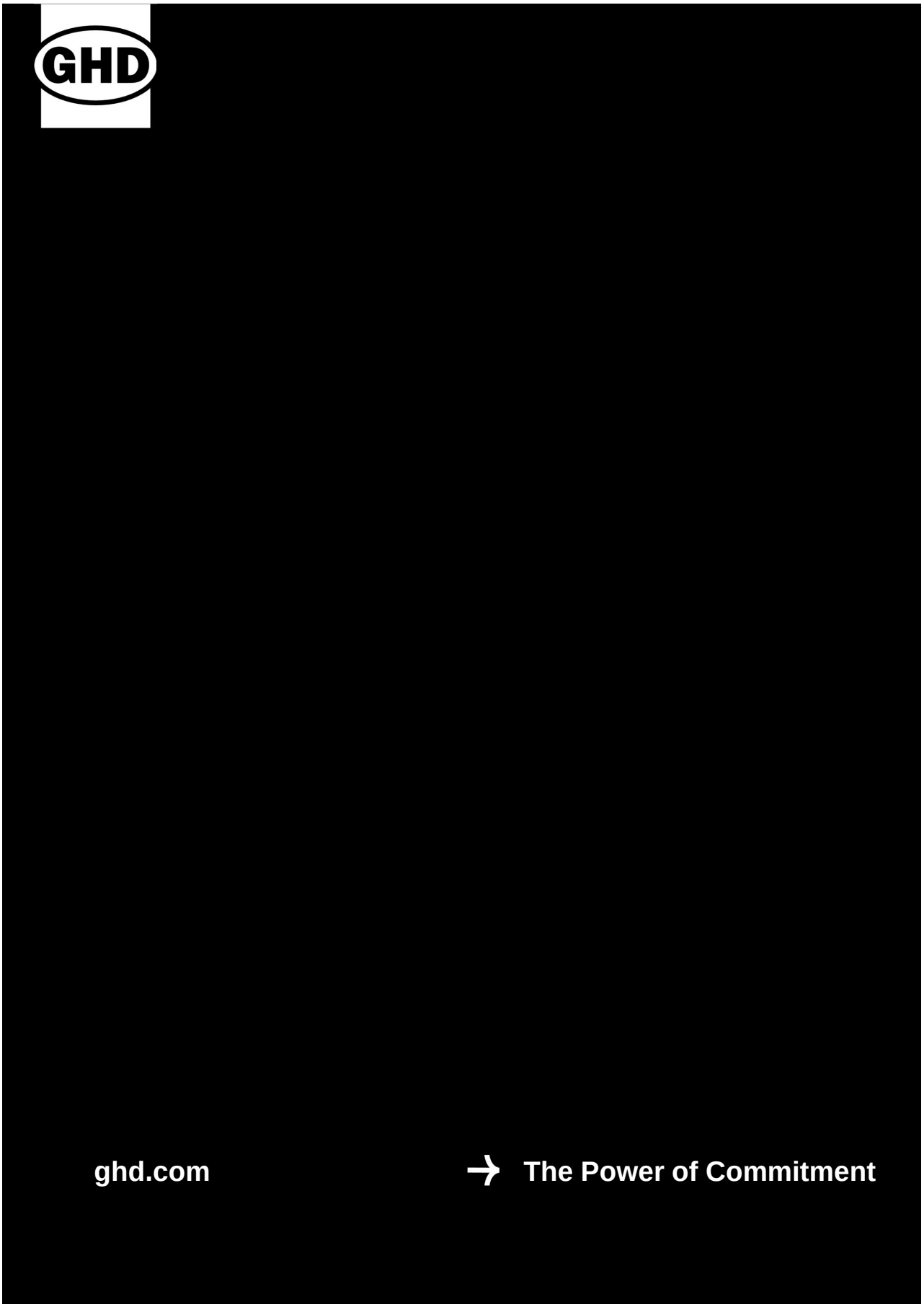
Item	Description	Unit	Quantity	Rate	Amount
1.0	**HDD Preliminaries**				**$ 58,000**
1.1	Establishment	Item	1	$ 30,000	$ 30,000
1.2	Demobilisation	Item	1	$ 20,000	$ 20,000
1.3	Management plans	Item	1	$ 8,000	$ 8,000
2.0	**OTE Sections**				**$ 4,054,226**
2.1	OTE sections (Alder Constructions Estimate)	Item	1	$ 4,054,226	$ 4,054,226
3.0	**Horizontal Directional Drilling - Setup**				**$ 1,797,270**
3.1	Site facilities and management at ends of HDD	ea	4	$ 15,000	$ 60,000
3.2	Environmental management plan and implementation for ends of HDD	ea	4	$ 12,000	$ 48,000
3.3	Surveys	m	1,491	$ 30.00	$ 44,730
3.4	Erosion and sediment control	ea	4	$ 9,000	$ 36,000
3.5	Access track 5m, A34 geofabrics, 150mm CBR45, 200mm rock	m	300	$ 547.00	$ 164,100
3.6	Working pad at ends of HDD 5m, A34 geofabrics, 150mm CBR45, 200mm rock	m^2	5,600	$ 109.40	$ 612,640
3.7	Traffic control	Item	1	$ 50,000	$ 50,000
3.8	Clearing and grubbing	m^2	200	$ 2.00	$ 400
3.9	Stripping topsoil to stockpile (assuming 100mm)	m^3	240	$ 11.00	$ 2,640
3.10	Respread topsoil	m^3	240	$ 27.00	$ 6,480
3.11	Hydromulching	m^2	2,400	$ 3.00	$ 7,200
3.12	ASS soil treatment to Entry/Exit pits, 15kg/m^3	m^3	160	$ 50.00	$ 8,000
3.13	ASS soil treatment to spoil from drill cuttings, (assume covered in instal rate)	m^3	0	$ -	$ -
3.14	Mobilisation of HDD Maxi Rigs and Support equipment to site. Set up and establishment on First HDD site (Site 1)	Item	1	$ 250,000	$ 250,000
3.15	Remobilisation of HDD Maxi rig between sites (to HDD6)	Item	1	$ 166,000	$ 166,000
3.16	Demobilisation of all HDD equipment from site, HSEQ, QA and WAE information	Item	1	$ 166,000	$ 166,000
