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IWCM Strategy
Coarse Screening of Climate Change Options

Workshop 1

To	MidCoast Council	Page	6
CC	Workshop Attendees		
Subject	IWCM Strategy Workshop 1 - Coarse Screening of Climate Change Options		
From	AECOM		
File/Ref No.	60696228	Date	6-Dec-2022

Introduction

The Coarse Screening of climate change options is the first step in the “all options on the table” approach as part of MidCoast Council’s (Council) Integrated Water Cycled Management (IWCM) Strategy. A comprehensive list of options to enhance the resilience of the development of the IWCM Strategy to climate change has been evaluated, including options that improve Council’s resilience to climate change and opportunities that support Council’s path to Net Zero emissions. Each option has been investigated to identify the key risks, issues and opportunities relating to climate change within the context of the local government area, prior to completing a coarse screening assessment based on a fatal flaw approach. The outcome of the project will be a short-list of options that pass the coarse screening and move into a quadruple bottom line investigation, for consideration in the scenarios phase of the IWCM strategy.

The coarse screening workshop will present the list of climate change hazards and potential impacts for IWCM options for discussion and endorsement of a short-list of options for further investigation. This briefing paper provides background information for workshop attendance.

Background

IWCM takes a holistic approach to effective and sustainable urban water supply and sewerage business. The IWCM Strategy sets the objectives, performance standards and associated performance indicators, while ensuring infrastructure meets the needs and priorities of the community and stakeholders. This process aims to develop a 30-year IWCM scenario that best meets the needs of the region on a social, environmental, economic and governance (quadruple bottom line) basis.

Council is currently reviewing their IWCM Strategy. One of the key issues identified was the risk of climate change impacts to Council’s assets and operations. The area of investigation is depicted in **Figure 1**.

A high-level climate change exposure assessment revealed that sea level rise, extreme storm events, flooding, bushfires, drought and extreme heat are the primary climate hazards posing threat to Council’s assets and operations. This exposure assessment was performed using climate projections which assume global greenhouse gas emissions remain high and continue to rise at a similar rate to today. The climate projections were calculated for the short term (2030) and long term (2090) and are summarised in **Table 1**. Options to reduce risk and increase resilience of Council assets and operations to climate change will be explored in the workshop. Adaptation options for drought (and therefore water security) will not be explored explicitly in this workshop as it is will be explored in detail at a subsequent workshop.

Additionally, Council has committed to achieve net zero greenhouse gas emissions and 100% renewable energy for its operations by 2040. Therefore, options to help Council achieve their net zero and renewable energy goals will be investigated.

Figure 1 MidCoast Council local government area

Table 1 MidCoast Climate Projections

	2030	2090
Mean temperature change	Average temperatures are expected to increase by 1.0°C, with Max and Min increasing by up to 1.4°C and 1.2°C respectively	Average temperatures are expected to increase by 3.7°C, with Max and Min increasing by up to 4.9°C and 4.7°C respectively
Extreme heat	Extreme heat days and heat waves are anticipated to increase in frequency and duration with very high confidence	Average annual number of days above 35°C for the MidCoast region are projected to increase from 3.1 days (current) to 15 days in 2090
Extreme rainfall – inland flooding	Extreme rainfall events to increase in intensity and severity	Extreme rainfall events to increase in intensity and severity
Sea level rise – coastal flooding	Sea level projected to rise on average to 0.10 to 0.19 metres	Sea level projected to rise on average to 0.45 to 0.88 metres
Bushfires	Increased fire weather risk with severe fire weather days to increase by an average of 45%	Increased fire weather risk with severe fire weather days to increase by an average of 130%

Assessment Approach and Criteria

The coarse screening will be based on a fatal flaw approach. Each climate security option will be assessed against the agreed assessment criteria as assigned a score:

Pass Option meets the criteria and should progress for further investigation

Fail Option does not meet the criteria and should not progress for further investigation

Unknown Option not scored due to lack of information, therefore progress for further investigation

The assessment criteria are provided in **Table 2**. The criteria were developed by the project team based on:

- Council's values,
- Council's Risk Management Framework,
- AECOM's experience with similar projects, and
- Advice from Department of Planning and Environment (DPE).

Table 2 Assessment Criteria

Council Values	Council Risk Category	Indicator for Coarse Screening	Description and Objectives of Indicator
Wellbeing	Worker and public health & wellbeing	Health and wellbeing	Construction and operating/maintenance risks Delivering the option in a safe manner to customers- both during construction and service delivery
	Service delivery & infrastructure	Beneficial to pursue	Option will give a measurable improvement in climate resilience and/or lead to reduction in carbon emissions
		Practically viable	Option can be delivered by Council and external support
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework
	Project timeline	Timeline for planning and delivery	Adaptive planning considerations. Is the timeline required for planning pathways and delivery known? Are there any unknowns about the planning and delivery pathway for this option?
	Financial Project budget	Cost- capital	Capital costs (qualitative only)
		Cost – O&M	Operating and maintenance costs (qualitative only)
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts
		Sustainability and resource consumption	Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact) Option aligns with principles of ecologically sustainable development and intergenerational equity
Respect	Reputation	Community acceptance	Option likely to have community support (based on assumption that there is enough information for the community to make a balanced judgement)

Long list of Climate Change Security Options

A wide range of climate change options have been investigated, taking an “all options on the table” approach. Noting there will be localised opportunities specific to each site, at a high level these options include:

1. Relocation of plant and equipment
2. Network reconfiguration
3. Active management / operational changes
4. Erosion management
5. On-site bunding
6. Elevation of electrics
7. Drainage works
8. Alternative power supply
9. Automation of plant
10. Buffer zones

A summary of the options considered is presented in Table 2.

Coarse Screening Workshop

During the coarse screening workshop, we will present the evaluation of each climate change hazard and option that were investigated. We will present the outcome of a preliminary coarse screening completed by the project team for discussion with the workshop group. The outcome of this workshop will be an endorsed short-list of climate change options for further investigation prior to development of the IWCM Strategy.

Next steps

Following the workshop, the project team will progress with development and assessment of IWCM scenarios, including quadruple bottom line analysis and financial modelling to inform the identification of the preferred IWCM Strategy.

Table 2 Long-list of Climate Change Options

Hazard	Impact / Risk	Assets impacted (not exhaustive)	Option / Opportunity	Comment

Sea level rise	Coastal inundation of plant	• Manning Point Sewage Treatment Plant (STP)
		• Sewage Pumping Stations (SPS) located below 2100 high tide, including:
		  ○ Manning Point
		  ○ Hawks Nest (Winda Woppa)
		  ○ Pacific Palms
		  ○ Smiths Lake
		  ○ Harrington
		• Numerous Water Pumping Stations (WPS) located below 2100 high tide
			• Relocate plant
			• Network reconfiguration to distribute resilience through network
			• Active management i.e., operational changes to manage extreme high tides (e.g. avoid use of plant when king tides / storm events are predicted)
				• Although Manning Point STP is above the 2100 high tide mark, most of Manning Point township would be regularly inundated.
				• Coastal inundation is a long-term risk that is likely outside timeframe of IWCM, although it is something to consider when renewing assets
				• Options should be explored on a case-by-case basis

	Exfiltration ponds impacted by erosion	• Old Bar STP	• Erosion management (i.e. rock revetment, groins / breakwaters, sea wall) • Relocate exfiltration beds • Replace beds with ocean outfall	• Need to understand why the assets were originally located adjacent to the coast? May they be moved further inland?
Extreme storm events	Effluent ponds impacted by erosion	• Manning Point STP	• Erosion management (i.e. rock revetment, groins / breakwater, sea wall)	
	Excessive pollution from STPs	• Harrington STP	• Alternative discharge options in wet weather • Inflow and infiltration reduction within network to reduce baseline and wet weather ingress to STP	• Council has a dedicated inflow and infiltration team
	Water quality	• Bootawa WTP	• Dissolved Air Filtration (DAF) pre-treatment to manage water quality pumped into dam	• May be necessary to pump dam when river quality is poor
	Damage to buildings, structures and the network from windblown debris (trees, rocks etc.)	• STPs / WTPs – General • SPSs / WPSs • Networks - Stormwater	• Vegetation management plans with appropriate clearance zones • Regular façade and debris audits on vulnerable sites	
Flooding	Flood inundation of assets	• Wingham STP, SPS 04 and SPS 01 • Bulahdelah SPS 01 • Taree SPS 01, SPS 02, SPS 10 • TA (south)-SPS-03 and TA-SPS-05 • WG-SPS-04 • CO-SPS-05 • Figtree Flow Meter • TWEMS buildings • Numerous WPSs • Pipeline assets	• Raise critical assets • On-site bunding • Elevate electrics / switchboard out of flood zone • Relocate storage ponds out of flood zone (i.e., fully enclose or elevate) • Relocate entire STP • Manipulate site drainage • Dual power supply or alternative back up • Improve system resilience within network with alternative pumping arrangements. • Renew pipeline assets at risk of flooding and relocate underground. • Transfer flow from Wingham to Dawson and decommission Wingham STP	• Wingham STP was fully inundated in 2022 flooding • What is the required height for bunding? • Ensure that bunding does not trap water onsite • How high should electrics be raised? Probable Maximum Flood level or 0.5m above 100-year flood level? • What is needed to maintain STP operation during floods and/or get back online quickly other than elevation of electrics? • Queanbeyan-Palerang Regional Council chose to relocate storage ponds out of flood zone. This option had higher emissions but lower flood risks • Above ground pipelines / aqueducts are at risk of damage from flooding
	Restricted access to assets	• Gloucester STP and WTP • TA SPS 01	• Operational plan to manage access issues • Improve automation at plant	• Gloucester STP was only accessible by boat during 2022 floods • Upgrade to Gloucester STP is required in the short term • A new WTP at Gloucester is required within the next 10 years • Regional interconnection with Manning via Krambach removes need for WTP at Gloucester.

Hazard	Impact / Risk	Assets impacted (not exhaustive)	Option / Opportunity	Comment

Bushfires and hazard reduction burnoffs	Full or partial fire damage to asset and/or power supply	• STPs – General
		• Bootawa WTP and Gloucester WTP
		• Most plants at some risk due to disruption of access and operation
			• Bushfire management plan
			• Cleared buffers on site
			• Secure power supply
			  ○ Provision of on-site generators
			  ○ Solar panels with battery storage
			  ○ Hydro electricity generation
				• Potential to locate panels on Bootawa or Peg Leg Dam (Peg Leg Dam preferred due to larger size)
				• In-line hydro electricity generation connected from Peg Leg Dam to WTP

Extreme heat	Increased risk of power failure	• STPs – General	• Solar panels with battery storage	• Battery storage increases resilience via provision of back-up power • Treatment team to inform of any impacts to operation
	Increased use of air-conditioning increases power bills	• WTPs – General	• Solar panels with battery storage	
	Increased risk of mechanical failure of critical assets (pumps)	• WTPs – General	• Install additional air-conditioning, fans and insulation • Consider building design for passive cooling	
	Increased risk of algal blooms, anoxic conditions	• Dams	• Selective pumping into off-stream storage • DAF • Aeration	
Combination of hazards	Poor water quality due to flooding, bushfires etc	• WTPs – General	• Increased backwashing	• Additional energy / water / chemical usage

N/A	N/A	• Assets – General	• Energy generation / net zero
			  ○ Provision of solar panels on off-stream storage ponds
			  ○ Hydro electricity generation
			• Efficiency gains
			  ○ Review design of STPs to look at resident times
			  ○ Baffles to redirect flow and increase efficiency
				• Solar panels on off-stream storage ponds may generate electricity and reduce evaporation
				• In-line hydro electricity generation on pipeline from Krambach to Gloucester. This interconnection would require two lift stations along route. There would be opportunity to recapture some energy on gravity sections.

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Minutes of Meeting

IWCM Strategy Options and Scenarios

Subject	Climate Change Coarse Screening Workshop	Page	3
Venue	Yalawanyi Ganya	Time	10:00 - 13:00
Participants	Rachael Abberton, MidCoast Project Manager and Water Planning Engineer Shane Beeton, MidCoast Manager Water Operations Dave Boland, MidCoast Coordinator Water Quality and Process Daniel Brauer, AECOM Project Director Marnie Coates, MidCoast Executive Manager Water and Systems Tracey Hamer, MidCoast Manager Water Planning and Assets Janice Moody, AECOM Strategic Planning Lead Water Sara Wilson, MidCoast Community Relation and Education Coordinator Chenxi Zeng, MidCoast Manager Water Management and Treatment Zena Smith-White, AECOM Project Manager and Strategic Planning Lead Wastewater Jesse Sourness, AECOM Sustainability and Resilience Lead Lakshu Suri, AECOM Water and Wastewater Planner Gerard Tuckerman, MidCoast Manager Natural Systems; Acting Manager Land Use Planning		
Apologies	Mitchell Stace, MidCoast Manager Water Project Delivery		
File/Ref No.	60696228	Date	06-Dec-2022
Distribution	As above		

No	Item	Action	Date
1.	**Opening – acknowledgement of Country and workshop agenda** Refer **Attachment A** for Presentations Slides		
2.	**Values Moment** AECOM shared a Safeguard moment around road safety and the need to be vigilant particularly at this time of year with many travelling long distances to be with loved ones.		
3.	**Introductions and workshop objectives and outcomes** Workshop objectives: • Present the long-list of climate change options for discussion • Undertake a coarse screening of the long-list of options • Agree the short-list of options for further investigation Workshop outcome: • To endorse a short-list of climate change options for further investigation prior to development of the IWCM Strategy		

No	Item	Action	Date
4.	**Project background** The journey to date for the Integrated Water Cycle Management strategy was provided, along with an introduction to climate change risks to be considered.		
5.	**Assessment Approach and Criteria** The assessment criteria and assessment methodology were shared. Scoring descriptors, Pass, Fail or Unknown were described for application in assessing each category of the criteria.		
6.	**Workshop Session 1: Sea Level Rise, Flooding and Storms** Refer to **Attachment B** for risk and opportunity assessment. Comments from discussion include: • **Generators** need a regional approach (beyond MidCoast) to make sure available when/where needed. • **Dawson STP**: potential for regional resource recovery hub, bring Wingham STP (flooding risk) and Old Bar STP (effluent management issues), consolidated process and achieve critical mass. Consider Taree/Dawson Wastewater Masterplan. • **Wingham STP**: relatively new and in good condition inundated in recent flooding. Bunding not considered practical. Potential to transfer in long term when plant due for major renewals, but this comes with pumping energy/cost/emissions • **Gas recovery**: CH_4 be burned to convert to CO_2, would reduce impact emissions significantly. Is there opportunity for beneficial reuse? • **Biosolids**: The IWCM Strategy review will not assess options for biosolids management at this point in time. The biosolids guidelines are currently under review by the NSW EPA. Council will investigate options for biosolids when the guideline review is completed. • **Protocols and procedures** to help with knowledge sharing and decision making, particularly during extreme events / emergencies • **Nabiac STP**: currently treats to secondary level then transferred to Hallidays Point STP then Tuncurry RTP, potentially treated three times. Is there an opportunity for beneficial reuse locally to reduce pumping/treatment cost/energy? • **Nabiac Aquifer**: Mapping suggests potential risk of sea level rise, increased saline intrusion? Also risk of changing rainfall patterns affecting aquifer recharge. Need to understand hydrology as Nabiac borefield is critical to current Manning supply.		
7.	**Workshop Session 2: Extreme Temperatures, Bushfires and Drought** Refer to Attachment B for risk and opportunity assessment. Comments from discussion include:		

No	Item	Action	Date
	• **Catchment management**: regenerative agricultural practices, cultural burning to reduce impact /risk of bushfires • **Worker Health and Safety**: need to manage worker health safety and fatigue during emergencies. Many workers are also volunteers (RFS, SES, etc) and/or may need to defend own homes, leading to Council operating on reduced staff. Risk of burnout, mental health impacts and/or longer-term impacts. • **Emergency Response Planning**: Need a robust approach to disaster management, emergency response planning review. • **Greening**: does Council have a greening strategy? No mandated canopy targets but suburb-based targets are applied where needed (i.e. Taree). Consider nature-based solutions to manage extreme heat. • **Water Demand**: demand-based pricing models to manage demand, could also influence water usage / behaviour more generally. • **Forster STP**: surrounded by National Park and conservation zones, hard to maintain appropriate buffers for bushfire protection. Which assets would need to be protected in an emergency?		
8.	**Summary** • No option was explicitly ruled out, noting some options likely to be highly location-specific whereas others will apply at a regional scale • Potential to develop framework or hierarchy of interventions that could be applied to address specific issues at each location • Timing for some risks likely outside planning horizon for this IWCM (i.e. sea level rise by 2100) however planning must consider future needs		
9.	**Next Steps** AECOM to identify scenarios and undertake scenario modelling and Quadruple Bottom Line Analysis	**AECOM**	

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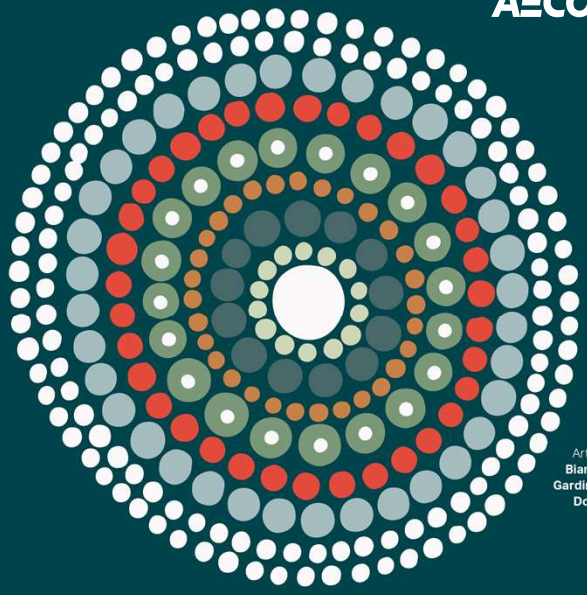
IWCM Strategy

Coarse Screening of Climate Change Options

Workshop 1

Workshop facilitated by Daniel Brauer, AECOM



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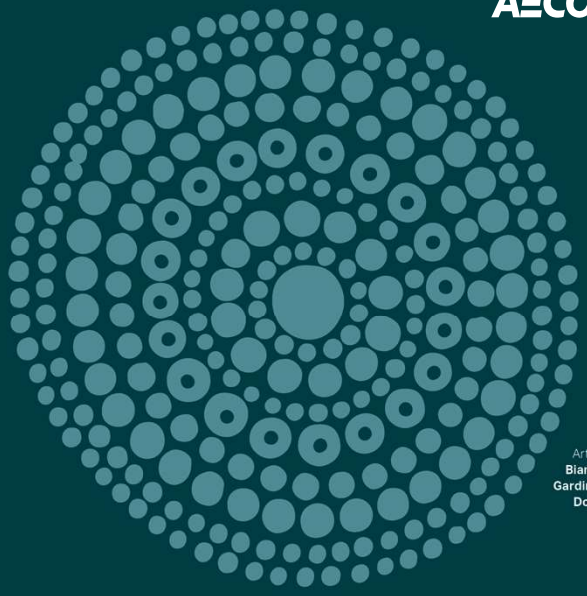
Acknowledgment of Country

We acknowledge the **Gathang-speaking (Biripi and Worimi)** people as the Traditional Custodians of the land on which we meet today, and recognise their connections to land, sea and community.

We pay our respect to their elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples today.



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Workshop 1 Agenda

1.	Welcome and Values Moment	10:00
2.	Introductions	10:05
3.	Workshop Objectives and Outcomes	10:10
4.	Project Background	10:15
5.	Assessment Approach and Criteria	10:35
6.	Sea Level Rise, Flooding and Storms	10:40
7.	Discussion	11:40
8.	Lunch break	12:20
9.	Extreme Temperatures, Bushfires and Drought	13:10
10.	Discussion	14:10
11.	Conclusion and Next Steps	14:50
12.	Close	15:00

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Values Moment – Christmas Road Safety

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Introductions

- What is your name and role?
- What are you hoping to contribute to the workshop?
- What would you like to achieve today?

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Workshop Objectives and Outcomes

The objective of the workshop is to:

- Present the long-list of climate change options for discussion
- Undertake a coarse screening of the long-list of options
- Agree the short-list of options for further investigation

The outcome of this workshop will be to an endorsed short-list of climate change options for further investigation prior to development of the IWCM Strategy

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Project Background – Integrated Water Cycle Management

- IWCM integrates water supply, sewerage and stormwater services within 30-year whole-of-catchment strategy
- Sets the objectives, performance standards and associated performance indicators for the water and sewer business
- Identifies needs and issues based on evidence and sound analysis and ensures infrastructure matches need
- Determines investment priority in consultation with community and stakeholders
- Identifies the 'best value 30-year' IWCM scenario on a social, environmental and financial basis

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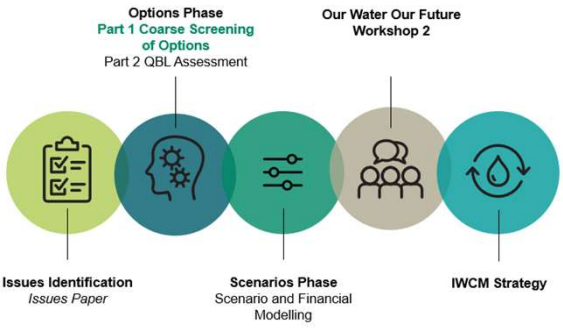
Project Background – MidCoast IWCM Journey to date

- MidCoast Water prepared 'Our Water Our Future 2045' in 2015 (water and sewerage only).
- Council is currently reviewing the IWCM, with final IWCM Strategy due May 2023
- Key outcome of the Issue Identification Phase:
  Bulahdelah, Gloucester and Stroud Supply Schemes do not have sufficient secure yield for supply – does not meet 5-10-10 rule



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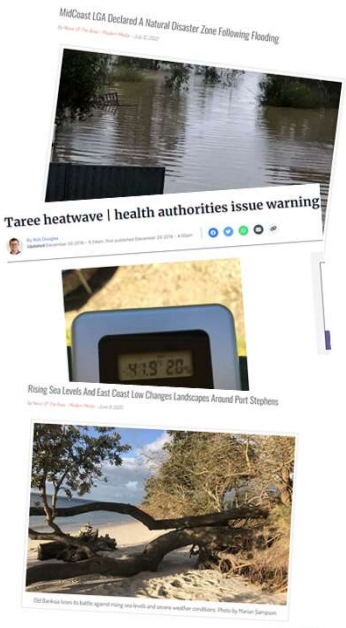
Historical climate events



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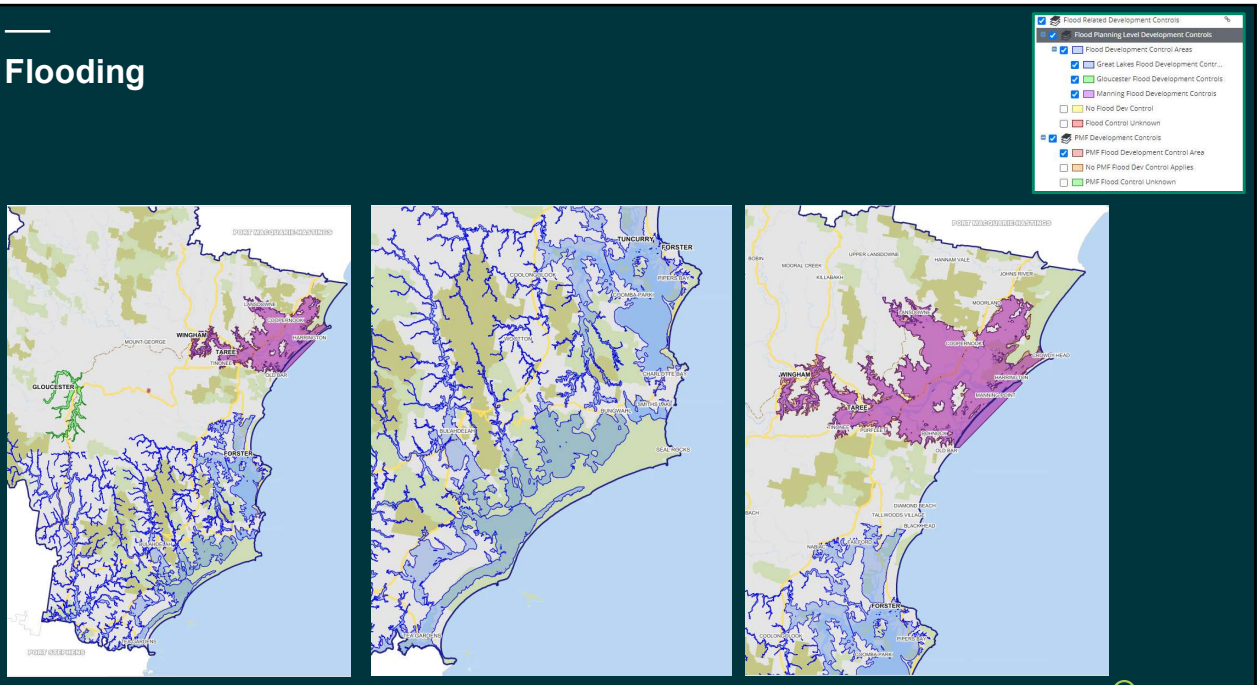
Slide 10

SJ0 [@Hudson, Sam] can you please update with some articles images from recent events? Bushfires, storms, floods etc.
Sounness, Jesse, 2022-12-01T20:34:36.386

HS0 0 Yep, will do now
Hudson, Sam, 2022-12-01T20:42:03.659

Flooding



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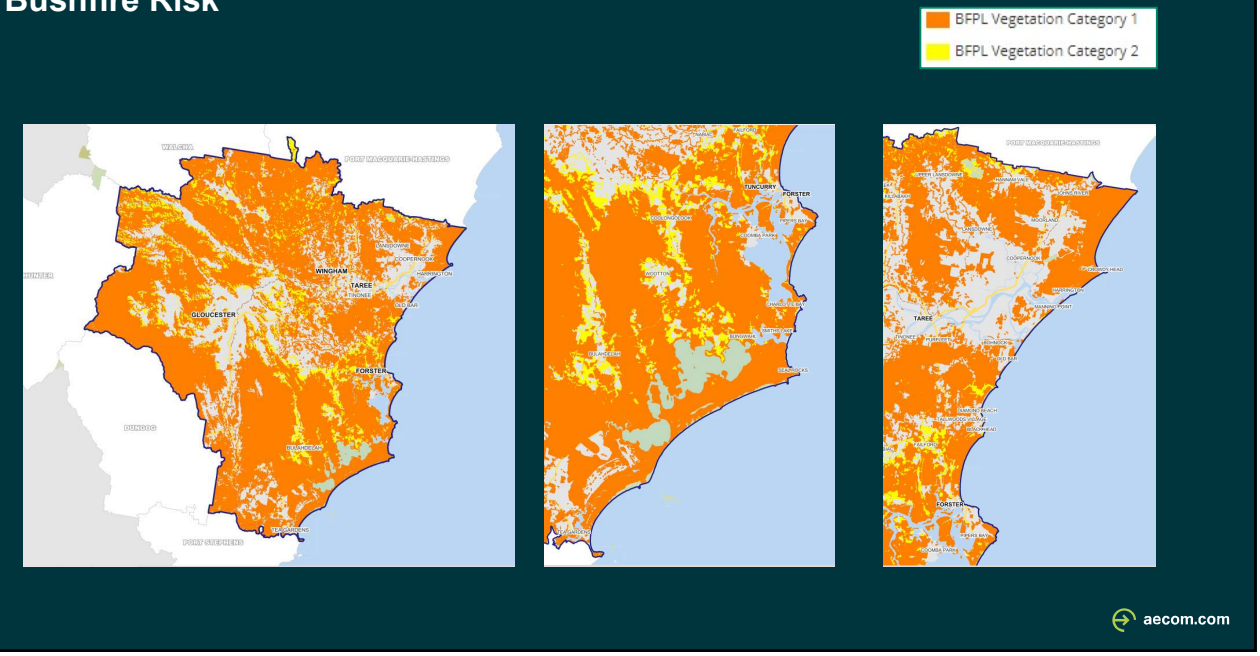
Bushfire Risk



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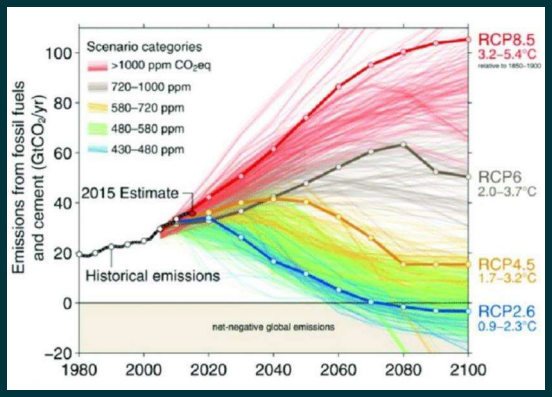
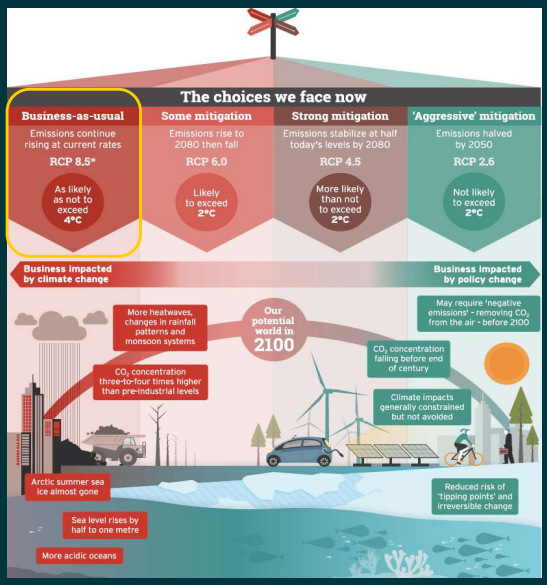
Climate emission scenarios

Scenario



Timeframes

2050



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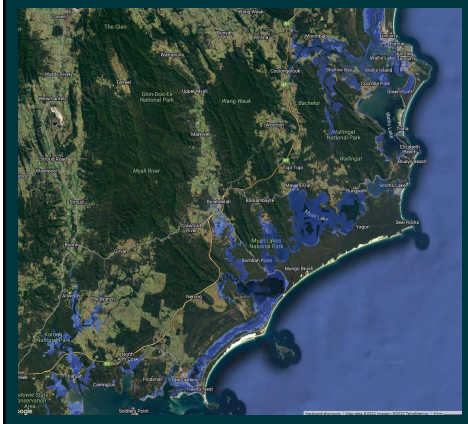
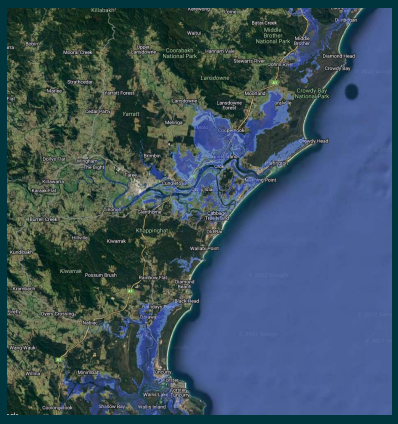
Sea level rise

Current Day
Highest Tide

2100 | +0.84m
Highest Tide





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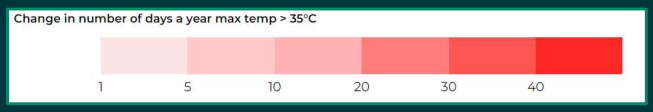
Extreme heat



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Future climate - Projected long term trends

Higher temperatures

- Average temperatures are increasing
- Increasing frequency and intensity of hot days

Increased rainfall and flooding

- There is an increasing likelihood of extreme rainfall occurring, and the intensity of extreme rainfall events is increasing.

Sea level rise

- Sea levels are projected to rise.

Bushfires

- Harsher fire weather
- Indirect impacts of bushfires anticipated to increase as likelihood and frequency of wildfires increases globally.

Drought and water scarcity

- Increased time spent in drought

Extreme storms

- Increasing frequency and intensity of extreme storms
- More extreme low pressure systems in the warmer months

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Assessment Approach

Each option assessed against the criteria and assigned a score:

- Pass: Option meets the criteria and should progress to Stage 2
- Fail: Option does not meet criteria and should not progress to Stage 2
- Unknown: Option cannot be scored and further investigation is required

Assessment criteria developed based on:

- Council Vision and Mission statements
- Risk Management Framework
- AECOM experience with similar projects
- Advice from DPE

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Assessment Criteria

Council Values	Council Risk Category	Indicator	Description and Objectives of Indicator
Wellbeing	Worker & public health and wellbeing	Health and wellbeing	Construction and operating/maintenance risks Delivering the option in a safe manner to customers - both during construction and service delivery
	Service delivery and infrastructure	Beneficial to pursue	Option will give a measurable improvement in climate resilience and/or lead to reduction in carbon emissions
		Practically viable	Option can be delivered by Council / external support
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework
	Project timeline	Timeline for planning and delivery	Adaptive planning considerations. Is the timeline required for planning pathways and delivery known? Are there any unknowns about the planning and delivery pathway for this option?
	Financial	Cost - capital	Capital costs (qualitative only)
	Project budget	Cost - O&M	Operating and maintenance costs (qualitative only)
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts
		Sustainability and resource consumption	Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact) Option aligns with principles of ecologically sustainable development and intergenerational equity
Respect	Reputation	Community acceptance	Option likely to have community support (based on assumption that there is enough information for the community to make a balanced judgement)

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Climate Change Options

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Group Discussion – Sea Level Rise, Flooding, Storms

1. Break out into groups
2. Discuss the following for each hazard (20 mins per hazard):
   1. How will the hazard impact the MidCoast Water Assets in your region?
   2. What are the opportunities/options for mitigating/adapting to these impacts?
   3. Assess each option using the criteria
3. Present back to the group on the priority options

Group 1	Group 2	Group 3	Group 4
Taree/Dawson Wingham Gloucester	Manning Point Old Bar Harrington Coopernook Lansdowne	Hallidays Point / Tuncurry / Nabiac Forster	Stroud Bulahdelah Tea Gardens / Hawks Nest Karuah
Chenxi, Marni, Jesse Lakshu	Shane, Gerard, Sara, Dan	Mitch, Rachael, Zena	Tracey, Dave, Janice

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Lunch

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Slide 21

SJ0 [@SmithWhite, Zena] can we get a map drawn up with loose boundaries?
Sounness, Jesse, 2022-12-01T21:13:13.918

Group Discussion – Extreme Temperatures, Bushfires, Drought

1. Break out into groups
2. Discuss the following for each hazard (20 mins per hazard):
   1. How will the hazard impact the MidCoast Water Assets in your region?
   2. What are the opportunities/options for mitigating/adapting to these impacts?
   3. Assess each option using the criteria
3. Present back to the group on the priority options

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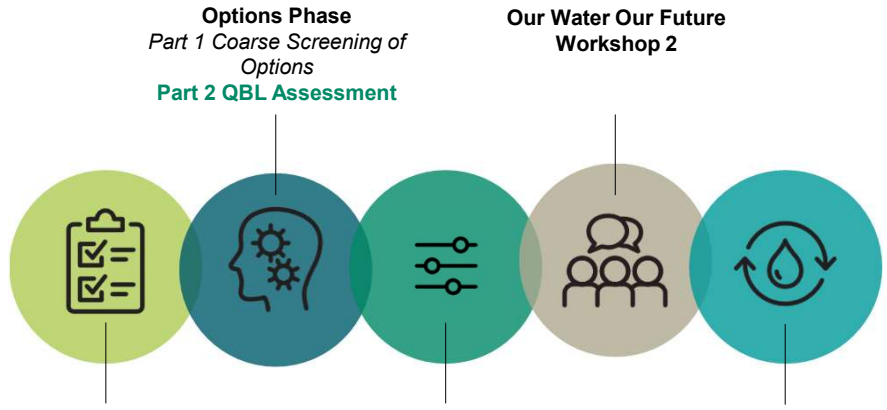
Next Steps



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Slide 25

SJ0 New slide to be added [@Sounness, Jesse]
Sounness, Jesse, 2022-12-02T00:36:22.496

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Thank You!

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About the artwork

Sydney CBD stands on the Traditional Lands and waterways of the Gadigal people of the Eora nation. AECOM's Sydney office resides over these lands and waterways, and we also respectfully pay homage to the memories and Traditional spirits within the land, and pay respect to those from the past, those in the present and those to come.

The palette of this work reflects both AECOM's interior design vision and the artist's own tonal impression of the lands and waterways of the Gadigal People. The six rings around the AECOM site represent AECOM's six core values. These core value rings can be seen radiating southwest along George Street out of the city into the broader community.

Today, George Street gently aligns itself over the path of the 'Tank Stream'. Its intersections often follow the pathways, eons in formation, from the passage of the Gadigal People. Having supplied fresh water and fish to the original Gadigal People for tens of thousands of years, it would serve as the main fresh water supply for the first 40 years of Sydney's European life.

The design respectfully acknowledges the 29 clans of the Eora nation represented by the various circles depicting meeting places, connecting them spiritually and physically over the Traditional paths and landforms that intertwine their worlds.

Here in the Sydney region, the 29 Eora clans share the land and its bounty. Each clan is unique, yet intrinsically linked, existing in perfect harmony with the spiritual & natural world.

Images of spears represent local Warriors, particularly Bennelong standing proudly over his Traditional Lands. Further down the stream, are the areas of Women's Business - birthing, celebrating, sharing & embracing their unique world. The sandy pebbles on the left bank signify the sandstone cliffs and ledges upon which Barangaroo now proudly sits, further identifying the connection between one of the wives of Bennelong with the land and water of the Gadigal People.