3.17	Air Valves including odour filter - for OD280	ea	4	$ 18,590	$ 74,360
3.18	Air Valves including odour filter - for OD450	ea	4	$ 25,180	$ 100,720
4.0	**HDD1 (857m)**				**$ 4,907,100**
4.1	Design Verification, Review and Optioneering - 1-3 Maxi bores	Item	1	$ 62,562	$ 62,562
4.2	Supply and unload OD280 PN20 pipe	m	857	$ 119.00	$ 101,983
4.3	Supply and unload OD450 PN20 pipe	m	857	$ 308.00	$ 263,956
4.4	Weld, string, and test OD280 PN20 pipe	m	857	$ 136.11	$ 116,646
4.5	Weld, string, and test OD450 PN20 pipe	m	857	$ 259.28	$ 222,203
4.6	Pilot Bore, Ream and Installation of OD280 pipe	m	857	$ 1,905	$ 1,632,585
4.7	Pilot Bore, Ream and Installation of OD450 pipe	m	857	$ 2,845	$ 2,438,165
4.8	Pressure testing	ea	2	$ 9,500	$ 19,000
4.9	Pigging	ea	2	$ 25,000	$ 50,000
5.0	**HDD5 (634m)**				**$ 3,664,457**
5.1	Design Verification, Review and Optioneering - 1-3 Maxi bores	Item	1	$ 62,562	$ 62,562
5.2	Supply and unload OD280 PN20 pipe	m	634	$ 119.00	$ 75,446
5.3	Supply and unload OD450 PN20 pipe	m	634	$ 308.00	$ 195,272
5.4	Weld, string, and test OD280 PN20 pipe	m	634	$ 136.11	$ 86,294
5.5	Weld, string, and test OD450 PN20 pipe	m	634	$ 259.28	$ 164,384
5.6	Pilot Bore, Ream and Installation of OD280 pipe	m	634	$ 1,905	$ 1,207,770
5.7	Pilot Bore, Ream and Installation of OD450 pipe	m	634	$ 2,845	$ 1,803,730
5.8	Pressure testing	ea	2	$ 9,500	$ 19,000
5.9	Pigging	ea	2	$ 25,000	$ 50,000
6.0	**Connection**				**$ -**
6.1	Connection (cost incl in OTE estimate)	Prov Sum	1	$ -	$ -
7.0	**Biodiversity credits**				**$ 400,000**
7.1	Biodiversity credits	Prov Sum	1	$ 400,000	$ 400,000
				TOTAL	**$ 14,881,053**