Bianca Gardiner Dodd

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Climate Change

Hazard	Impact	Location/asset	Options	Discussion
Flooding	Asset under water during 100-year flooding event	Wingham STP	• Bunding around site- not considered practical • Raise electrical assets / switchboards • Relocate or raise key processes, including clarifiers • Relocate STP or divert flow to Dawson- relatively new asset in otherwise good working condition. May be a consideration in longer term (beyond 30 years)	• Wingham STP inundated during recent flooding • Potential for untreated sewage contaminating surrounding environment
	Power outages	All sites	• Raise critical electrical assets / switchboards	• Note that it takes time to ensure safety before power supply can be returned after flooding
	Pump stations under water	All sites	• Raise critical electrical assets / switchboards	• All PS at risk of flooding
	Reduced access	Gloucester STP/WTP & Darawank WPS and Reservoir	• assessing geographical spread of Council resources in line with road / access closure during emergency • Emergency procedures to help manage response • The Gloucester Reservoir and Mains project is currently in construction phase. This will provide around 1-week storage within the network.	
Sea Level Rise	Inundation, erosion and wave overtopping	Assets located in Hallidays Point, Tuncurry, Nabiac, Forster, Pacific Palms and Smiths Lake identified at risk of sea level rise by 2100	• Raise critical assets / switchboards • Vacuum / low pressure systems • Relocated PS to higher elevation (where network reconfiguration is required due to inundation) • Include sea level rise and increased rainfall in modelling	• Sea level rise may have potential to impact Nabiac aquifer • Land use planning to consider climate impact
		Old Bar STP exfiltration beds within 2100 sea level	• Relocate exfiltration ponds • Reuse (limited to dry weather) • Transfer to Dawson • Ocean outfall	• Consider current position of Old Bar break wall, does this provide coastal erosion protection long-term? • Consider options for the Old Bar sewerage scheme in parallel with sustainable effluent management
	Sea water intrusion to aquifers / rivers	Nabiac / Tea Gardens Aquifers Manning, Myall, Karuah Rivers	• Sea level rise may have potential impact to aquifers and river tidal zones	• Hydrological modelling needed to understand potential risk • Aquifers may not be reliable long term • May need to relocated river offtakes upstream
	General	Manning Point STP	• Manning Point at risk of forecast 2100 sea level	• Whole community is vulnerable from sea level rise • Local reuse at Mitchell Island • Must consider capital costs and impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts
Storms	Damage due to extreme storm events (wind, hail, lightning, flooding etc.)	All assets	• Vegetation management / façade audits • Raise switchboards above flood levels • Erosion control / embankment stabilisation • 'Caging' around off-take to protect asset from debris within storm flows	• Is there risk of outfall to river / ocean? • Forster ocean outfall was washed away during storm event shortly after construction, highlighting risk to any future ocean outfall
		Harrington vacuum station & general vacuum network	• Pop-up gullies (note not yet WSAA approved)	• Vacuum networks and stations vulnerable in storm events, prone to high inflow and infiltration • Greatest issue is operational / suction continuity
	Power outages	All sites	• Opportunity for solar with battery storage where appropriate to provide emergency power along with baseload / net zero benefits	

Hazard	Impact	Location/asset	Options	Discussion
Extreme Temperatures	Reduced WHS conditions and increased worker fatigue	All sites	• Define triggers and protocols • Emergency scenario planning • Capitalise on local employee knowledge • Ensure emergency management plans are ready for adoption when needed.	
	Employees occupied in emergency services / volunteering roles and/or defending their homes	All sites		• Disruption to operations / workforce accessibility • Mental health and wellbeing impacts
	Staff WHS	All sites	• Council WH&S policy to include appropriate PPE including sunscreen	
	Parasites/organisms in water (i.e. increased algal blooms)	All sites	• Increased dosing • Controlled pumping from river to manage nutrients / maintain water quality in dams and avoid toxic algal blooms • Mechanical aeration • Pretreatment / dissolved air filtration (DAF)	
	Mechanical/electrical failure (switchboards overheating and failure resulting in interruption)	All Sites	• Air conditioning to maintain temperatures required for treatment processes and operator safety • Heat shields on switchboards (Council has already adopted this, assets in southern region could adopt this measure when renewed) • Opportunity for solar with battery storage where appropriate to provide emergency power along with baseload / net zero benefits	• Air conditioning would need to consider emissions / energy use • Switchboards overheating and failure resulting in interruption has been experienced by Council in the past
	Extreme heat	All sites	• Increased tree canopy / carbon heat mitigation	
	Increased water use	All sites	• Demand-based pricing models to reduce overall demand	• Consider in parallel with water security
	Structural stresses	All sites	• Design and construction for new structures and specifications.	• Cracking and maintenance of joints is of concern

Bushfire	Ash in raw water leading to impacts to treatment stations	All sites	• Management plans for water quality (additional backwashing, etc)
			• Alternative raw water sources and/or selective pumping from existing sources
			• Catchment management as a means to mitigate bushfire impacts, including:
			  ○ Cultural burning and regeneration
			  ○ Riparian management
			  ○ Regenerative agriculture
			• Refuge pools aimed at supporting regeneration of ecosystems during and/or following fire events.
				• Smaller catchments are more vulnerable
				• Water quality issues are manageable with appropriate operational protocols. This may require additional backwashing, chemicals. etc

	General damage and safety risks (asset damage, reduced water quality during/after bushfires)	All sites	• Air conditioning to maintain temperatures and air quality required for treatment processes and operator safety • Controlled pumping from river to manage nutrients / maintain water quality in dams and avoid toxic algal blooms • Mechanical aeration • Pretreatment / DAF • Management plans for water quality	• Hallidays Point was clear of fire in 2019 • How did Forster STP fare? Does Forster require greater buffers / easements? • Consider which plants are manned and remote in identifying high risk sites • Need to review bushfire management plans • Need clarification on Council's jurisdiction - do vegetation buffers form part of National Parks jurisdiction; is there the option to extend buffers?
	Power supply failure	All sites	• Increased availability of generators • Critical pump station shutdown • Opportunity for solar with battery storage where appropriate to provide emergency power along with baseload / net zero benefits	• Interruption to power supply is significant risk, including WHS dangers when responding to power supply issues. • Availability of generators; opportunity for a regional 'fleet' of generators that can be deployed to specific locations across MidCoast and neighbouring LGA's when needed.

Hazard	Impact	Location/asset	Options	Discussion
	Reduced access due to road closures and fire danger	All sites	• Consider automation at STPs and WTPs where risk of road closure	• Increased contractor management requirements for designation filling stations and reduced access via standpipes.
	Staff safety and wellbeing i.e. smoke inhalation	All sites	• Manage operation remotely where possible • Appropriate PPE	
	Increased Water Demand - (compound effect of drought and bushfire)	All sites	• Identify and use alternative sources of water for fire-fighting (e.g. Stratford Mine Dam at Gloucester) • Demand-based pricing models to reduce overall demand	• Consider in parallel with water security options
	Combination of all bushfire impacts	All sites	• Revise bushfire management plans • Prepare emergency response plans consider bushfires	
General	Staff WHS (mental health and wellbeing)	All sites	• Emergency procedures to help response • 2-way radio network to maintain communication when power / mobile unavailable	• Risk of mental health impacts to staff due to repeated extreme events and emergencies.
	Emissions reduction / net zero	All sites	• Potential for solar panels with battery storage and hydroelectricity at various locations across LGA, need to consider available space and balance cost / benefit • Bioreactors- use methane biofuels as alternate energy source • Opportunity to convert CH_4 to CO_2, reduce emissions • Review STP process efficiency	• Opportunistic approach to renewable energy. • Limited opportunity for other forms of renewable energy; does Council want to be an energy provider? • STP gas capture / reduction
	Operational resilience	LGA wide	• 2-way radio network to maintain communication when power / mobile unavailable • Integrated management plan for each site • Workforce resilience (assess geographic spread of resources to assess workforce shortages if access restricted from flood, road closure, fire, etc.) • Response staff wellbeing (greater support, better culture)	

AECOM

IWCM Strategy
Coarse Screening of Water Security Options

Workshop 2

To	MidCoast Council	Page	12
CC	Workshop Attendees		
Subject	IWCM Strategy Workshop 2 - Coarse Screening of Water Security Options		
From	AECOM		
File/Ref No.	60696228	Date	7-Dec-2022

Introduction

The Coarse Screening of Water Security Options is the first step in the “all options on the table” approach for the Gloucester, Stroud and Bulahdelah Water Supply Schemes, as part of MidCoast Council’s (Council) Integrated Water Cycled Management (IWCM) Strategy. A comprehensive list of water security options, including both water demand and source augmentation options, have been evaluated. Each option has been investigated to identify the key risks, issues and opportunities, prior to completing a coarse screening assessment based on a fatal flaw approach. The outcome of the project will be a short-list of options that pass the coarse screening and move into a quadruple bottom line investigation, for consideration in the scenarios phase of the IWCM strategy.

The coarse screening workshop will present the list of water security options for discussion and endorsement of a short-list of options for further investigation. This briefing paper provides background information for workshop attendance.

Background

IWCM takes a holistic approach to effective and sustainable urban water supply and sewerage business. The IWCM Strategy sets the objectives, performance standards and associated performance indicators, while ensuring infrastructure meets the needs and priorities of the community and stakeholders. The outcome is a 30-year IWCM scenario that best meets the needs of the region on a social, environmental, economic and governance (quadruple bottom line) basis.

Council is currently reviewing their IWCM Strategy. One of the key issues identified was insufficient secure yield within the Gloucester, Stroud and Bulahdelah Water Supply Schemes.

The **Gloucester** Scheme supplies the towns of Gloucester and Barrington, with a 2020 total permanent population of around 3,500 people. Water is drawn from the Barrington River to the Gloucester Water Treatment Plant (WTP), and there is currently no off-stream storage within the scheme. During the recent 2019/20 drought, the Barrington River flow ceased and water was carted from Tea Gardens. Council is currently in the process of constructing the Gloucester Reservoirs Project, which when complete will augment the network significantly. The network will have approximately 10 ML of storage at completion of this project.

The **Stroud** Scheme supplies the towns of Stroud and Stroud Road, with a 2020 total permanent population of around 900 people. Water is drawn from the Karuah River weir either directly to the WTP or via a 50 ML off-stream storage located at the WTP site. The weir pool provides up to 17 ML on-stream storage.

The **Bulahdelah** Scheme supplies the township of Bulahdelah, with a 2020 total permanent population of around 1,100 people. Water is drawn from upstream of the Crawford River weir to the WTP. The weir pool provides up to 163 ML on-stream storage.

The water supply schemes are presented in Figure 1, 2 and 3.

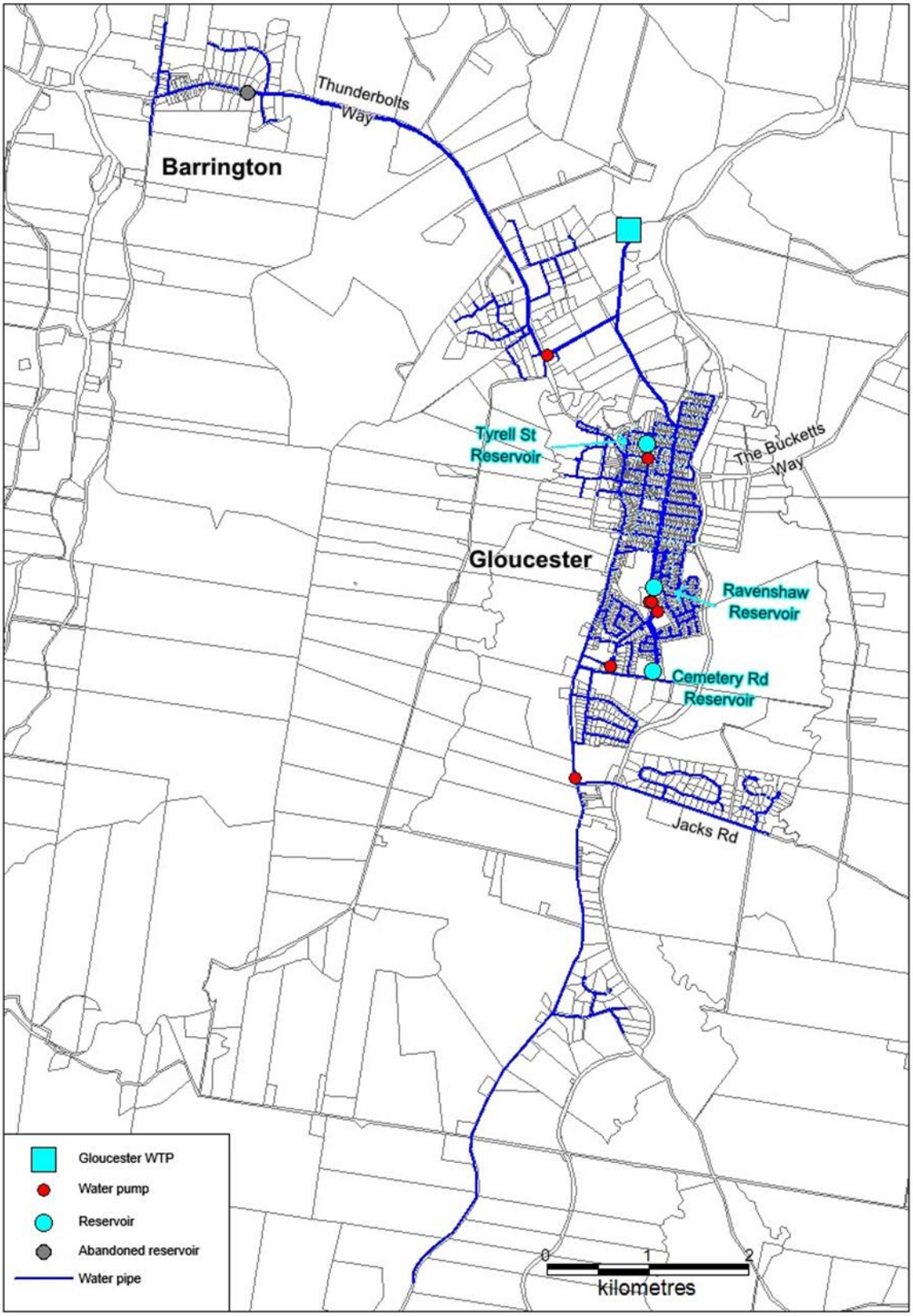

Figure 1 Gloucester Water Supply Scheme

Note: This figure does not include the Gloucester Reservoir Project network augmentations.