https://projectsportal.ghd.com/sites/pp14_10/oceanshoresstptobrun/ProjectDocs/12649325-EST-001_A_Summary Cost Estimates.xlsx

GHD PROJECT NUMBER: 12649325
OCEAN SHORES STP TO BRUNSWICK VALLEY STP TRANSFER PIPELINE
COST ESTIMATE OF ALIGNMENT 5

Item	Description	Unit	Quantity	Rate	Amount
1.0	**HDD Preliminaries**				**$ 58,000**
1.1	Establishment	Item	1	$ 30,000	$ 30,000
1.2	Demobilisation	Item	1	$ 20,000	$ 20,000
1.3	Management plans	Item	1	$ 8,000	$ 8,000
2.0	**OTE Sections**				**$ 3,461,967**
2.1	OTE sections (Alder Constructions Estimate)	Item	1	$ 3,461,967	$ 3,461,967
3.0	**Horizontal Directional Drilling - Setup**				**$ 1,770,850**
3.1	Site facilities and management at ends of HDD	ea	4	$ 15,000	$ 60,000
3.2	Environmental management plan and implementation for ends of HDD	ea	4	$ 12,000	$ 48,000
3.3	Surveys	m	1576	$ 30.00	$ 47,280
3.4	Erosion and sediment control	ea	4	$ 9,000	$ 36,000
3.5	Access track 5m, A34 geofabrics, 150mm CBR45, 200mm rock	m	250	$ 547.00	$ 136,750
3.6	Working pad at ends of HDD 5m, A34 geofabrics, 150mm CBR45, 200mm rock	m^2	5600	$ 109.40	$ 612,640
3.7	Traffic control	Item	1	$ 50,000	$ 50,000
3.8	Clearing and grubbing	m^2	750	$ 2.00	$ 1,500
3.9	Stripping topsoil to stockpile (assuming 100mm)	m^3	200	$ 11.00	$ 2,200
3.10	Respread topsoil	m^3	200	$ 27.00	$ 5,400
3.11	Hydromulching	m^2	2000	$ 3.00	$ 6,000
3.12	ASS soil treatment to Entry/Exit pits, 15kg/m3	m^3	160	$ 50.00	$ 8,000
3.14	ASS soil treatment to spoil from drill cuttings, (assume covered in instal rate)	m^3	0	$ -	$ -
3.15	Mobilisation of HDD Maxi Rigs and Support equipment to site. Set up and establishment on First HDD site (Site 2)	Item	1	$ 250,000	$ 250,000
3.16	Remobilisation of HDD Maxi rig between sites (to HDD6)	Item	1	$ 166,000	$ 166,000
3.17	Demobilisation of all HDD equipment from site, HSEQ, QA and WAE information	Item	1	$ 166,000	$ 166,000
3.18	Air Valves including odour filter - for OD280	ea	4	$ 18,590	$ 74,360
3.19	Air Valves including odour filter - for OD450	ea	4	$ 25,180	$ 100,720
4.0	**HDD4 (942m)**				**$ 5,380,753**
4.1	Design Verification, Review and Optioneering - 1-3 Maxi bores	Item	1	$ 62,562	$ 62,562
4.2	Supply and unload OD280 PN20 pipe	m	942	$ 119.00	$ 112,098
4.3	Supply and unload OD450 PN20 pipe	m	942	$ 308.00	$ 290,136
4.4	Weld, string, and test OD280 PN20 pipe	m	942	$ 136.11	$ 128,216
4.5	Weld, string, and test OD450 PN20 pipe	m	942	$ 259.28	$ 244,242
4.6	Pilot Bore, Ream and Installation of OD280 pipe	m	942	$ 1,905	$ 1,794,510
4.7	Pilot Bore, Ream and Installation of OD450 pipe	m	942	$ 2,845	$ 2,679,990
4.8	Pressure testing	ea	2	$ 9,500	$ 19,000
4.9	Pigging	ea	2	$ 25,000	$ 50,000
5.0	**HDD5 (634m)**				**$ 3,664,457**
5.1	Design Verification, Review and Optioneering - 1-3 Maxi bores	Item	1	$ 62,562	$ 62,562
5.2	Supply and unload OD280 PN20 pipe	m	634	$ 119.00	$ 75,446
5.3	Supply and unload OD450 PN20 pipe	m	634	$ 308.00	$ 195,272
5.4	Weld, string, and test OD280 PN20 pipe	m	634	$ 136.11	$ 86,294
5.5	Weld, string, and test OD450 PN20 pipe	m	634	$ 259.28	$ 164,384
5.6	Pilot Bore, Ream and Installation of OD280 pipe	m	634	$ 1,905	$ 1,207,770
5.7	Pilot Bore, Ream and Installation of OD450 pipe	m	634	$ 2,845	$ 1,803,730
5.8	Pressure testing	ea	2	$ 9,500	$ 19,000
5.9	Pigging	ea	2	$ 25,000	$ 50,000
6.0	**Connection**				**$ -**
6.1	Connection (cost incl in OTE estimate)	Prov Sum	1	$ -	$ -
7.0	**Biodiversity credits**				**$ 350,000**
7.1	Biodiversity credits	Prov Sum	1	$ 350,000	$ 350,000
				TOTAL	**$ 14,686,028**

https://projectsportal.ghd.com/sites/pp14_10/oceanshoresstptobrun/ProjectDocs/12649325-EST-001_A_Summary Cost Estimates.xlsx


GHD
ghd.com
The Power of Commitment

FOR INFORMATION ONLY

Report No. 6.1 Status update - Mullumbimby Water Supply Strategy Project

Directorate: Infrastructure Services

Report Author: Pablo Orams, Integrated Water Management Officer

File No: I2025/751

Summary:

This report aims to brief the WSAC on the status of the Mullumbimby Water Supply Strategy project, including updates on:

- Project delivery plan
- Response to previous WSAC meeting's recommendations

Feedback from the WSAC is welcomed.

Attachments:

1 NSW Gov Business Case Guidelines on a page (TPG24-29), E2025/53961 , page 207
2 Minutes 17/04/2025 Water and Sewer Advisory Committee, I2025/491 , page 209
3 Minutes 19/07/2024 Water and Sewer Advisory Committee Extraordinary, I2024/1042 , page 215

FOR INFORMATION ONLY 6.1

Report

1. Project delivery plan

1.1. Stage 1 – Project methodology development

Following the outcomes of the previous WSAC meeting (17 April 2025), and subsequent refinement of the project concept plan, Council has engaged consultancy firm Natural Capital Economics (NCEconomics) to assist in the development of a robust, best-practice methodology to deliver the desired project outcome (i.e. "provide Council with evidence-based recommendations for deciding on a long-term water supply strategy for Mullumbimby").

This stage will cost **$19,899** and will be completed before the end of **June 2025**. It will include:

- **Task 1 - Development of a decision-making framework** that aligns with the **NSW Government Business Case Guidelines - TPG24-29** (see a summary of the guidelines in **Attachment 1**). These provide an established framework to guide policy or investment decisions, and will ensure that Council's consideration of water supply options for Mullumbimby is aligned with best practice. If external public funding is required (and available), the assessments and outputs from this project can then be easily included into a detailed business case to the NSW Government.

- **Task 2 - Audit and gap analysis of previous assessments**, including (but not limited to):

    - Technical assessments of option development.
    - Extent of stakeholder/community engagement.
    - Robustness of current and projected water demand assessments.
    - Environmental, economic, financial and social impact assessments.

  This evaluation will gauge the appropriateness of previous work to feed into the decision-making framework developed in Task 1. This will be supported by engaging with Council staff and, where feasible, with previous consultants, to understand challenges and complexities with previous assessments.

- **Task 3 - Identify additional technical assessments** based on the outcomes of Task 2. Consideration will be given to appropriate sequencing of these technical assessment to inform the methodology for delivery.

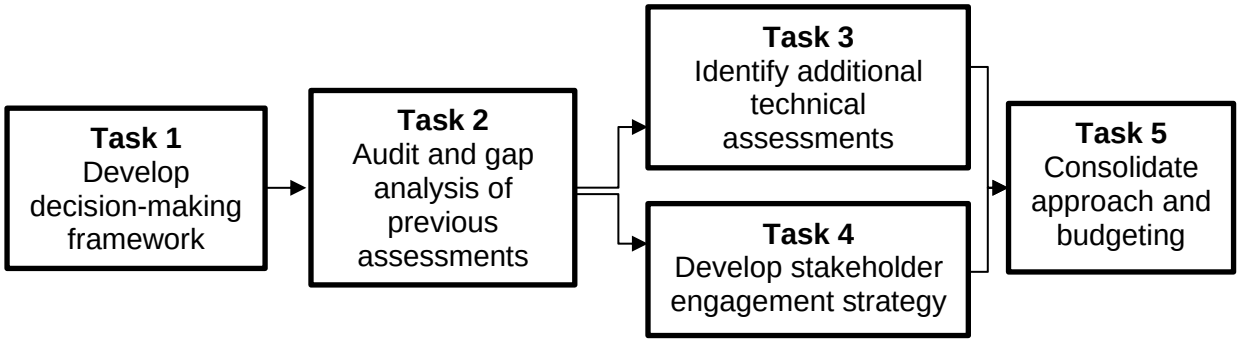
- **Task 4 - Develop robust stakeholder engagement strategy** that can directly and meaningfully feed into the decision-making process. This may include:

    - Surveys to capture specific stakeholder input into multi-criteria analysis.

- Facilitating focus groups and/or workshops to identify key social impacts from options.

- Targeted engagement with a community or stakeholder reference group or other fit-for-purpose deliberative process.

- **Task 5** - **Consolidate approach and budgeting.** This task involves consolidating findings from preceding tasks into a recommended project delivery plan and indicative budget for the next 14-16 months of work.



1.2. Stage 2 – Implementation of decision-making framework

Having developed a robust best-practice methodology and a clear delivery plan, Council will move into Stage 2 of the project, undertaking the necessary technical assessments and stakeholder engagement to feed into the decision-making framework that Council will use to make its final decision.

Completion of Stage 2 is expected by **October 2026**.

While the cost of Stage 2 is to be defined based on the outcomes of Stage 1, early estimates indicate a budget scope of **$150K to $200K**.

2. Consideration of recommendations from the WSAC

As per the minutes from the 17 April 2025 WSAC meeting (see **Attachment 2**), Report No. 4.2, the WSAC provided two recommendations:

> *"3. That Council keep the WSAC informed of subsequent changes to the project design, including between WSAC meetings."*

> *"4. That Council consider in the project the investigations previously sought by the WSAC, and recorded in its Minutes for the meeting of 19 July 2024."*

Item 3 is noted. Staff will maintain regular and transparent engagement with the WSAC.

Item 4 has been considered by staff. The "investigations previously sought by the WSAC" are outlined in Item 5 of Report 4.1 of the referred minutes (see **Attachment 3**), and summarised in the below table with comments from staff for their relevance and adequacy for the project.