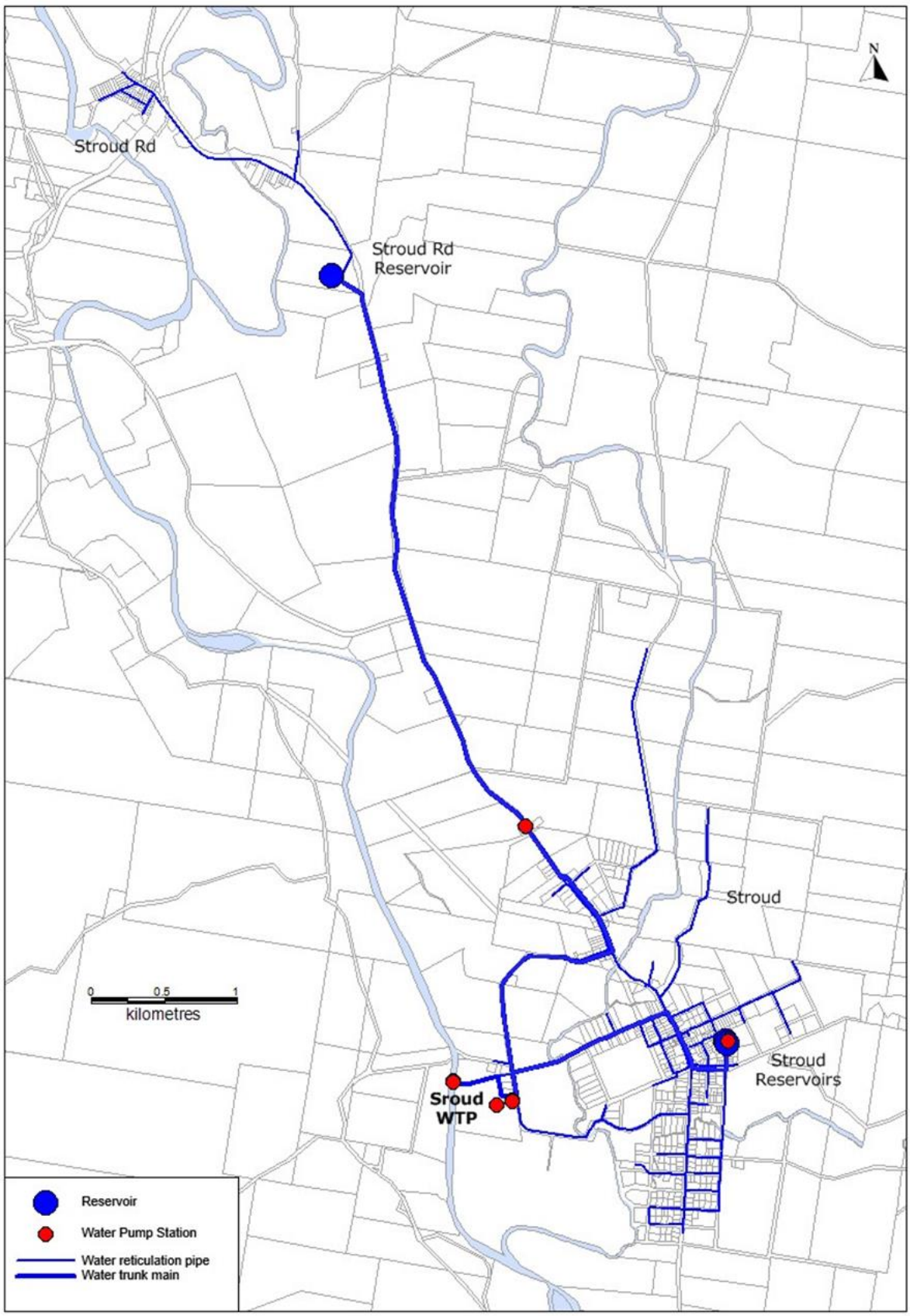

Figure 2 Stroud Water Supply Scheme

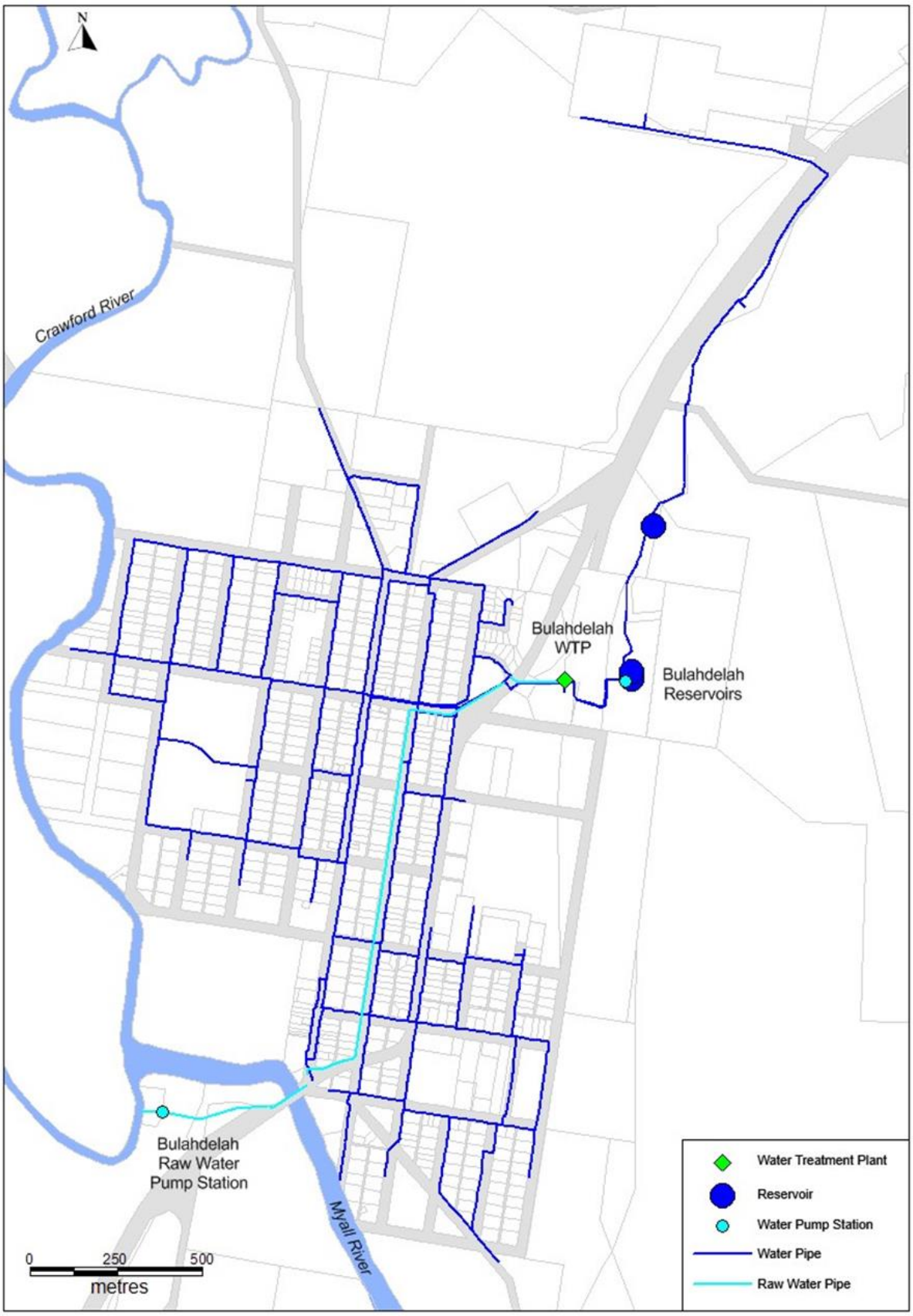

Figure 3 Bulahdelah Water Supply Scheme

Assessment Approach and Criteria

The coarse screening will be based on a fatal flaw approach. Each water security option will be assessed against the agreed assessment criteria as assigned a score:

Pass Option meets the criteria and should progress for further investigation

Fail Option does not meet the criteria and should not progress for further investigation

Unknown Option not scored due to lack of information, therefore progress for further investigation

The assessment criteria are provided in Table 1. The criteria were developed by the project team based on:

- Council's values,
- Council's Risk Management Framework,
- AECOM's experience with similar projects, and
- Advice from Department of Planning and Environment (DPE).

Table 1 Assessment Criteria

Council Values	Council Risk Category	Indicator for Coarse Screening	Description and Objectives of Indicator
Wellbeing	Worker and public health & wellbeing	Health and wellbeing	Fit for purpose water quality- meetings legislative requirements Construction and operating/maintenance risks Delivering the option in a safe manner to customers- both during construction and service delivery
	Service delivery & infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)
		Yield / beneficial to pursue / supply	Option will give a measurable improvement in water security by either reducing demand or increasing supply (option improved long-term water security) based on future water supply and demand forecasts
		Practically viable	Option can be delivered by Council and external support
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework
	Project timeline	Timeline for planning and delivery	Adaptive planning considerations. Is the timeline required for planning pathways and delivery known? Are there any unknowns about the planning and delivery pathway for this option?
	Financial Project budget	Cost- capital	Capital costs (qualitative only)
		Cost – O&M	Operating and maintenance costs (qualitative only)
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts
		Sustainability and resource consumption	Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact) Option aligns with principles of ecologically sustainable development and intergenerational equity
Respect	Reputation	Community acceptance	Option likely to have community support (based on assumption that there is enough information for the community to make a balanced judgement)

Long List of Water Security Options

A wide range of water security options have been investigated, taking an “all options on the table” approach. Noting there will be localised opportunities specific to each water supply scheme, at a high level these options include:

1. Off-stream storage
2. Desalination
3. Purified recycled water
4. Recycled water for municipal irrigation, agricultural and construction use
5. Recycled water for non-potable use via dual reticulation
6. Recycled water for environmental flow replacement
7. Stormwater harvesting
8. Groundwater
9. Interconnection with regional schemes – pipeline
10. Interconnection with regional schemes - tanker

In addition, a water balance has been undertaken, to consider the potential benefits of both demand management and water conservation measures in a parallel with the source augmentation options.

A summary of the options considered is presented in Table 2 to Table 4.

Coarse Screening Workshop

During the coarse screening workshop, we will present the evaluation of each water security option that was investigated. We will present the outcome of a preliminary coarse screening completed by the project team for discussion with the workshop group. The outcome of this workshop will be an endorsed short-list of water security options for further investigation prior to development of the IWCM Strategy.

Next steps

Following the workshop, the project team will progress with development and assessment of IWCM scenarios, including quadruple bottom line analysis and financial modelling to inform the identification of the preferred IWCM Strategy.

Table 2 Gloucester Long-list of Water Security Options

Option	Option Name	Option Description	Risks	Issues	Benefits and Opportunities
1	Off Stream Storage	Off-stream storage. Storage supplied raw water from Barrington River and water treated at Gloucester WTP. Option study completed by SMEC in 2016 investigated six sites, with two sites deemed feasible. Principle items include zoned embankment, foundation excavation, spillway excavation and inlet / outlet pipework and pumps.	• Approvals and permits • Offtake water quality • Cultural heritage sites • Current socio-political sentiment towards proposed dam projects	• Not rainfall independent • Large carbon footprint • Complex geology • Availability of fill materials	• Flexibility in staging • Increased reliability of supply- provide raw water storage • Enhanced raw water quality management • Potential hydropower to offset raw water pumping
2	Desalination of Seawater	Permanent desalination plant utilising sea water. Sea water intake, desalination plant and brine discharge located on coast. Treated water pumped to Gloucester. Principle items include land acquisition nearby coast, sea water intake and pumping infrastructure, storage tanks, screening and microfiltration units, reverse osmosis units, brine pumping system and discharge line to ocean outfall, permeate pipeline from desalination plant to Gloucester WTP (70 – 80 km depending on pipeline route and plant location) and multiple booster pump stations and balance tanks.	• Approvals and permits • Aquatic ecology – impingement and entrainment • Aquatic ecology – reject discharge • Community acceptance	• Inland community • Large carbon footprint • High operation and maintenance costs • Significant construction lengths for pipeline	• Rainfall independent • Proven technology • Operation flexible to demand
3	Reticulated Recycled Water	Dual reticulation network to supply recycled water for new development areas only. Recycled water could be utilised for outdoor uses, toilet flushing and laundry, offsetting potable water demand. Principle items include upgrade of the STP to meet recycled water quality suitable for unrestricted public access (advanced water treatment including membrane filtration) and transfer pumping systems including pipeline/s to development. Note the Gloucester STP upgrade has provision for future treatment to reach a higher quality recycled water.	• Community acceptance • Approvals and permits • Insufficient recycled water demand due to low growth • Public health - potential misuse of recycled water	• Greenhouse gas emissions • High operation and maintenance costs with dual reticulation network • Only suitable for new residential developments (not practical to retrofit existing properties) • Rainfall dependent demand (for outdoor use)	• Rainfall independent • Community participation • Effluent management • Aesthetic values maintained
4	Recycled Water for Restricted Use	Gloucester RTP currently provides restricted quality recycled water. Increased use of recycled water for agriculture to offset potable demand. Four potential agricultural end users were identified in an options study (2015). Principle items include transfer pumping and pipelines for expansion of recycled water network.	• Recycled water demand • Approvals and permits	• Rainfall dependent demand • Increased operation and maintenance costs	• Community participation • Effluent management • No upgrade to current RTP
5	Recycled Water for Unrestricted Use	Recycled water for public open space irrigation to offset potable demand. Five potential open spaces were identified in an options study (2015). This would require advanced water treatment, suitable for unrestricted public use. Principle items include membrane filtration, chlorination and treated water storage tanks at the STP, transfer infrastructure (pipelines and pumps), storage and recycled water irrigation infrastructure at end users.	• Approvals and permits • Community acceptance	• Significant distribution infrastructure • Rainfall dependent demand • Greenhouse gas emission • High operation and maintenance costs	• Rainfall independent • Community participation • Effluent management • Aesthetic values maintained
6	Recycled Water for Environmental Flows	Substitution of flows downstream of Barrington River offtake point to enable greater extraction upstream. Replacement flows supplied from Gloucester STP. Principle items include upgrade of Gloucester STP to achieve required water quality, transfer infrastructure (pipeline and pumps) and construction of off-stream storage.	• Approvals and permits • Community acceptance • River health and ecology – substitution flow • River health and ecology – increased offtake	• Greenhouse gas emission • High operation and maintenance costs • May not improve yield / supply • Requires an off-stream storage to enable increased extraction (option 1)	• Effluent management • May improve river flow

Option	Option Name	Option Description	Risks	Issues	Benefits and Opportunities
7	Purified Recycled Water	Recycled water from RTP redirected to future off-stream storage, to mix with raw water extracted from Barrington River. A new WTP is required at Gloucester in 5 - 10 years. Principle items include treatment addition to the new STP that achieves advanced water treatment, transfer infrastructure connecting RTP to new off-stream storage.	• Approvals and permits • Community acceptance • Severe public health consequences • Cultural heritage sites	• Greenhouse gas emission • Supporting legislation • High operation and maintenance costs • Requires construction of off-stream storage	• Effluent management • Rainfall independent • Utilises existing water and sewer network infrastructure • Increased reliability of supply- provide raw water storage
8	Groundwater	New bore field water supply. Principal items include bore field, water treatment plant and pipeline to nearest reservoir.	• Groundwater availability • Environmental impacts • Approvals and permits	• No groundwater resources identified in previous investigations • Long lead time	• Further investigation to investigate potential for unidentified groundwater resources
9	Interconnection with Regional Schemes (via Pipeline from Krambach)	Connection of Gloucester scheme to the Manning scheme via. a pipeline connecting Krambach and Gloucester. Gloucester to become part of the Manning scheme, supplied from Bootawa WTP and Nabiac bore field. The Gloucester WTP would be decommissioned. Principle items include transfer infrastructure connecting Krambach and Gloucester, including approximately 40 km pipeline, two balance tanks and two water pump stations, chlorine booster station, upgrade of mains in Manning scheme and upgrade of Krambach reservoir.	• Environmental impacts • Approvals and permits • Impacts of natural disasters (i.e., fire) • Land acquisition	• Requires two big lifts between Krambach and Gloucester • Greenhouse gas emission • Pipeline through potentially environmentally sensitive corridors	• Remove need for Gloucester WTP upgrade • Transfer point of raw water extraction to Manning Scheme. Secure yield issue currently being investigated; considered in water security solution for combined scheme • Connect new customers to the water supply along pipeline route
10	Interconnection with Regional Schemes (via Water Carting from Tea Gardens)	Water carting from Tea Gardens WTP when flow unavailable in Barrington River (emergency measure). It is approximately 110 km each way via. road between Tea Gardens and Gloucester.	• Impact / delay of transport from unforeseen circumstances • Supply availability from Tea Gardens bore field • Freight availability for prolonged periods • Public health consequences form contamination	• Greenhouse gas emission • Long transport distances	• Short term water security solution until long term solution implemented • Scalable to requirements • Implemented successfully in past; no additional infrastructure for loading and unloading required
11	Stormwater Harvesting	Offset potable water use with scheme for stormwater collection, storage and transfer to WTP. Principle items include multiple stormwater collection basins to capture stormwater, multiple sets of transfer infrastructure (pipelines and pumps) to transfer flows (when available) to a future off-stream storage for storage.	• Approvals and permits • Community acceptance • Water quality	• High operation and maintenance costs • Significant collection and transfer infrastructure • Rainfall dependent • Requires construction of off-stream storage (option 1)	• Utilisation of some exiting stormwater network
12	Stratford Mine Dam	Acquire Stratford Mine Dam as off-stream storage. The Return Water Dam holds approximately 10,000 ML of water. Principle items include acquiring existing dam, transfer infrastructure (pumps and pipeline, approximately 9 km) to the Gloucester WTP, raw water transfer infrastructure (pumps and pipeline) from the Barrington River- either from the current offtake or identifying a raw water offtake location closer to the dam.	• Approvals and permits • Environmental impacts • Land acquisition, including dam	• Rainfall dependent • Potential easements through private property • High operation and maintenance costs	• Provide raw water storage • Enhanced raw water quality management

Table 3 Stroud Long-list of Water Security Options

Option	Option Name	Option Description	Risks	Issues	Benefits and Opportunities
1	Off-Stream Storage	Off-stream storage dam, 2 x 50 ML proposed to be located adjacent to existing off-stream storage. Raw water is supplied from the Karuah River and transported to the WTP. Principal items include 2 x in-ground new storage dams, upgrade of delivery pipe from river pump station from DN150 to DN200, and either valving arrangement pits or small pump station.	• Approvals and permits • Potential for impact with dam failure • Compliance with current legislation	• Unfavourable ground conditions • Aeration required for maintaining raw water quality	• Land owned by Council • Operational flexibility • Increased reliability of supply
2	Desalination	Permanent desalination plant located on the coastline utilising sea water. Treated water will be pumped to Stroud. Principal items include land acquisition nearby coast, sea water intake and pumping infrastructure, storage tanks, screening and microfiltration units, reverse osmosis units, brine pumping system and discharge line to ocean outfall, permeate pipeline from desalination plant to Stroud WTP (30 – 60 km depending on pipeline route and plant location) and multiple booster pump stations and balance tank.	• Approvals and permits • Aquatic ecology – impingement and entrainment • Aquatic ecology – reject discharge • Community acceptance	• Significant construction lengths for pipeline • Large carbon footprint • High operation and maintenance costs	• Rainfall independent • Proven technology • Operation flexible to demand
3	Reticulated Recycled Water	Dual reticulation network to supply recycled water for new development areas only. Recycled water could be utilised for outdoor uses, toilet flushing and laundry, offsetting potable water demand. Principle items include an upgrade of the STP to meet recycled water quality suitable for unrestricted public access (advanced water treatment including membrane filtration), transfer pumping systems including pipelines to development and treated storage tanks.	• Community acceptance • Approvals and permits • Insufficient recycled water demand due to low growth • Public health - potential misuse of recycled water	• Greenhouse gas emissions • High operational and maintenance costs associated with dual network • Only suitable for new residential developments (not practical to retrofit existing properties) • Rainfall dependent demand (for outdoor use)	• Rainfall independent • Community participation • Effluent management • Aesthetic values maintained
4	Recycled Water for Restricted Use	Stroud STP currently provides restricted quality recycled water. Increased use of recycled water for agriculture to offset potable demand. Potential future users include chicken farms in the vicinity. Principle items include offtake points or transfer pumping and pipelines for expansion of recycled water network.	• Recycled water demand • Approvals and permits	• Rainfall dependent demand • Increased operation and maintenance costs	• Community participation • Effluent management • No upgrade required to STP
5	Recycled Water for Unrestricted Use	Recycled water for public open space irrigation to offset potable demand. Potential open spaces include local parks such as Silo Hill Park and Mills Creek Lions Park, Stroud Showground and Stroud Public School. Principle items include an upgrade to the RTP with membrane filtration, chlorination and treated water storage tanks, transfer infrastructure (pipelines and pumps), storage and recycled water irrigation infrastructure at end users.	• Approvals and permits • Community acceptance	• Significant treatment infrastructure • Rainfall dependent demand • Greenhouse gas emission • High operation and maintenance costs	• Rainfall independent • Community participation • Effluent management • Aesthetic values maintained
6	Recycled Water for Environmental Flows	Substitution of flows downstream of Karuah River offtake point to enable greater extraction upstream. Replacement flows supplied from Stroud STP. Principle items include upgrade of Stroud STP to achieve required water quality, transfer infrastructure (pipeline and pumps) and construction of additional off-stream storage.	• Approvals and permits • Community acceptance • River health and ecology – substitution flow • River health and ecology – increased offtake	• Greenhouse gas emission • High operation and maintenance costs • May not improve yield / supply • Requires additional off-stream storage to enable increased extraction (option 1)	• Effluent management • May improve river flow
7	Purified Recycled Water	Recycled water from Stroud RTP transferred to off-stream storage and treated at the Stroud WTP. Principle items include an upgrade to the RTP with membrane filtration, RO and UV advanced oxidation processes, as well as transfer infrastructure connecting RTP to off-stream storage.	• Approvals and permits • Community acceptance • Severe public health consequences	• Supporting legislation • Greenhouse gas emission • High operation and maintenance costs	• Rainfall independent • Effluent management • Utilises existing network infrastructure • Increased reliability of supply

Option	Option Name	Option Description	Risks	Issues	Benefits and Opportunities
8	Groundwater	New bore field water supply. Principal items include borefield, water treatment plant, and pipeline to nearest reservoir.	• Groundwater availability • Environmental impacts • Approvals and permits	• No groundwater resources identified in previous investigations • Long lead time	• Further investigation to investigate potential for unidentified groundwater resources
9	Interconnection with Regional Schemes (via Pipeline)	Connection of Stroud scheme to Hunter Water with a pipeline connecting Dungog and Stroud. Water will be conveyed to Stroud Road reservoir. Principle items include transfer infrastructure connecting Dungog and Stroud, including approximately 24 km pipeline following existing railway track, balance tanks, chlorine dosing system, and modifications to Stroud Road reservoir for flexibility to pump both to Stroud Road and Stroud zone.	• Availability of water supply at Dungog • Sharing agreement between Councils • Environmental impacts • Impacts of natural disasters	• Distance of pumping • Greenhouse gas emission • Integration with existing network operation	• Connect new customers along pipeline route
10	Interconnection with Regional Schemes (via Water Carting from Tea Gardens)	Water carting from Tea Gardens WTP when flow unavailable in Karuah River (emergency measure). It is approximately 60 km each way via. road between Tea Gardens and Stroud.	• Impact / delay of transport from unforeseen circumstances • Supply availability from Tea Gardens bore field • Freight availability for prolonged periods • Public health consequences form contamination	• Greenhouse gas emission • Long transport distances	• Short term water security solution until long term solution implemented • Scalable to requirements • Implemented successfully in past; no additional infrastructure for loading and unloading required
11	Stormwater Harvesting	Offset potable water use with scheme for stormwater collection, storage and transfer to WTP. Principle items include multiple stormwater collection basins to capture stormwater, multiple sets of transfer infrastructure (pipelines and pumps) to transfer flows (when available) to off-stream storage (may require additional off-stream storage to be constructed).	• Water quality • Approvals and permits • Community acceptance	• High operation and maintenance costs • Significant collection and transfer infrastructure • Rainfall dependent • May still require construction of additional off-stream storage (option 1)	• Utilisation of some exiting stormwater network