WSCA recommendation	Staff comment
5. [That Council] Proceeds with the investigations previously outlined in Parts 7 and 8 of Resolution 23-120 with some additions in 8b and 8c, namely*:** ***7. [That Council] Investigates a strategy for Mullumbimby's long term water supply based on the following concept:	
a) Lavertys Gap as the source during flows in excess of environmental requirements;	Noted. This scenario has already been considered in previous investigations. To be further assessed during Task 2 and Task 3 of project Stage 1.
b) water stored off-stream between the source and Mullumbimby;	
c) water treated at a new location between the storage and Mullumbimby;	
d) water delivered to Mullumbimby and possibly beyond; and	Noted. Investigation will focus on the Mullumbimby system. Commentary on potential spare supply capacity may be provided.
e) maximising demand management, including the harvesting of roof water.	Noted. To be assessed during Task 2 and Task 3 of project Stage 1.
8. [That Council] Includes in this investigation:	
a) the topography of the terrain between Lavertys Gap and Mullumbimby, to identify potential dam sites;	Noted. While high-level commentary will be provided regarding potential locations for an off-stream storage, detailed topography assessments are not required to develop reasonable cost estimates.
b) the hydrology of Wilsons Creek and its capacity to supply, including *(i) seasonality,* *(ii) establishing environmental flows for future EPA licensing;*	Noted. To be assessed during Task 2 and Task 3 of project Stage 1.
c) the impact of climate change on supply and on demand (using up-to-date CC data and methodologies in the pilot phase for local water supply through DPE, and applied in Regional Water Strategies);	
d) infrastructure needs including offtake, storage, treatment and linkages to the town's reservoirs;	Noted. To be assessed during Task 2 and Task 3 of project Stage 1. Detailed design, technical specifications or planning consent materials, beyond those required to develop a reasonable estimate of costs, will not be pursued. The condition of Lavertys Gap weir's condition is being assessed, monitored and managed in alignment with the Utilities Department's Asset Management System.
e) environmental assessments for the creation and operation of that infrastructure, including greenhouse gas emissions;	
f) assessment of the weir at Lavertys Gap including *(i) structural integrity;* *(ii) means of creating fish passage; and* *(iii) how this proposal enhances its heritage and preservation; and*	
g) economic assessment;	Noted.

3. Next steps

Following the completion of **Stage 1** of the project, the detailed scope of work for **Stage 2** will be presented to the WSAC.

Strategic Considerations

5 Community Strategic Plan and Operational Plan

CSP Objective	CSP Strategy	DP Action	Code	OP Activity
5: Connected Infrastructure	5.5: Provide continuous and sustainable water and sewerage management	5.5.1: Water supply - Provide a continuous water supply that is maintained in accordance with NSW Health guidelines	5.5.1.20	Report to Council on the future water strategy for Mullumbimby

Business Case Guidelines on a page (TPG24-29)

NSW GOVERNMENT

Components of a business case

Investment case
Primary focus for all business cases. Establish the rationale for government action, and the reasons for recommending a specific option(s) for consideration.

Case for change	Establish what the proposal sets out to achieve, how it supports government priorities and the chain of logic that leads to success.
Options	Identify a range of realistic options that meet the proposal's objectives.
Cost-benefit analysis	Assess the costs and benefits of a range of options on the welfare of the people of NSW.
Financial analysis	Estimate financial impacts of the proposal on the finances of the entity undertaking the policy and the government as a whole.
Risk analysis	Ensure that decision-makers can carefully consider the risks associated with a proposal, by identifying, assessing, and appropriately responding to risks.
Monitoring & evaluation approach	Ensure that resourcing, accountability and data collection arrangements are in place to support evaluation.

Delivery feasibility
Establish how the preferred option will deliver on its objectives and provide confidence to decision-makers that the initiative will be delivered efficiently and effectively.

Procurement approach	Provide decision-makers with confidence that assets and services required for completion of the proposal (and delivery of its benefits) can be procured within the cost and timeframes specified by the business case.
Management approach	Provide decision-makers with confidence that the agency will deliver and implement the proposal efficiently and effectively.

? cee@treasury.nsw.gov.au

Keep in mind:

- → The purpose of a business case is to support decision-makers in the allocation of scarce resources and inform investment decisions.
- → Business cases are NOT a box-ticking exercise and should not be completed retrospectively to justify existing decisions.

- → Business cases should be proportionate to a proposal's cost and risk, as indicated by its gateway risk tier.
- → Detailed design, technical specifications or planning consent materials, beyond those required to develop a reasonable estimate of costs, are not required. This work should take place following an investment decision.

- → Business case components can be approached in order or at the same time, with iterations to account for interdependency.
- → Analysis should become more detailed as more data and information becomes available, and the proposal moves closer to investment decision.

Before starting a business case:
- Appoint a senior responsible officer.
- Complete a go/no-go document.
- Consult the relevant assurance framework, complete a risk tier self-assessment and register with the Gateway coordination agency (if required).
- Conduct targeted consultation where appropriate.
- Scope and plan the business case approach, inputs and decision pathways.

Types of business cases

Single-stage business case for smaller, less risky proposals (i.e. not rated as tier 1 or tier 2) ← **Lean business case**

Go/no-go → Supports a decision on whether a business case should be prepared

For larger, riskier proposals (tier 1 or tier 2) - narrows down options to be explored in a full business case ← **Preliminary business case**

Full business case → For larger, riskier proposals (tier 1 or tier 2) - Identifies the preferred option for an investment decision

Where a business case is not prepared, a **short-form assessment** must be submitted to NSW Treasury to support:
- recurrent proposals with a total cost between $10m–$20m (over the forward estimates)
- capital proposals with a total cost at or above $10m (over ten years) that are not registered under the Infrastructure Investor Assurance Framework (IIAF) ($10m to $20m) or are rated tier 4 under the IIAF.
- digital proposals with a total cost over $10 million (over ten years) that are rated as tier 4 under the Digital Assurance Framework.

How NSW Treasury assesses business cases

Strategic fit
Is there a clear rationale for the proposal that supports current government priorities?

Societal impact
Is economic, social, cultural and environmental value demonstrated?

Affordability
Are costs understood and affordable within the current budget context?

Deliverability
Can the proposal be effectively and efficiently delivered?

NSW Treasury

Business Case Guidelines on a page (TPG24-29)

NSW GOVERNMENT

How developed should business case components be?

Component			Go/no-go	Preliminary business case	Full business case		Lean business case	Short-form assessment
			Tiers 1 to 3	Tier 1 and Tier 2	Tier 2	Tier 1	Tier 3 [e]	Tier 4
Investment case	Case for change		Preliminary	Comprehensive	Comprehensive	Comprehensive	Comprehensive	Comprehensive
	Options		Conceptual	Preliminary	Comprehensive	Comprehensive	Comprehensive	Comprehensive [d]
	Cost-benefit analysis		Conceptual	Preliminary	Comprehensive	Comprehensive	Comprehensive	Conceptual
	Financial analysis	Financial appraisal	N/A	Preliminary [a]	Comprehensive [a]	Comprehensive [a]	Comprehensive [a]	N/A
		Financial Impact Statement	Conceptual	Preliminary	Comprehensive	Comprehensive	Preferred option only	Preferred option only
	Risk analysis	Risk register, residual risks	Conceptual	Preliminary	Comprehensive	Comprehensive	Comprehensive	Comprehensive
	Monitoring and Evaluation approach	High-level monitoring and evaluation plan	N/A	N/A	High-level	High-level	High-level	High-level
Delivery feasibility	Procurement approach	Market capability and capacity	Conceptual [b]	Conceptual [b]	High-level	Comprehensive	High-level	N/A
		Delivery model	Conceptual [b]	Conceptual [b]	High-level [c]	Comprehensive	Summary or evidence of previous delivery	N/A
	Management approach	Delivery schedule, governance framework	As relevant to support next stage	As relevant to support next stage	High-level	Comprehensive	Summary or evidence of previous delivery	High-level
		Resourcing and management	As relevant to support next stage	As relevant to support next stage	Summary or evidence of previous delivery	High-level	Summary or evidence of previous delivery	N/A

[a] Not required if no significant commercial returns or revenues, or financing arrangements outside of government funding. See section 3.4 of the Business Case Guidelines (TPG24-29).
[b] Include details likely to influence a decision to proceed to next stage of proposal development.
[c] Comprehensive assessment may be required in certain circumstances. See section 4.1 of the Business Case Guidelines (TPG24-29).
[d] Comprehensively define a preferred option and provide high-level explanation why it is preferred over other options.
[e] Lean business case also applies to recurrent proposals values over $20 million that do not require assurance registration and Tier 4 recurrent proposals.

Legend	
Conceptual	Limited to key points based on existing information and evidence.
Preliminary	Completed with a basic level of detail and accuracy, that will be refined during the full business case.
High-level	Detailed plans not required. Focus on demonstrating capability and capacity to efficiently and effectively procure, manage and evaluate the proposal.
Comprehensive	Complete. Rigour of analysis not expected to increase following investment decision, but detail may be amended as more evidence comes to light.

? cee@treasury.nsw.gov.au NSW Treasury

Minutes of Meeting

Water and Sewer Advisory Committee Meeting

Venue	**Conference Room, Station Street, Mullumbimby**
Date	**Thursday, 17 April 2025**
Time	**11:30 AM**

BYRON SHIRE COUNCIL

BYRON SHIRE COUNCIL

WATER AND SEWER ADVISORY COMMITTEE MEETING MINUTES 17 APRIL 2025

Minutes of the Water and Sewer Advisory Committee Meeting held on Thursday, 17 April 2025

File No: I2025/491

PRESENT:

Councillors:	Cr S Ndiaye (Mayor)	Zoom
	Cr M Lyon	Zoom
	Cr E Hauge (Chair)	Present
Staff:	Christopher Soulsby (Acting Director Infrastructure Services)	Present
	Cameron Clark (Manager Utilities)	Present
	Pablo Orams (Integrated Water Management Officer)	Present
	Rachel Derbyshire (Project Liaison Officer)	Present
	Amber Evans Crane Corporate Planning & Improvement Officer)	Present
	Chloe Woods (Minute taker)	Present
Community	Duncan Dey	Present
	Ben Fawcett	Present
	Taisa Baars	Present

The Water and Sewer Advisory Committee voted Cr Hauge as Chair.

Cr Hauge (Chair) opened the meeting at 11:33 am and acknowledged that the meeting was being held on Bundjalung Country.

BYRON SHIRE COUNCIL

WATER AND SEWER ADVISORY COMMITTEE MEETING MINUTES 17 APRIL 2025

ATTENDANCE VIA AUDIO-VISUAL LINK:

Cr S Ndiaye (Mayor) and Cr Lyon attended via Zoom Link.

APOLOGIES:

An apology was received from Phillip Holloway (Director Infrastructure Services).

DECLARATIONS OF INTEREST – PECUNIARY AND NON-PECUNIARY

Ben Fawcett declared a non-pecuniary interest in Report 4.2. The nature of the interest being that Ben Fawcett's residence is less than 1km from Lavertys Gap Weir and 500m from the water treatment plant. Ben Fawcett elected to remain in the Meeting and will participate in discussion and the vote.