Table 4 Bulahdelah Long-list of Water Security Options

Option	Option Name	Option Description	Risks	Issues	Benefits and Opportunities
1	Off Stream Storage	Off-stream storage. Storage supplied raw water from Crawford River and water treated at Bulahdelah WTP. Principle items include zoned embankment, foundation excavation, spillway excavation and inlet / outlet pipework and pumps.	• Approvals and permits • Offtake water quality • Cultural heritage sites • Current socio-political sentiment towards proposed dam projects	• Not rainfall independent • Large carbon footprint • Complex geology • Availability of fill materials	• Flexibility in staging • Increased reliability of supply • Enhanced raw water quality management • Potential hydropower to offset raw water pumping
2	Desalination of Seawater	Permanent desalination plant utilising sea water. Sea water intake, desalination plant and brine discharge located on coast. Treated water pumped to Bulahdelah network. Principle items include land acquisition nearby coast, sea water intake and pumping infrastructure, storage tanks, screening and microfiltration units, reverse osmosis units, brine pumping system and discharge line to ocean outfall, permeate pipeline from desalination plant to Bulahdelah WTP (approximately 40 km depending on pipeline route and plant location) and multiple booster pump stations and balance tanks.	• Approvals and permits • Aquatic ecology – impingement and entrainment • Aquatic ecology – reject discharge • Community acceptance	• Inland community • Large carbon footprint • High operation and maintenance costs • Significant construction lengths for pipeline	• Rainfall independent • Proven technology • Operation flexible to demand
3	Reticulated Recycled Water	Dual reticulation network to supply recycled water for new development areas only. Recycled water could be utilised for outdoor uses, toilet flushing and laundry, offsetting potable water demand. Principle items option include an upgrade of the STP to meet recycled water quality suitable for unrestricted public access (advanced water treatment including membrane filtration) and transfer pumping systems including pipelines to development.	• Community acceptance • Approvals and permits • Insufficient recycled water demand due to low growth • Public health - potential misuse of recycled water	• Greenhouse gas emissions • High operation and maintenance costs with dual reticulation network • Only suitable for new residential developments (not practical to retrofit existing properties) - low growth • Rainfall dependent demand (for outdoor use)	• Rainfall independent • Community participation • Effluent management • Aesthetic values maintained
4	Recycled Water for Restricted Use	Bulahdelah RTP currently provides restricted quality recycled water. Increased use of recycled water for agriculture to offset potable demand. Principle items include transfer pumping and pipelines for expansion of recycled water network.	• Recycled water demand • Approvals and permits	• Rainfall dependent demand • Increased operation and maintenance costs	• Community participation • Effluent management • No upgrade to current RTP
5	Recycled Water for Unrestricted Use	Recycled water for public open space irrigation to offset potable demand. Principle items include membrane filtration, chlorination and treated water storage tanks, transfer infrastructure (pipelines and pumps), storage and recycled water irrigation infrastructure at end users.	• Approvals and permits • Community acceptance	• Significant distribution infrastructure • Rainfall dependent demand • Greenhouse gas emission • High operation and maintenance costs	• Rainfall independent • Community participation • Effluent management • Aesthetic values maintained
6	Recycled Water for Environmental Flows	Substitution of flows downstream of Crawford River offtake point to enable greater extraction upstream. Replacement flows supplied from Bulahdelah STP. Principle items include upgrade of Bulahdelah STP to achieve required water quality, transfer infrastructure (pipeline and pumps) and construction of an off-stream storage.	• Approvals and permits • Community acceptance • River health and ecology – substitution flow • River health and ecology – increased offtake	• Greenhouse gas emission • High operation and maintenance costs • May not improve yield / supply • Additional off-stream storage required (option 1)	• Effluent management • May improve river flow
7	Purified Recycled Water	Recycled water from RTP redirected to future off-stream storage and treated at the WTP. Principle items include an upgrade to the RTP with membrane filtration, RO and UV advanced oxidation processes, as well as transfer infrastructure connecting RTP to a future off-stream storage.	• Approvals and permits • Community acceptance • Severe public health consequences	• Greenhouse gas emission • Supporting legislation • High operation and maintenance costs • Requires construction of off stream storage (option 1)	• Effluent management • Rainfall independent • Utilises existing water and sewer network infrastructure • Increased reliability of supply

Option	Option Name	Option Description	Risks	Issues	Benefits and Opportunities
8	Groundwater	New bore field water supply. Sites identified in 1999 PPK study identified a prospective bore field in the Bulahdelah area. Principal items include borefield, WTP and pipeline to reservoir.	• Groundwater availability • Environmental impacts • Approvals and permits	• Long lead time	• Further investigation to investigate potential for groundwater resources
9	Interconnection with Regional Schemes (via Pipeline from Smiths Lake)	Connection of Bulahdelah scheme to the Manning scheme via. a pipeline connecting Smiths Lake and Bulahdelah. Bulahdelah to become part of the Manning scheme, supplied from Bootawa WTP and Nabiac bore field. The Bulahdelah WTP would be decommissioned. Principle items include transfer infrastructure connecting Smiths Lake and Bulahdelah, including approximately 40 km pipeline, one/multiple balance tanks and water pump stations, chlorine booster station, and potential upgrade of mains / reservoirs in southern Manning scheme.	• Environmental impacts • Approvals and permits • Impacts of natural disasters (i.e., fire) • Land acquisition	• Potential big lifts between Smiths Lake and Bulahdelah • Pipeline through environmentally sensitive corridors (possibly National Park) • Greenhouse gas emission	• Transfer point of raw water extraction to Manning Scheme. Secure yield issue currently being investigated; considered in water security solution for combined scheme. • Connect new customers to the water supply along pipeline route
10	Interconnection with Regional Schemes (via Pipeline from Tea Gardens)	Connection of Bulahdelah scheme to the Tea Gardens scheme via. a pipeline connecting Tea Gardens and Bulahdelah. Bulahdelah to become part of the Tea Gardens scheme, supplied from Tea Gardens bore field. The Bulahdelah WTP would be decommissioned. Principle items include transfer infrastructure connecting Tea Gardens and Bulahdelah, including approximately 40 km pipeline, one/multiple balance tanks and water pump stations, chlorine booster station, potential upgrade of mains / reservoirs in Tea Gardens scheme.	• Environmental impacts • Approvals and permits • Impacts of natural disasters (i.e., fire) • Land acquisition	• Potential big lifts between Tea Gardens and Bulahdelah • Greenhouse gas emission • Pipeline through environmentally sensitive corridors (possibly National Park)	• Connect new customers to the water supply alone pipeline route
11	Interconnection with Regional Schemes (via Water Carting from Tea Gardens)	Water carting from Tea Gardens WTP when flow unavailable in Crawford River (emergency measure). It is approximately 40 km each way via road between Tea Gardens and Bulahdelah.	• Impact / delay of transport from unforeseen circumstances • Supply availability from Tea Gardens bore field • Freight availability for prolonged periods • Public health consequences form contamination	• Greenhouse gas emission • Transport distances	• Short term water security solution until long term solution implemented • Scalable to requirements • Implemented successfully in past; no additional infrastructure needed for loading at Tea Gardens
12	Stormwater Harvesting	Offset potable water use with scheme for stormwater collection, storage and transfer to WTP. Principle items include multiple stormwater collection basins to capture stormwater, multiple sets of transfer infrastructure (pipelines and pumps) to transfer flows (when available) to a future off-stream storage for storage.	• Approvals and permits • Community acceptance • Water quality	• High operation and maintenance costs • Significant collection and transfer infrastructure • Requires construction of off-stream storage (option 1) • Rainfall dependent	• Utilisation of some exiting stormwater network

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Minutes of Meeting

IWCM Strategy Options and Scenarios

Subject	Water Security Coarse Screening Workshop	Page	6
Venue	Yalawanyi Ganya	Time	10:00 - 15:30
Participants	Rachael Abberton, MidCoast Project Manager and Water Planning Engineer Nathan Bakewell, MidCoast Coordinator Water Management and Treatment Central Shane Beeton, MidCoast Manager Water Operations Marnie Coates, MidCoast Executive Manager Water and Systems Tracey Hamer, MidCoast Manager Water Planning and Assets Daniel Harris, MidCoast Coordinator Water Management and Treatment North & West Roshan Iyadurai, DPE Principal Urban Water Planner Geoff Matheson, MidCoast Senior Process Controller South Valerie Masterton, DPE Principal Urban Water Planner Janice Moody, AECOM Strategic Planning Lead Water Mitchell Stace, MidCoast Manager Water Project Delivery Sara Wilson, MidCoast Community Relation and Education Coordinator Chenxi Zeng, MidCoast Manager Water Management and Treatment Craig Smith, MidCoast Senior Process Controller South Zena Smith-White, AECOM Project Manager and Strategic Planning Lead Wastewater Lakshu Suri, AECOM Water and Wastewater Planner Gerard Tuckerman, MidCoast Manager Natural Systems and Land Use Planning		
Apologies			
File/Ref No.	60696228	Date	07-Dec-2022
Distribution	As above		

No	Item	Action	Date
1.	**Opening – acknowledgement of Country and workshop agenda** Refer **Attachment A** for presentation slides		
2.	**Values Moment** AECOM shared a Safeguard moment from a recent incident detected by AECOM personnel in the Sydney offices, emphasizing the importance of responsibility for safety at all times for all.		
3.	**Introductions and workshop objectives and outcomes** Workshop objectives: • Present the long-list of water security options for discussion • Undertake a coarse screening of the long-list of options • Agree the short-list of options for further investigation Workshop outcome:		

No	Item	Action	Date
	• To endorse a short-list of water security options for further investigation prior to development of the IWCM Strategy		
4.	**Project background** The journey to date for the Integrated Water Cycle Management strategy was provided.		
5.	**Assessment Approach and Criteria** The assessment criteria and assessment methodology were shared. Scoring descriptors, Pass, Fail or Unknown were described for application in assessing each category of the criteria.		
6.	**Bulahdelah Water Security – Background** The background on Bulahdelah Water Supply Scheme and preliminary yield modelling results were presented. DPE provided clarification on the 5-10-10 rule. The discussions identified scope for amendment in the application of the rule in yield modelling. **AECOM** to confirm modelling methodology with DPE and update models	**AECOM**	23/12/2022
7.	**Bulahdelah Water Security – Coarse Screening of Options** The 12 long-list options were each presented in detail with a short description, and identified risks, issues, and opportunities. During discussions, some additional options were identified: These included: • *Interconnection with regional scheme – pipeline from Manning via Nabiac* • *Additional on-stream storage via raising weir crest at Crawford Weir Pool* • *Desalination of river water via Myall River* Following each option, an interactive group discussion was undertaken, and the option was assessed against the assessment criteria. Key outcomes from the coarse screening are presented in the attached table and summarised below: • The following options are to be progressed to Stage 2. o New off-stream storage dam o Additional on-stream storage via raising weir crest- *requires confirmation of technical feasibility* o Regional connection with pipeline from Manning via Nabiac o Regional connection with water carting from Tea Gardens (applicable only in an emergency scenario) o Groundwater – option to proceed ahead for further investigation with Water NSW for potential sources • The following options did not pass the coarse screening and will not progress to Stage 2:		

No	Item	Action	Date
	○ Desalination of sea water at Pacific Palms - *requires transfer pipeline through national park, expected very high cost, requires cost confirmation* ○ Desalination of river water via Myall River - *long pipeline required to transfer brine to coast, expected very high cost, requires cost confirmation* ○ Regional connection with pipeline from Manning via Smiths Lake – *requires transfer pipeline through national park, expected very high cost, requires cost confirmation* ○ Regional connection with pipeline from Manning via Tea Gardens - *long transfer pipeline required with expected high cost, potential impact to water security of Tea Gardens aquifer, requires cost confirmation* ○ Stormwater harvesting - *limited opportunity to offset potable water demand, high infrastructure cost, requires cost confirmation* ○ Reticulated recycled water - *only appropriate for growth areas (impractical to retrofit existing properties), limited growth in Bulahdelah, very limited opportunity to offset potable demand at very high capital and operational cost, limited yield available to expand reuse within Bulahdelah* ○ Recycled water for restricted use - *limited opportunity to offset potable demand, insufficient supply as high demand from existing customers in drought* ○ Recycled water for unrestricted use - *limited opportunity to offset potable demand, insufficient supply as high demand from existing customers in drought* ○ Recycled water for environmental flows - *high level treatment required for limited additional draw from river, limited benefit in drought/low flow conditions, regulatory framework not fully developed, high cost* ○ Purified recycled water - *very high cost, no supporting regulatory framework* **AECOM** to finalise options before proceeding to next stage	**AECOM**	23/12/2022
8.	**Stroud Water Security – Background** The background on Stroud Water Supply Scheme and preliminary yield modelling results were presented. **AECOM** to confirm modelling methodology with DPE and update models	**AECOM**	23/12/2022
9.	**Stroud Water Security – Coarse Screening of Options** The 11 long-list options were each presented in detail with a short description, and identified risks, issues, and opportunities. During discussions, some additional options were identified: These included: • *Duralie Mine Dam* • *Additional on-stream storage via raising weir crest*		

No	Item	Action	Date
	• *Desalination of river water via Karuah River* • *Interconnection with regional scheme – Gloucester via Stratford Dam* Following each option, an interactive group discussion was undertaken, and the option was assessed against the assessment criteria. Key outcomes from the coarse screening are presented in the attached table and summarised below: The following options are to be progressed to Stage 2. o Additional off-stream storage with new dam o Duralie Mine Dam o Regional connection with pipeline from Hunter via Dungog o Regional connection with water carting from Tea Gardens (applicable only in an emergency scenario) o Regional connection with water carting from Gloucester via Stratford Dam (applicable only in an emergency scenario) o Groundwater – option to proceed ahead for further investigation with Water NSW for potential sources The following options did not pass the coarse screening and will not progress to Stage 2: o Additional on-stream storage – *existing weir on Karuah River is a fish ladder, raising it would require significant environmental approvals.* o Desalination of sea water at Pacific Palms - *long transfer pipeline through national park, expected very high cost, requires cost confirmation* o Desalination of river water via Karuah River - *long pipeline required to transfer brine to coast, expected very high cost, requires cost confirmation* o Stormwater harvesting - *limited opportunity to offset potable water, multiple discharge locations, high infrastructure cost, requires cost confirmation* o Reticulated recycled water - *only appropriate for growth areas, limited growth in Stroud, very limited opportunity to offset potable demand at very high capital and operational cost, limited yield available to expand reuse within Stroud* o Recycled water for restricted use - *limited opportunity to offset potable demand, insufficient supply as high demand from existing customer in drought* o Recycled water for unrestricted use - *limited opportunity to offset potable demand, insufficient supply as high demand from existing customer in drought* o Recycled water for environmental flows - *high level treatment required for limited additional draw from river, limited benefit in drought/low flow conditions, high cost, regulatory framework not fully developed*		

No	Item	Action	Date
	○ Purified recycled water – *very high cost, no supporting regulatory framework* **AECOM** to finalise options before proceeding to next stage	**AECOM**	23/12/2022
10.	**Gloucester Water Security – Background and Long-list Options** The background on Gloucester Water Supply Scheme and preliminary yield modelling results were presented. The 12 options were each presented in detail with a short description, and identified risks, issues, and opportunities. During discussions, some additional options were identified: These included: • *Additional on-stream storage via new weir* • *Desalination of river water via Gloucester River* **AECOM** to confirm modelling methodology with DPE and update models	**AECOM**	23/12/2022
11.	**Gloucester Water Security – Coarse Screening of Options** Interactive discussions in four groups were undertaken for assessing options before presenting the findings to the wider group for challenge and acceptance. Key outcomes from the coarse screening are presented in the attached table and summarised below: The following options are to be progressed to Stage 2. ○ New off-stream storage dam ○ Stratford Mine Dam – *need to confirm how the dam would be used, i.e. as emergency supply during drought only via pipeline or tankering, or would it operate as off-stream storage filled via pumping from river* ○ Recycled water for unrestricted use (applicable as a supplementary option) ○ Regional connection with pipeline from Manning via Krambach ○ Regional connection with water carting from Tea Gardens (applicable only in an emergency scenario) ○ Stormwater harvesting ○ Groundwater – option to proceed ahead for further investigation with Water NSW for potential sources The following options did not pass the coarse screening and will not progress to Stage 2: ○ On-stream storage – *unfavourable riparian corridor not conducive to raising river levels, unlikely to provide sufficient storage to resolve water security, significant environmental approvals, high cost, rainfall dependent solution* ○ Desalination of sea water via Halliday's Point - *requires very long transfer pipeline, very high cost, requires cost confirmation. Agreed to consider as part of regional connection to Manning via Krambach*		

No	Item	Action	Date
	○ Desalination of river water at via Gloucester River - *requires very long transfer pipeline to transfer brine to coast, expected very high cost, requires cost confirmation* ○ Reticulated recycled water - *only appropriate for growth areas, limited growth in Gloucester, very limited opportunity to offset potable demand at very high capital and operational cost, limited yield available to expand reuse within Gloucester* ○ Recycled water for restricted use - *limited opportunity to offset potable demand, insufficient supply as high demand from existing customers* ○ Recycled water for environmental flows - *high level treatment required for limited additional draw from river, limited benefit in drought/low flow conditions, high cost, regulatory framework not fully developed* ○ Purified recycled water - *very high cost, no supporting regulatory framework* **AECOM** to finalise options before proceeding to next stage	**AECOM**	23/12/2022
12.	**General Discussion** Rainwater tanks: *Uptake of rainwater tanks will continue to increase, due to the requirements of the Building Sustainability Index (BASIX) regulations applying to all new residential dwellings since mid-2004. The BASIX system works on achieving water consumption savings, with rainwater tanks commonly installed as it provides a large proportion of the water consumption target. This will provide an alternative supply of water at a property scale; however, it will not solve our water security issue. In drought times, this source may be unavailable, as it is rainfall dependent. When the rainwater tank empties, it will be topped up by the town water supply.*		
13.	**Next Steps** AECOM to identify scenarios and undertake scenario modelling and Quadruple Bottom Line Analysis	**AECOM**	

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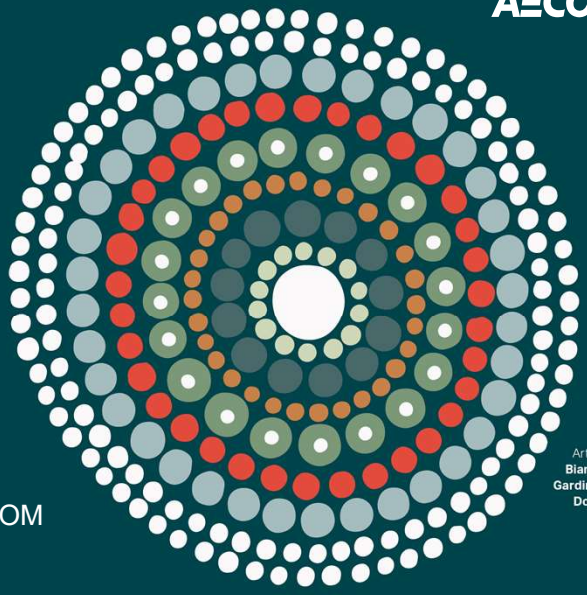
IWCM Strategy

Coarse Screening of Water Security Options

Workshop 2

Workshop facilitated by Zena Smith-White, AECOM



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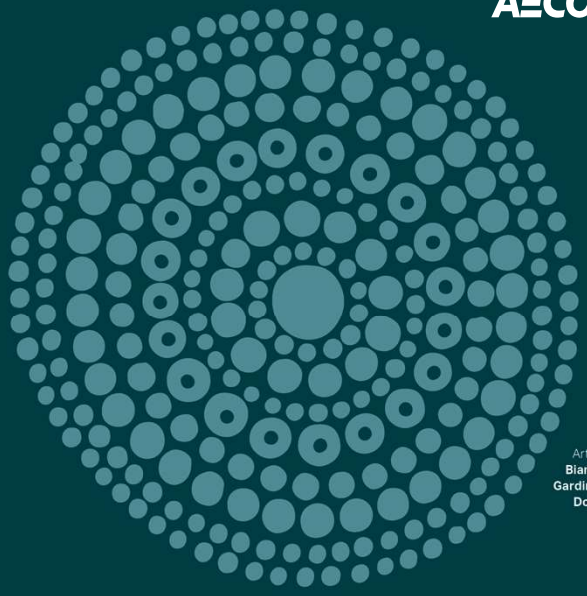
Acknowledgment of Country

We acknowledge the **Gathang-speaking (Biripi and Worimi)** people as the Traditional Custodians of the land on which we meet today, and recognise their connections to land, sea and community.