MINUTES FROM PREVIOUS MEETINGS

Report No. 3.1 **Adoption of minutes from Previous Meeting**
File No: I2025/480

Moved:

That the minutes of the Water and Sewer Advisory Committee Meeting held on 19 July 2024 be confirmed.

(Ndiaye/Fawcett)

Note: The minutes of the meeting held on 19 July 2024 were noted, and the Committee Recommendations adopted by Council, at the Ordinary Meeting held on 15 August 2024.

STAFF REPORTS - CORPORATE AND COMMUNITY SERVICES

Report No. 4.1 **Integrated Planning and Reporting**
File No: I2025/481

Committee Recommendation:

That the Water and Sewer Advisory Committee:

1. **Notes Council's Integrated Planning and Reporting Framework;**

2. **Notes Council's priorities as identified by Councillors for the 2025 – 2029 and Delivery Program** (Fawcett/Baars)

The recommendation was put to the vote and declared carried.

Cr Hauge left the meeting at 12:28 pm and returned to the meeting at 12:28 pm.

STAFF REPORTS - INFRASTRUCTURE SERVICES

Report No. 4.2 **Mullumbimby water supply strategy - High-level project plan**
File No: I2025/395

Committee Recommendation:

1. **That the Water and Sewer Advisory Committee notes the proposed project design**

2. **That the Committee provides feedback to staff on how to improve the project design, in alignment with: -**

a) **The aim of the project i.e. provide evidence-based recommendations for Council to decide on a long-term water supply strategy for Mullumbimby**

b) **The need to provide best-value to ratepayers via sustainable and efficient water services provision**

3. **That Council keep the WSAC informed of subsequent changes to the project design, including between WSAC meetings.**

4. **That Council consider in the project the investigations previously sought by the WSAC, and recorded in its Minutes for the meeting of 19 July 2024.**

(Dey/Hauge)

The recommendation was put to the vote and declared carried.

BYRON SHIRE COUNCIL

WATER AND SEWER ADVISORY COMMITTEE MEETING MINUTES 17 APRIL 2025

Rachel Derbyshire left the meeting at 12:45pm and did not return.

Report No. 4.3 **Byron STP Wetlands Monitoring Report**
File No: I2025/470

Committee Recommendation:

That the committee note the report. (Lyon/Hauge)

The recommendation was put to the vote and declared carried.

FOR INFORMATION ONLY

Report No. 6.1 **Infrastructure Services Utilities Monthly Status Report December 2024 - February 2025**
File No: I2025/434

Cr Lyon left the meeting 12:53 pm and did not return.
Quorum was lost at 12:53pm and the Chair, Cr Hauge, subsequently declared the meeting closed.

There being no further business the meeting concluded at 12:54 pm.

Minutes of Meeting

Extraordinary Water and Sewer Advisory Committee Meeting

Venue	**Conference Room, Station Street, Mullumbimby**
Date	**Friday, 19 July 2024**
Time	**10:00 AM**

BYRON SHIRE COUNCIL

EXTRAORDINARY WATER AND SEWER ADVISORY COMMITTEE MEETING
MINUTES 19 JULY 2024

Minutes of the Extraordinary Water and Sewer Advisory Committee Meeting held on Friday, 19 July 2024

File No: I2024/1042

PRESENT:

Councillors:	Cr C Coorey	Present
	Cr M Lyon	Present
	Cr S Ndiaye	Present
	Cr D Dey	Present
	Cr A Pugh	Present
Staff:	Phil Holloway (Acting General Manager)	Present
	Cameron Clark (Manager Utilities)	Present
	Annie Lewis (Media Communications Coordinator)	Present
	Chloe Woods (Minute taker)	Present
Community	Elia Hauge	Present
	David Fligelman	Apology
	Ben Fawcett	Present
	Bruce Clarke	Present
Visitors	Peter Trute	Present

Cr Sarah Ndiaye (Chair) opened the meeting at 10:13am and acknowledged that the meeting was being held on Bundjalung Country.

ATTENDANCE VIA AUDIO-VISUAL LINK:

Cr Arsen Pugh attended via Audio-Visual Link.

APOLOGIES:

Apologies were received from David Fligelman.

DECLARATIONS OF INTEREST – PECUNIARY AND NON-PECUNIARY

Ben Fawcett declared non-pecuniary interest in Report No. 4.1. The nature of the interest being that Ben Fawcett's residence is less than 1km from Lavertys Gap Weir and 500m

from the water treatment plant. Ben Fawcett elected to remain in the Meeting and will participate in discussion and the vote.

Elia Hauge declared a pecuniary/non-pecuniary interest in Report No. 4.1. The nature of the interest being that In Elia's role as an engineer at Greg Alderson Associates, Elia is working on a project for NSW Public Works that involves remediation design for a Rous Water pipeline. Elia Hauge elected to remain in the Meeting and will participate in discussion and the vote.

ADOPTION OF MINUTES FROM PREVIOUS MEETINGS

Report No. 3.1 **Adoption of Minutes from Previous Meetings**
File No: I2024/984

Committee Recommendation:

That the minutes of the Water and Sewer Advisory Committee Meeting held on 30 May 2024 be confirmed. (Fawcett/Clarke)

The recommendation was put to the vote and declared carried.