We pay our respect to their elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples today.



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Workshop 2 Agenda

1.	Welcome and Values Moment	10:00
2.	Introductions	10:05
3.	Workshop Objectives and Outcomes	10:10
4.	Project Background	10:15
5.	Assessment Approach and Criteria	10:20
6.	Bulahdelah Long-list Coarse Screening	10:30
7.	Stroud Long-list Coarse Screening	11:30
8.	Lunch break	12:30
9.	Gloucester Long-list Coarse Screening	13:00
10.	Conclusion	14:55
11.	Close	15:00

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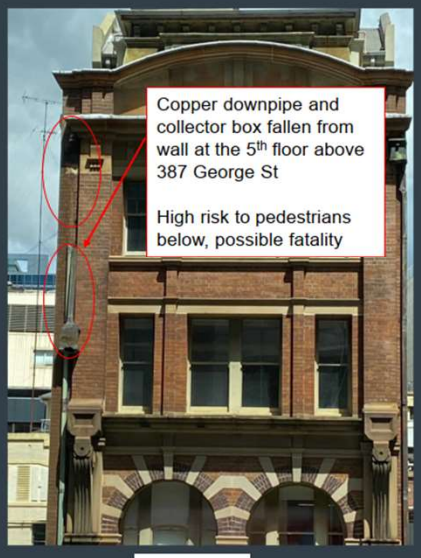
Values Moment – Safeguard



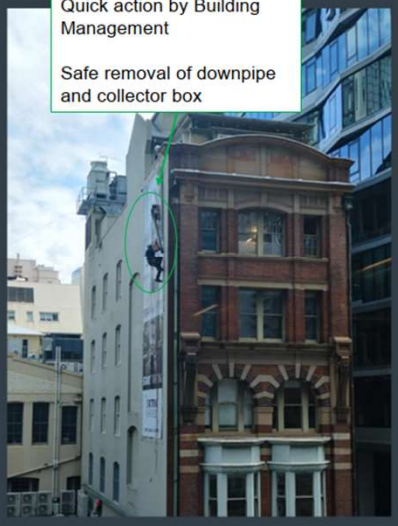
10:40am

Actions:

- Googled building address and building manager
- Visited the site, and talked to someone to show them the hazard
- Building manager rectified the hazard - potential crisis averted

A small effort to resolve a potentially fatal consequence

11:10am



12:15pm

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Introductions

- What is your name and role?
- What are you hoping to contribute to the workshop?
- What would you like to achieve today?

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Workshop Objectives and Outcomes

The objective of the workshop is to:

- Present the long-list of water security options for discussion
- Undertake a coarse screening of the long-list of options
- Agree the short-list of options for further investigation

The outcome of this workshop will be to an endorsed short-list of water security options for further investigation prior to development of the IWCM Strategy

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Project Background – Integrated Water Cycle Management

- IWCM integrates water supply, sewerage and stormwater services within 30-year whole-of-catchment strategy
- Sets the objectives, performance standards and associated performance indicators for the water and sewer business
- Identifies needs and issues based on evidence and sound analysis and ensures infrastructure matches need
- Determines investment priority in consultation with community and stakeholders
- Identifies the 'best value 30-year' IWCM scenario on a social, environmental and financial basis

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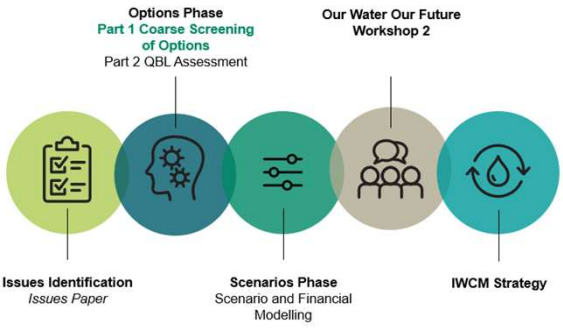
Project Background – MidCoast IWCM Journey to date

- MidCoast Water prepared 'Our Water Our Future 2045' in 2015 (water and sewerage only).
- Council is currently reviewing the IWCM, with final IWCM Strategy due May 2023
- Key outcome of the Issue Identification Phase:
  Bulahdelah, Gloucester and Stroud Supply Schemes do not have sufficient secure yield for supply – does not meet 5-10-10 rule



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Assessment Approach and Criteria

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Assessment Approach

Each option assessed against the criteria and assigned a score:

- Pass: Option meets the criteria and should progress to Stage 2
- Fail: Option does not meet criteria and should not progress to Stage 2
- Unknown: Option cannot be scored and further investigation is required

Assessment criteria developed based on:

- Council Vision and Mission statements
- Risk Management Framework
- AECOM experience with similar projects
- Advice from DPE

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Assessment Criteria

Council Values	Council Risk Category	Indicator	Description and Objectives of Indicator
Wellbeing	Worker & public health and wellbeing	Health and wellbeing	Fit for purpose water quality - meetings legislative requirements Construction and operating/maintenance risks Delivering the option in a safe manner to customers - both during construction and service delivery
	Service delivery and infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)
		Yield / beneficial to pursue / supply	Option will give either a measurable improvement in water security by either reducing demand or increasing supply (option improved long-term water security) based on future water supply and demand forecasts
		Practically viable	Option can be delivered by Council / external support
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework
	Project timeline	Timeline for planning and delivery	Adaptive planning considerations. Is the timeline required for planning pathways and delivery known? Are there any unknowns about the planning and delivery pathway for this option?
	Financial	Cost - capital	Capital costs (qualitative only)
	Project budget	Cost - O&M	Operating and maintenance costs (qualitative only)
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts
		Sustainability and resource consumption	Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact) Option aligns with principles of ecologically sustainable development and intergenerational equity
Respect	Reputation	Community acceptance	Option likely to have community support (based on assumption that there is enough information for the community to make a balanced judgement)

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Bulahdelah Water Supply Scheme
Long List of Options

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Project Background – Bulahdelah Water Supply Scheme

- Supplies township of Bulahdelah
- 2020 total permanent population of ~1,100 people
- Scheme supplies 2020 ADD ~320 kL/day, expected to increase to ~650 kL/day by 2050
- Water drawn from upstream of the Crawford River weir and treated at the Bulahdelah WTP
- Weir pool provides up to 163 ML on-stream storage

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Yield Modelling – Preliminary Results

AD (ML/d)	2020	2051
Bulahdelah	0.32	0.68

Base Case			
Demand: 0.32 ML/d (average)			
5 - RULE (Duration)			
Measurement Type	Time (days)	% Total Duration	
WEIR	0	0%	OK
10 - RULE (Frequency)			
Measurement Type	Time (years)	% Total Years	
WEIR	0	0%	OK
10 - RULE (Severity)			
Measurement Type	Longest Continous D	Year	
WEIR	0	0%	OK
Actions - None			

Provision Climate Change (2050) - No Action			
Demand: 0.68 ML/d (average)			
5 - RULE (Duration)			
Measurement Type	Time (days)	% Total Duration	
WEIR	5220	11%	NO
10 - RULE (Freqeuncy)			
Measurement Type	Time (years)	% Total Years	
WEIR	122	91%	NO
10 - RULE (Severity)			
Measurement Type	Longest Continous D	Year	
WEIR	40	1965	NO
Note - Reliability can be improved by increasing Water Access Limit from 221 ML to 250 ML			

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Yield Modelling – Preliminary Results

AD (ML/d)	2020	2051
Bulahdelah	0.32	0.68

Provision Climate Change (2050) - Action			
Demand: 0.68 ML/d (average)			
5 - RULE (Duration)			
Measurement Type	Time (days)	% Total Duration	
WEIR	19	0%	OK
10 - RULE (Freqeuncy)			
Measurement Type	Time (years)	% Total Years	
WEIR	1	1%	OK
10 - RULE (Severity)			
Measurement Type	Longest Continous D	Year	
WEIR	19	1965	OK
ACTIONS: - Increasing Water Access Limit from 221 ML to 250 ML - New 20 ML Offstream Storage OR Supplentary water source of 0.64 ML/d			

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Long-list of Water Security Options – Bulahdelah

- Increase storage yield via new off-stream storage
- Desalination of sea water (permanent)
- Interconnection with regional schemes (via pipeline to Smiths Lake)
- Interconnection with regional schemes (via pipeline to Tea Gardens)
- Interconnection with regional schemes (via water carting from Tea Gardens)
- Stormwater harvesting
- Groundwater

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Long-list of Water Security Options continued

- Recycled water for restricted use (agriculture and irrigation)
- Recycled water for unrestricted use (public open spaces)
- Recycled water for non-potable use via dual reticulation (new developments only)
- Recycled water for environmental flow replacement
- Purified recycled water

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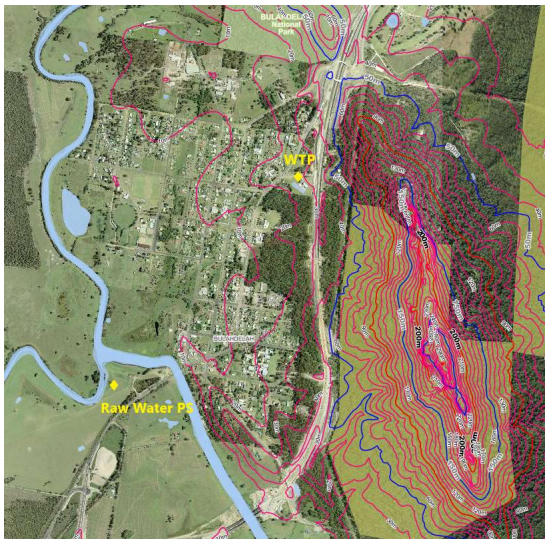
New Off-Stream Storage

- Construction of a new off-stream storage
- Bulahdelah currently does not have off-stream storage, little opportunity to avoid pumping when water quality not ideal
- Raw water supplied from the Crawford River and treated at Bulahdelah WTP
- Principal items include foundation excavation, storage construction, inlet / outlet pipework and pumps



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New Off-Stream Storage

Risks

- Approvals and permits
- Offtake water quality
- Cultural heritage sites
- Environmental impacts, including local ecology
- Stored water quality
- Current socio-political sentiment towards proposed dam projects

Issues

- Long lead time
- Not rainfall independent
- Large carbon footprint
- Complex geology
- Availability of fill materials

Opportunities

- Flexibility in staging
- Increased reliability of supply
- Enhanced stored raw water quality management – provide an alternative raw water supply when quality in the Crawford River unfavourable
- Potential hydropower to offset raw water pumping

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Seawater Desalination

- Construction of a permanent desalination plant at the coast utilising sea water, located adjacent to proposed Pacific Palms STP
- Raw water intake and reject discharge via ocean
- Treated water pumped from coast to Bulahdelah network for distribution
- Principal items include land acquisition nearby coast, sea water intake and pumping infrastructure, storage tanks, screening and microfiltration units, reverse osmosis units, brine pumping system and discharge line to ocean outfall, pipeline from desalination plant to Bulahdelah and multiple booster pump stations and balance tanks

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Seawater Desalination

Risks

- Approvals and permits
- Aquatic ecology – impingement and entrainment
- Aquatic ecology – reject discharge
- Community acceptance
- Significant construction lengths for pipeline, including potential for environmental corridors

Issues

- Inland community
- Large carbon footprint
- High operation and maintenance costs

Opportunities

- Rainfall independent supply
- Proven technology
- Operation flexible to demand

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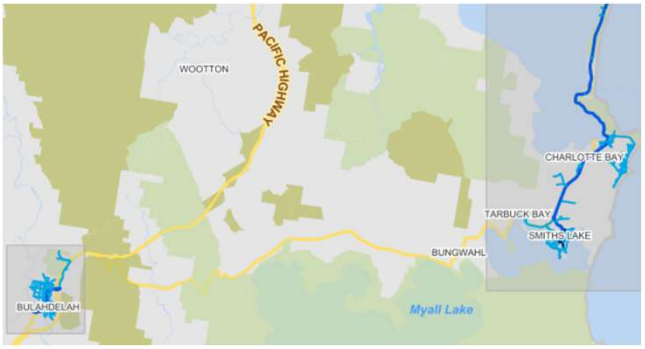
Interconnection with Regional Schemes (Pipeline from Smiths Lake)

- Connection of Bulahdelah scheme to the Manning scheme via a pipeline connecting Smiths Lake and Bulahdelah
- Bulahdelah to become part of the Manning scheme, supplied from Bootawa WTP and Nabiac Bore Field
- Interconnection would allow the Bulahdelah WTP to be decommissioned
- Principle items include transfer infrastructure connecting Smiths Lake and Bulahdelah, including approximately 35 km pipeline, one/several balance tanks and water pump stations, chlorine booster station, potential upgrade of mains / reservoirs in southern Manning scheme



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Interconnection with Regional Schemes (Pipeline from Smiths Lake)

Risks

- Environmental impacts
- Approvals and permits
- Impacts of natural disasters (i.e., fire) to pump stations- power failure, staff unable to access
- Land acquisition

Issues

- Greenhouse gas emission
- Potential big lifts between Smiths Lake and Bulahdelah

Opportunities

- Transfer point of raw water extraction to Manning Scheme. Secure yield issue currently being investigated; considered in water security solution for combined scheme.
- Connect new customers to the water supply along pipeline route

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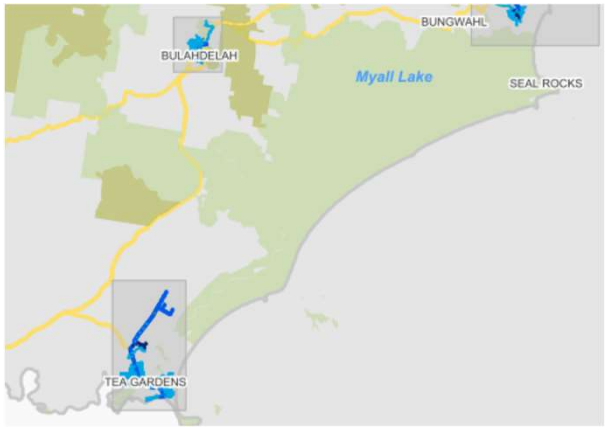
Interconnection with Regional Schemes (Pipeline from Tea Gardens)

- Connection of Bulahdelah scheme to the Tea Gardens scheme via a pipeline connecting Tea Gardens and Bulahdelah
- Bulahdelah to become part of the Tea Gardens scheme, supplied from Tea Gardens Bore Field
- Interconnection would allow the Bulahdelah WTPto be decommissioned
- Principle items include transfer infrastructure connecting Tea Gardens and Bulahdelah, including approximately 40 km pipeline, one/several balance tanks and water pump stations, chlorine booster station, potential upgrade of mains / reservoirs in southern Manning scheme



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Interconnection with Regional Schemes (Pipeline from Tea Gardens)

Risks

- Environmental impacts
- Approvals and permits
- Impacts of natural disasters (i.e., fire) to pump stations- power failure, staff unable to access
- Land acquisition

Issues

- Greenhouse gas emission
- Potential big lifts between Tea Gardens and Bulahdelah

Opportunities

- Transfer point of raw water extraction to Tea Gardens bore field.
- Connect new customers to the water supply along pipeline route

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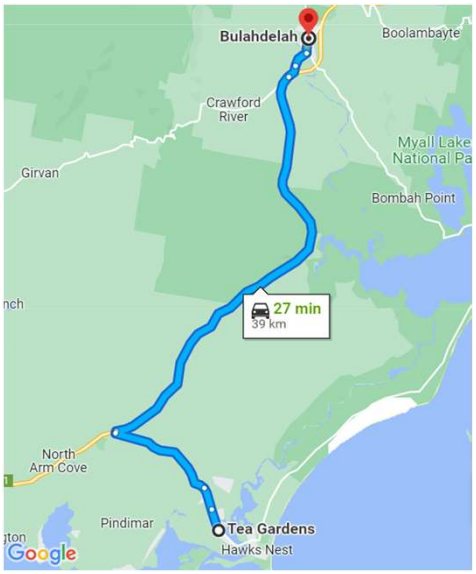
Interconnection with Regional Schemes (Water Carting from Tea Gardens)

- Water carting from Tea Gardens WTP when flow unavailable in Crawford River
- This is an emergency measure option
- It is approximately 40 km each way via road between Tea Gardens and Bulahdelah



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Interconnection with Regional Schemes (Water Carting from Tea Gardens)

Risks

- Impact / delay of transport from unforeseen circumstances I.e., traffic accident, bush fire,
- Supply availability from Tea Gardens Bore Field
- Freight availability for prolonged periods
- Public health consequences form contamination

Issues

- Greenhouse gas emission
- Transport distances

Opportunities

- Scalable to requirements
- Short term water security solution until long term solution implemented
- Implemented successfully in past
- Infrastructure for loading from Tea Gardens in place

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Groundwater

- This option considers groundwater sources in the Bulahdelah region.
- Sites identified in 1999 by PPK included drilling along the alluvial floodplain of the Myall River, upstream and downstream of Bulahdelah.
- Three sites were investigated. One of the sites included three test bores drilled in National Park 9 km downstream of Bulahdelah on the eastern side of Myall River. This produced high yields from deeper fluviatile sand and gravel aquifers.
- PPK concluded the sites have a reasonable chance of providing a potable supply in the order of 3 to 8 ML/day, depending on access considerations and further investigations.
- Principal items include bore field, water treatment plant, and pipeline to nearest reservoir.

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Groundwater

Risks

- Groundwater availability
- Approvals and permits

Issues

- Long lead time
- Storage volumes for the low salinity resource are uncertain as the bounds of the fresh quality aquifer are unknown
- Close to Myall Lake National Park
- Nearby wetlands that have a groundwater base component
- Possibility of saltwater intrusion if a bore field was over pumped
- High hardness and dissolved iron content at some sites tested in 1999

Opportunities

- Further investigation to investigate potential for groundwater resources

30

Recycled Water for Restricted Use (Agriculture)

- Current approach – recycled water supplied to Bulahdelah Golf course with restricted access
- Expansion of recycled water supply to new users for agriculture purposes
- Bulahdelah catchment includes various farms and agricultural properties
- Principal items include expansion of recycled water distribution infrastructure to new users

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Recycled Water for Restricted Use (Agriculture)

Risks

- Insufficient recycled water demand due to low growth in catchment
- Approvals and permits

Issues

- High demand for golf course - FY19/20 drought, all effluent reused
- Increased operation and maintenance costs
- Usage not guaranteed over longer term
- Increased greenhouse gas emissions
- Rainfall dependent demand

Opportunities

- Promotes community education and acceptance
- Effluent management
- No upgrade to STP treatment

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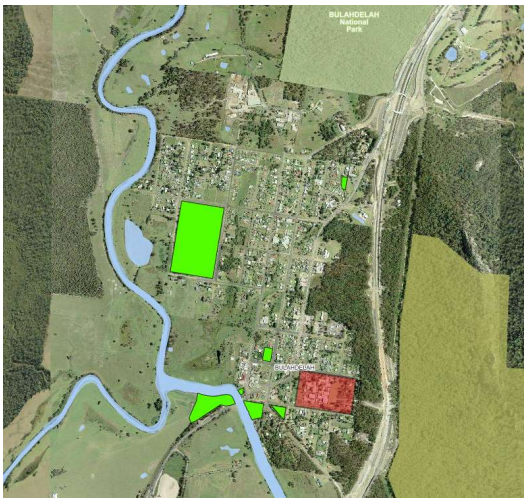
Recycled Water for Unrestricted Use (Public Open Spaces)

- Upgrade of STP to Australian recycling water standards for unrestricted use for public open space irrigation
- Potential sites include Bulahdelah Showground, Jack Ireland Sports Complex, Bulahdelah Central School
- Principle items include upgrade to STP with membrane filtration, chlorination, and treated water storage tanks; transfer infrastructure including pipeline/s and pumps, storage and recycled water irrigation infrastructure for end users (where Council owned and operated)



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Recycled Water for Unrestricted Use (Public Open Spaces)

Risks

- Approvals and permits
- Community acceptance
- Insufficient recycled water demand for material impact on potable water demand

Issues

- High demand for golf course - FY19/20 drought, all effluent reused
- Usage not guaranteed over longer term
- Rainfall dependent demand
- Increased operation and maintenance costs
- Increased greenhouse gas emissions

Opportunities

- Rainfall independent yield
- Promotes community education and acceptance
- Effluent management
- Maintains aesthetic values during drought

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Recycled Water for Non-potable Use via Dual Reticulation

- Provide reticulated recycled water to new development areas only to offset potable water use
- Recycled water used for outdoor uses, toilet flushing and laundry purposes
- Principle items include upgrade of the STP to meet recycled water quality suitable for unrestricted public access with advanced water treatment including membrane filtration, and transfer pumping systems including pipeline/s to development

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Recycled Water for Non-potable Use via Dual Reticulation

Risks

- Cross-contamination
- Approvals and permits – specifically for land clearing adjacent to STP
- Community acceptance
- Insufficient recycled water demand due to low growth
- Public health - potential misuse of recycled water

Issues

- Only suitable for new residential developments (not practical to retrofit existing properties)
- Partially rainfall dependent demand
- Developer driven
- Increase in greenhouse gas emissions
- High operation and maintenance costs with dual network

Opportunities

- Rainfall independent yield
- Promotes community education and acceptance
- Effluent management
- Maintains aesthetic values during drought

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Recycled Water for Environmental Flow Replacement

- Substitution of flow in Crawford River downstream of weir to enable greater extraction upstream
- Replacement flows supplied from Bulahdelah STP – may need to increase effluent quality
- Replacement flows potentially enable increased extraction rates under normal conditions for storage in future off-stream storage dam
- Principle items include upgrade of Bulahdelah STP to achieve required water quality suitable for Crawford River's ecosystem, transfer infrastructure including pipeline and pumps, and construction of additional off-stream storage

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Recycled Water for Environmental Flow Replacement

Risks

- River health and ecology – substitution flow
- River health and ecology – increased offtake
- Approvals and permits – pipeline corridor through Mill Creek

Issues

- May not improve yield / supply – river extraction limits
- High capital costs
- High operation and maintenance costs
- Requires additional off-stream storage to enable increased extraction

Opportunities

- Effluent management
- May improve river flow
- Adaptable to growth

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Purified Recycled Water

- High quality recycled water from STP redirected to future off-stream storage, to mix with raw water extracted from Crawford River
- Principle items include additional advanced treatment at STP to achieve required water quality, including membrane filtration, reverse osmosis, UV advanced oxidation, treated water storage tank, transfer infrastructure connecting STP to new off-stream storage (~2.5km if the storage is located close to the WTP).

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Purified Recycled Water

Risks

- Community acceptance
- Environmental impacts
- Approvals and permits
- Land acquisition
- Severe public health consequences

Issues

- Greenhouse gas emission
- Supporting legislation
- High operation and maintenance costs
- Brine discharge from RO

Opportunities

- Effluent management
- Rainfall independent
- Increased reliability of supply
- Utilises existing water and sewer network infrastructure

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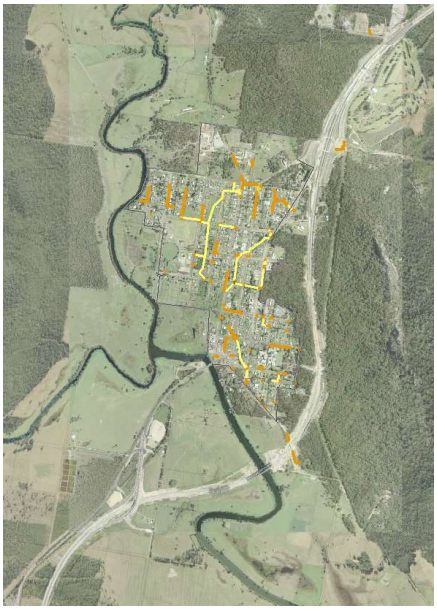
Stormwater Harvesting

- This option involves capturing this stormwater and transferring it to a future off-stream storage, to supplement the extraction of raw water from the Crawford River.
- Bulahdelah is boarded on the western side by the Myall River. The highest elevation is on the east of the town, falling to the river. The stormwater infrastructure GIS mapping, combined with contours, indicate multiple stormwater catchments that direct stormwater to the river via various routes.
- Principle items for this option include multiple collection basins for each catchment and pumping and transfer infrastructure from each collection basin to a future off-stream storage, to store the stormwater when available.



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Stormwater Harvesting

Risks

- Approvals and permits
- Stormwater yield
- Water quality and associated level of treatment
- Mosquito breeding at collection points and storage basins

Issues

- Rainfall dependent
- High operation and maintenance costs
- Multiple catchments
- Minimal growth in Bulahdelah for developer driven opportunities
- Significant infrastructure for retrofitting, including collection basins, pumps and pipelines
- This option still requires off stream storage to be constructed to collect stormwater when available

Opportunities

- Utilisation of some exiting stormwater network
- Flow attenuation in low flow events
- Reduced pollutants in natural waterways

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Coarse Screening of Options - Interactive

Break into 3 groups.

Each group to evaluate 5 options based on the assessment criteria.

Present findings to the group for challenge and discussions.

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Stroud Water Supply Scheme
Long List of Options

Art by
Bianca
Gardiner
Dodd

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Delivering a better world

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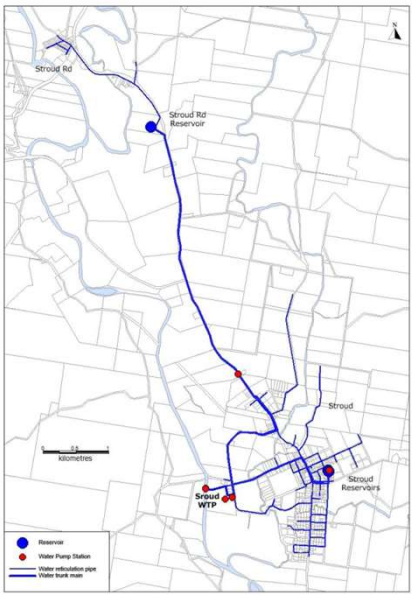
Project Background – Stroud Water Supply Scheme

- Supplies towns of Stroud and Stroud Road
- 2020 total permanent population of ~900 people
- Scheme supplies current ADD ~ 260 kL/day, expected to increase to ~ 660 kL/day by 2050
- Water drawn from upstream of the Karuah River weir. The weir pool provides up to 17 ML on-stream storage
- Stroud also has a 50 ML off-stream storage
- Water is treated at the Stroud WTP



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Yield Modelling – Preliminary Results

AD (ML/d)	2020	2051
Stroud	0.27	0.62

Base Case			
Demand: 0.27 ML/d (average)			
5 - RULE (Duration)			
Measurement Type	Time (days)	% Total Duration	
OffStream	99	0%	OK
10 - RULE (Freqeuncy)			
Measurement Type	Time (years)	% Total Years	
OffStream	2	1%	OK
10 - RULE (Severity)			
Measurement Type	Longest Continous Dr	Year	
OffStream	87	1965	NO
ACTIONS:			
- New 12 ML Offstream Storage OR Supplentary water source of 0.22 ML/d			
****Not yet reflected in the 5/10/10 results above****			

Provision Climate Change (2050) - No Action			
Demand: 0.62 ML/d (average)			
5 - RULE (Duration)			
Measurement Type	Time (days)	% Total Duration	
OffStream	622	1%	OK
10 - RULE (Freqeuncy)			
Measurement Type	Time (years)	% Total Years	
OffStream	17	13%	NO
10 - RULE (Severity)			
Measurement Type	Longest Continous Dr	Year	
OffStream	180	1965	NO
ACTIONS:			
- NIL			

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Yield Modelling – Preliminary Results

AD (ML/d)	2020	2051
Stroud	0.27	0.62

Provision Climate Change (2050) - Action			
Demand: 0.62 ML/d (average)			
5 - RULE (Duration)			
Measurement Type	Time (days)	% Total Duration	
OffStream	622	1%	OK
10 - RULE (Freqeuncy)			
Measurement Type	Time (years)	% Total Years	
OffStream	17	13%	NO
10 - RULE (Severity)			
Measurement Type	Longest Continous Dr	Year	
OffStream	180	1965	NO

ACTIONS:
- New 90 ML Offstream Storage OR Supplentary water source of 0.59 ML/d

****Not yet reflected in the 5/10/10 results above****

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Long-list of Water Security Options

- Increase storage yield via additional off-stream storage
- Desalination of sea water (permanent)
- Interconnection with regional schemes (via pipeline to Dungog)
- Interconnection with regional schemes (via water carting from Tea Gardens)
- Stormwater harvesting
- Groundwater

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Long-list of Water Security Options continued

- Recycled water for restricted use (agriculture)
- Recycled water for unrestricted use (public open spaces)
- Recycled water for non-potable use via dual reticulation
- Recycled water for environmental flow replacement
- Purified recycled water

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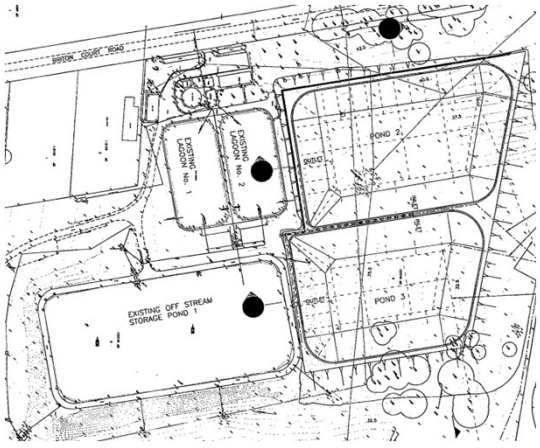
Additional Off-stream Storage

- 2 x new off-stream storage dams adjacent to existing dam at WTP site
- Raw water from Karuah River transported to existing sedimentation system and pre-treated before overflowing
- Based on 2009 concept design by NSW Dams & Civil
- Principal items include 2 x in-ground storage dams, valve pit arrangement or small pump station for each dam, upgrade of transfer pipe from river pump station to DN200
- Total storage increased to 150 ML (an additional 100 ML)



Source: NSW Public Works (Archived Working File - Part 01 - D1012 Stroud Off River Storage Design), 2009. *Stroud WS In Ground Storage General Arrangement drawings*. Midcoast Water.

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Additional Off-stream Storage

Risks

- Approvals and permits
- Potential for severe consequences with dam failure
- Compliance with current legislation

Issues

- Stratification from poor water quality
- Unfavourable ground conditions – clay material
- No allowance for staging – shared dam wall

Opportunities

- Land owned by Council
- Operational flexibility
- Increased reliability of supply

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Seawater Desalination

- Construction of a permanent desalination plant at the coast utilising sea water, located adjacent to proposed Pacific Palms STP
- Extension of Bulahdelah Desalination option
- Raw water intake and reject discharge via ocean
- Treated water pumped from coast to Stroud network for distribution
- Principal items include land acquisition nearby coast, sea water intake and pumping infrastructure, storage tanks, screening and microfiltration units, reverse osmosis units, brine pumping system and discharge line to ocean outfall, pipeline from desalination plant to Stroud (50 - 80 km inland from coast, depending on route) and multiple booster pump stations and balance tanks

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Seawater Desalination

Risks

- Approvals and permits
- Aquatic ecology – impingement and entrainment
- Aquatic ecology – reject discharge
- Community acceptance
- Significant construction lengths for pipeline, including potential for environmental corridors

Issues

- Inland community
- Large carbon footprint
- High operation and maintenance costs

Opportunities

- Rainfall independent supply
- Proven technology
- Operation flexible to demand

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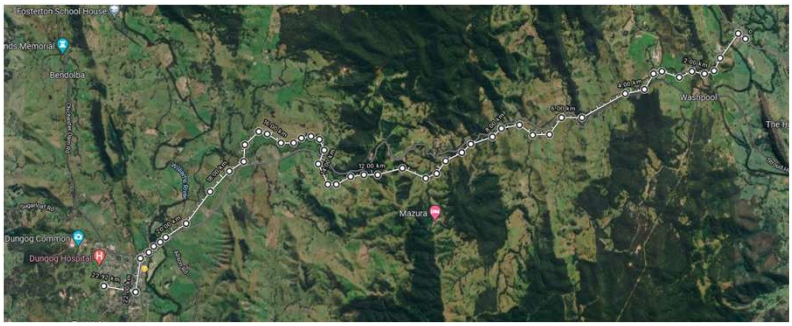
Interconnection with Regional Schemes (Pipeline from Dungog, Hunter Water)

- Connection of Stroud scheme to the Manning scheme via a pipeline connecting Dungog and Stroud
- Principle items include transfer infrastructure connecting Dungog and Stroud, including approximately 24 km pipeline, balance tanks, chlorine dosing system, and potential modifications to Stroud Road reservoir for flexibility to pump both to Stroud Road and Stroud water supply zones



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Interconnection with Regional Schemes (Pipeline from Dungog, Hunter Water)

Risks

- Environmental impacts
- Approvals and permits
- Impacts of natural disasters (i.e., fire) to pump stations- power failure, staff unable to access
- Land acquisition
- Availability of water supply at Dungog
- Sharing agreement between Council and Hunter Water

Issues

- Greenhouse gas emission
- Distance of pumping
- Operational arrangement at Stroud Road Reservoir to gravitate to Stroud

Opportunities

- Connect new customers to the water supply along pipeline route

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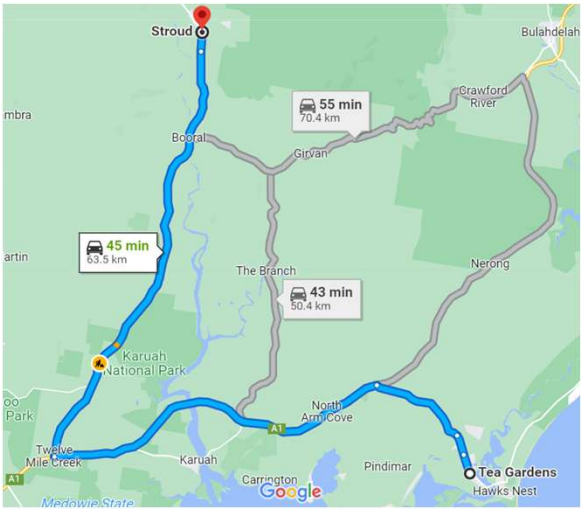
Interconnection with Regional Schemes (Water Carting from Tea Gardens)

- Water carting from Tea Gardens WTP when flow unavailable in Karuah River
- This is an emergency measure option
- It is approximately 60 km each way via road between Tea Gardens and Stroud



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Interconnection with Regional Schemes (Water Carting from Tea Gardens)

Risks

- Impact / delay of transport from unforeseen circumstances I.e., traffic accident, bush fire,
- Supply availability from Tea Gardens Bore Field
- Freight availability for prolonged periods
- Public health consequences form contamination

Issues

- Greenhouse gas emission
- Transport distances

Opportunities

- Scalable to requirements
- Short term water security solution until long term solution implemented
- Implemented successfully in past
- Infrastructure for loading from Tea Gardens and unloading at Stroud in place

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Groundwater

- This option considers groundwater sources in the Stroud region.
- Prospective sites identified in the 1999 PPK study did not identify any potential sites in the Stroud area.
- The area of Stroud falls within the Gloucester Basin groundwater source as per the Water Sharing Plan for the Lower North Coast. This basin covers an area extending from Gloucester to Stroud in the south. Local water utility licence for water supply to townships has a limitation of 50 ML/yr for this specific basin, which is an insufficient yield for the township of Stroud, even when assuming 100% allocation.
- Principal items include bore field, water treatment plant, and pipeline to nearest reservoir.