STAFF REPORTS - INFRASTRUCTURE SERVICES

Cr Ndiaye left the meeting at 11:04am and returned at 11:05 am.

Report No. 4.1 **Mullumbimby Water Supply Strategy Public Consultation Report**
File No: I2024/1032

Committee Recommendation:

That Council:

1. **Publicly thanks the community for its participation in making more than 433 Your-Say submissions during June 2024 on Mullumbimby's future water supply;**

2. **Acknowledges that 89% of 411 valid Your-Say respondents oppose abandoning the Wilsons Creek source (Lavertys Gap), while 6% are neutral and 5% support;**

3. **Notes that Hydrosphere's report "Mullumbimby Water Supply Strategy" of December 2021 does not investigate Option 2 (adding off-stream storage and retaining the Wilsons Creek source) to the extent suggested in Council's**

Resolution 23-120 and that it assesses Option 3 (Rous only) without Dunoon Dam which is now included in Rous's forward water source planning;

4. Notes the following extract from the North Coast Enabling Regional Adaptation, North Coast Region Report (NSW Office of Environment and Heritage, 2019) which states on page 15:

"Under a transformed system for infrastructure [,] water systems are smaller, localised and decentralised with multiple redundancies providing tailored and integrated solutions"

5. Proceeds with the investigations previously outlined in Parts 7 and 8 of Resolution 23-120 with some additions in 8b and 8c, namely:

7. Investigates a strategy for Mullumbimby's long term water supply based on the following concept:
- ***a) Lavertys Gap as the source during flows in excess of environmental requirements;***
- ***b) water stored off-stream between the source and Mullumbimby;***
- ***c) water treated at a new location between the storage and Mullumbimby;***
- ***d) water delivered to Mullumbimby and possibly beyond; and***
- ***e) maximising demand management, including the harvesting of roof water.***

8. Includes in this investigation:
- ***a) the topography of the terrain between Lavertys Gap and Mullumbimby, to identify potential dam sites;***
- ***b) the hydrology of Wilsons Creek and its capacity to supply, including (i) seasonality, (ii) establishing environmental flows for future EPA licensing;***
- ***c) the impact of climate change on supply and on demand (using up-to-date CC data and methodologies in the pilot phase for local water supply through DPE, and applied in Regional Water Strategies);***
- ***d) infrastructure needs including offtake, storage, treatment and linkages to the town's reservoirs;***
- ***e) environmental assessments for the creation and operation of that infrastructure, including greenhouse gas emissions;***
- ***f) assessment of the weir at Lavertys Gap including (i) structural integrity; (ii) means of creating fish passage; and (iii) how this proposal enhances its heritage and preservation; and***
- ***g) economic assessment;***

6. Notes the successful upgrade to Kyogle's water supply which included off stream storage and creation of fish passage on the existing weir in the Richmond River.

BYRON SHIRE COUNCIL

7. Supports Council consulting with landowners of properties currently supplied from the pressure line between the Water Treatment Plant at Lavertys Gap and the reservoir near Azalea Street, by

a. Listening to their wishes, and

b. Considering outcomes including a reticulation pipeline returning from Azalea Street reservoir to those properties. (Dey/Clarke)

Cr Coorey and Cameron Clark left the meeting at 11:29am and did not return.

The recommendation (Dey/Clarke) was put to the vote and declared carried.
Cr Lyon voted against the motion.
Cr Coorey was not present for the vote.

There being no further business the meeting concluded at 12:43pm.

FOR INFORMATION ONLY 6.2

Report No. 6.2 Byron Bay Sewage Treatment Plant Master Plan Update

Directorate: Infrastructure Services

Report Author: John Hart, Senior Project Manager
Dean Baulch, Principal Engineer, Systems Planning

File No: I2025/766

Byron Bay STP Master Plan - Status Summary for Information Only:

Council retained GHD Pty Ltd (GHD) to conduct a Master Plan for the Byron Bay Sewage Treatment Plant (BBSTP).

Key Findings:

- Inlet flows to BBSTP (2017–2023 data) are nearing 80% of its design capacity for Average Dry Weather Flow (ADWF).
- BBSTP is at the threshold for planning on capacity augmentation.

Master Plan Scope:

- Re-baselined actual inflow and loadings from the catchment.
- Forecast how long the current plant can continue delivering compliant service under EPA licence: Results suggest that BBSTP shall remain compliant with its current EPA licence conditions up until 2036 and 2041, subject to the growth experienced between now and that period.
- Identified the timing and need for major treatment process upgrades.

Interim Work:

- GHD conducted detailed flow and load sampling to inform planning.
- Several short- and medium-term projects have been identified for Council's capital works program.
- Interim upgrades will be required before major augmentation begins.

Status:

- Final Master Plan report to be delivered early next financial year.
- A more detailed update will follow upon receipt of the final report.

A timeline of planning stages:

- The design and approvals are forecast to take 2-3 years to complete
- Procurement and construction would take 1-2 years.

- Utilities will plan to repeat the BBSTP loading assessment and capacity re-baselining in ~2030 to inform when the planning process should commence for the augmentation.

Overview of new approvals or licences likely required for the upgrade:

- An Environmental Impact Statement (with its ancillary companion studies) and application for an Environmental Protection Licence amendment shall be the principal major components for the Development Application for the augmentation works.