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Groundwater

Risks

- Groundwater availability
- Approvals and permits

Issues

- No prospective sites have been identified in previous studies for the Stroud region

Opportunities

- Further investigation to investigate potential for unidentified groundwater resources

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Recycled Water for Restricted Use (Agriculture)

- Current approach – recycled water supplied for dairy cattle grazing to single user
- Expansion of recycled water supply to new users for agriculture purposes
- Potential users include 2 poultry farms (approximately 4 km to each site) and additional farmland sites
- Principal items include expansion of recycled water distribution infrastructure to new users

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Recycled Water for Restricted Use (Agriculture)

Risks

- Insufficient recycled water demand due to low growth in catchment
- Approvals and permits

Issues

- Increased operation and maintenance costs
- Usage not guaranteed over longer term
- Long pipelines required for single users
- Greenhouse gas emissions
- Rainfall dependent demand

Opportunities

- Promotes community education and acceptance
- Effluent management
- No upgrade to STP treatment
- Increases reliability with increased users

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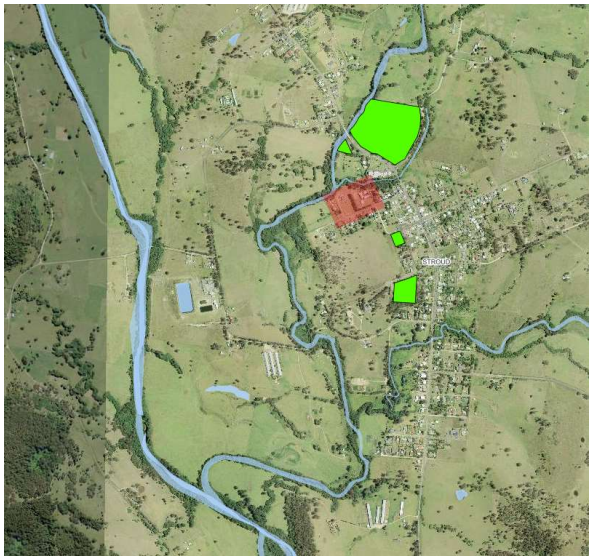
Recycled Water for Unrestricted Use (Public Open Spaces)

- Upgrade of STP to Australian recycling water standards for unrestricted use for public open space irrigation
- Potential sites include local parks such as Allen Park, Silo Hill Park, and Mills Creek Lions Park, Stroud showgrounds, and Stroud Public School
- Principle items include a new RTP with membrane filtration, chlorination and treated water storage tanks, transfer infrastructure including pipeline/s and pumps, storage and recycled water irrigation infrastructure at end user sites (if Council owned and operated)



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Recycled Water for Unrestricted Use (Public Open Spaces)

Risks

- Approvals and permits – specifically for land clearing adjacent to STP
- Community acceptance
- Insufficient recycled water demand for material impact on potable water demand

Issues

- Significant treatment infrastructure
- Significant infrastructure maximise use
- Usage not guaranteed over longer term
- Rainfall dependent demand
- Increased operation and maintenance costs
- Increased greenhouse gas emissions

Opportunities

- Rainfall independent yield
- Promotes community education and acceptance
- Effluent management
- Maintains aesthetic values during drought

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Recycled Water for Non-potable Use via Dual Reticulation

- Provide reticulated recycled water to new development areas only to offset potable water use
- Used for outdoor uses, toilet flushing and laundry purposes
- Principle items include upgrade of STP to meet recycled water quality suitable for unrestricted public access with membrane filtration, transfer pumping systems including pipeline/s to development, and treated storage tanks

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Recycled Water for Non-potable Use via Dual Reticulation

Risks

- Cross-contamination
- Approvals and permits – specifically for land clearing adjacent to STP
- Community acceptance
- Insufficient recycled water demand due to low growth
- Public health - potential misuse of recycled water

Issues

- Only suitable for new residential developments (not practical to retrofit existing properties)
- Partially rainfall dependent demand
- Developer driven
- Increase in greenhouse gas emissions
- High operation and maintenance costs with dual network

Opportunities

- Rainfall independent yield
- Promotes community education and acceptance
- Effluent management
- Maintains aesthetic values during drought

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Recycled Water for Environmental Flow Replacement

- Substitution of flows downstream of Karuah River offtake point for Stroud WTP to enable greater extraction upstream
- Replacement flows supplied from Stroud STP– may need to increase effluent quality
- Replacement of flows to potentially enable increased extraction rates under normal conditions for storage in future off-stream storage dam
- Principle items include upgrade of Stroud STP to achieve required water quality suitable for Karuah River's ecosystem, transfer infrastructure including pipeline and pumps, and construction of additional off-stream storage

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Recycled Water for Environmental Flow Replacement

Risks

- River health and ecology – substitution flow
- River health and ecology – increased offtake
- Approvals and permits – pipeline corridor through Mill creek

Issues

- May not improve yield / supply – river extraction limits
- High capital costs
- High operation and maintenance costs
- Requires additional off-stream storage to enable increased extraction

Opportunities

- Effluent management
- May improve river flow
- Adaptable to growth

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Purified Recycled Water

- High quality recycled water from STP redirected to future off-stream storage, to mix with raw water extracted from Karuah River.
- Principle items include treatment addition to the STP that achieves advanced water treatment, including membrane filtration, reverse osmosis, UV advanced oxidation, treated water storage tank, transfer infrastructure connecting STP to off-stream storage (~ 4.0km).

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Purified Recycled Water

Risks

- Community acceptance
- Environmental impacts
- Approvals and permits
- Land acquisition
- Severe public health consequences

Issues

- Greenhouse gas emission
- Supporting legislation
- High operation and maintenance costs
- Brine discharge from RO

Opportunities

- Effluent management
- Rainfall independent
- Increased reliability of supply
- Utilises existing water and sewer network infrastructure

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Stormwater Harvesting

- This option involves capturing this stormwater and transferring it to the Stroud off-stream storage, to supplement the extraction of raw water from the Karuah River.
- Stroud is boarded on the western side by the Crawford River. The highest elevation is on the east of the town, falling to the river. The stormwater infrastructure GIS mapping, combined with contours, indicate multiple stormwater catchments that direct stormwater to the river via various routes.
- Principle items for this option include multiple collection basins for each catchment and pumping and transfer infrastructure from each collection basin to the current off-stream storage (may require additional off-stream storage to be constructed), to store the stormwater when available.

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Stormwater Harvesting

Risks

- Approvals and permits
- Stormwater yield
- Water quality and associated level of treatment
- Mosquito breeding at collection points and storage basins

Issues

- Rainfall dependent
- High operation and maintenance costs
- Multiple catchments
- Minimal growth in Stroud for developer driven opportunities
- Significant infrastructure for retrofitting, including collection basins, pumps and pipelines
- This option may require the additional off stream storage to be constructed

Opportunities

- Utilisation of some exiting stormwater network
- Flow attenuation in low flow events
- Reduced pollutants in natural waterways

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Coarse Screening of Options - Interactive

Break into 3 groups.

Each group to evaluate 5 options based on the assessment criteria.

Present findings to the group for challenge and discussions.

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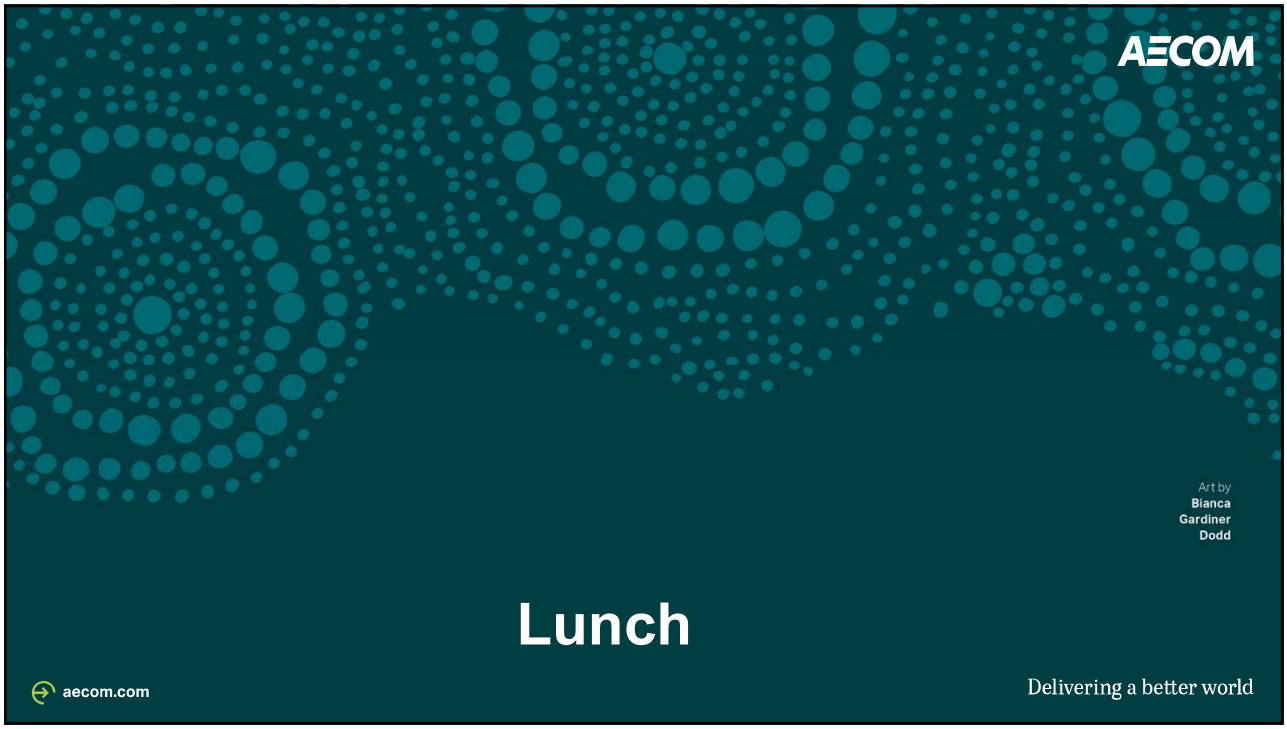
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Gloucester Water Supply Scheme
Long List of Options
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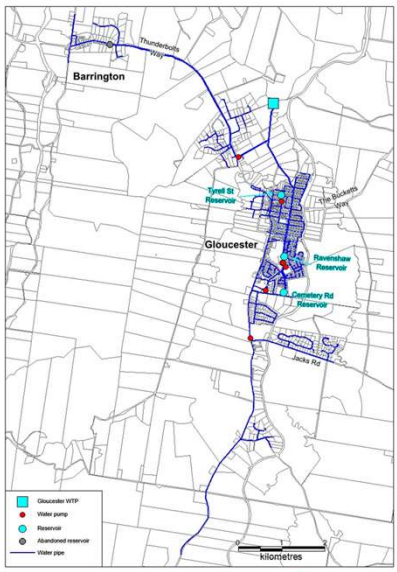
Project Background – Gloucester Water Supply Scheme

- Supplies towns of Gloucester and Barrington
- 2020 total permanent population of ~3,500 people
- Scheme supplies 2020 ADD ~790 kL/day, expected to increase to ~1500 kL/day by 2050
- Water is extracted from the Barrington River and treated at the Gloucester WTP
- No off-stream storage (run-of-the-river scheme)
- Approximately 10 ML of storage in network reservoirs (in construction)



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Long-list of Water Security Options – Gloucester

- Increase storage yield via new off-stream storage
- Stratford Mine Dam
- Desalination of sea water (permanent)
- Interconnection with regional schemes (via pipeline to Krambach)
- Interconnection with regional schemes (via water carting from Tea Gardens)
- Stormwater harvesting
- Groundwater

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Long-list of Water Security Options continued

- Recycled water for restricted use (agriculture)
- Recycled water for unrestricted use (public open spaces)
- Recycled water for non-potable use via dual reticulation
- Recycled water for environmental flow replacement
- Purified recycled water

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New Off-Stream Storage

- Construction of a new off-stream storage
- No off-stream storage currently, little opportunity to avoid pumping when water quality not ideal
- Raw water supplied from Barrington River and treated at Bulahdelah WTP
- Six off-stream storage locations were investigated by SMEC in 2016; two were deemed feasible
- Principal items include zoned embankment, foundation excavation, spillway construction and inlet / outlet pipework and pumps connecting the storage with the Barrington River and Gloucester WTP

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Off-Stream Storage

Risks

- Approvals and permits
- Offtake water quality
- Cultural heritage sites
- Environmental impacts, including local ecology
- Stored water quality
- Current socio-political sentiment towards proposed dam projects

Issues

- Long lead time
- Not rainfall independent
- Large carbon footprint
- Complex geology
- Availability of fill materials
- Potential easements required through private property

Opportunities

- Flexibility in staging
- Increased reliability of supply
- Enhanced stored raw water quality management – provide an alternative raw water supply when quality in the Crawford River unfavourable
- Potential hydropower to offset raw water pumping

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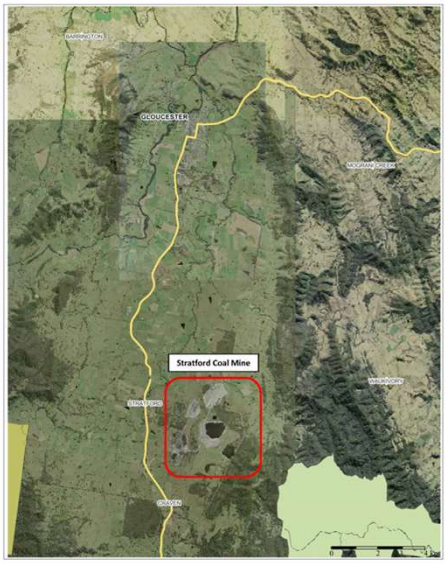
Stratford Mine Dam - Acquire for Off-Stream Storage

- Acquire Stratford Mine Dam as off-stream storage.
- The Return Water Dam holds approximately 10,000 ML of water.
- Principle items include acquiring the dam, transfer infrastructure (pumps and pipeline, approximately 9 km) to the Gloucester WTP, raw water transfer infrastructure (pumps and pipeline) from the Barrington River, either from the current offtake or identifying a raw water offtake location closer to the dam.



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Stratford Mine Dam - Acquire for Off-Stream Storage

Risks

- Approvals and permits
- Offtake water quality
- Cultural heritage sites
- Environmental impacts
- Stored water quality
- Current socio-political sentiment towards proposed dam projects

Issues

- Long lead time
- Not rainfall independent
- Large carbon footprint
- Potential easements required through private property

Opportunities

- Increased reliability of supply
- Enhanced stored raw water quality management – provide an alternative raw water supply when quality in the Barrington River unfavourable

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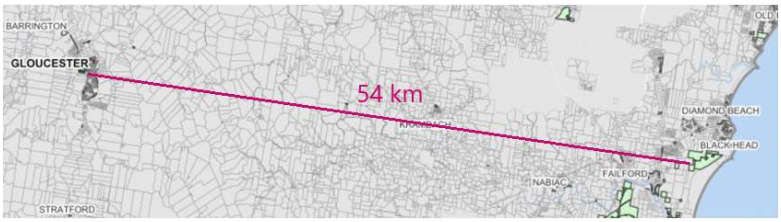
Seawater Desalination

- Construction of a permanent desalination plant at the coast utilising sea water on Hallidays Point STP land
- Raw water intake and reject discharge via ocean
- Treated water pumped from coast to Gloucester network for distribution
- Principal items include land acquisition nearby coast, sea water intake and pumping infrastructure, storage tanks, screening and microfiltration units, reverse osmosis units, brine pumping system and discharge line to ocean outfall, pipeline from desalination plant to Gloucester (~ 70 km inland from coast, depending on route) and multiple booster pump stations and balance tanks.



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Seawater Desalination

Risks

- Approvals and permits
- Aquatic ecology – impingement and entrainment
- Aquatic ecology – reject discharge
- Community acceptance
- Significant construction lengths for pipeline, including potential for environmental corridors

Issues

- Inland community
- Large carbon footprint
- High operation and maintenance costs

Opportunities

- Rainfall independent supply
- Proven technology
- Operation flexible to demand

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Interconnection with Regional Schemes (Pipeline from Krambach)

- Connection of Gloucester scheme to the Manning scheme via a pipeline connecting Krambach and Gloucester.
- Gloucester to become part of the Manning scheme, supplied from Bootawa WTP and Nabiac Bore Field.
- Interconnection would allow the Gloucester WTP to be decommissioned
- Principle items include transfer infrastructure connecting Krambach and Gloucester, including approximately 40 km pipeline, two balance tanks and water pump stations, chlorine booster station, upgrade of mains in Manning scheme and upgrade of Krambach reservoir.

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Interconnection with Regional Schemes (Pipeline from Krambach)

Risks

- Environmental impacts
- Approvals and permits
- Impacts of natural disasters (i.e., fire) to pump stations- power failure, staff unable to access
- Land acquisition

Issues

- Greenhouse gas emission
- Two big lifts between Krambach and Gloucester

Opportunities

- Transfer point of raw water extraction to Manning Scheme. Secure yield issue currently being investigated; considered in water security solution for combined scheme.
- Connect new customers to the water supply along pipeline route

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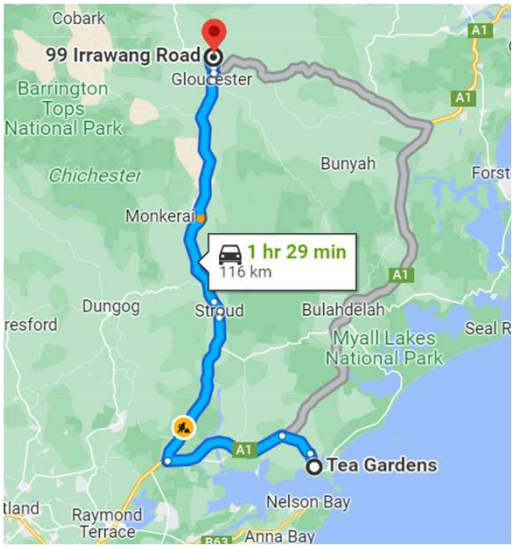
Interconnection with Regional Schemes (Water Carting from Tea Gardens)

- Water carting from Tea Gardens WTP when flow unavailable in Barrington River
- This is an emergency measure option
- It is approximately 120 km each way via. road between Tea Gardens and Gloucester



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Interconnection with Regional Schemes (Water Carting from Tea Gardens)

Risks

- Impact / delay of transport from unforeseen circumstances I.e., traffic accident, bush fire,
- Supply availability from Tea Gardens Bore Field
- Freight availability for prolonged periods
- Public health consequences form contamination

Issues

- Greenhouse gas emission
- Transport distances

Opportunities

- Scalable to requirements
- Short term water security solution until long term solution implemented
- Implemented successfully in past
- Infrastructure for loading from Tea Gardens and unloading at Gloucester in place

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Groundwater

- This option considers groundwater sources in the Gloucester region.
- Prospective sites identified in the 1999 PPK study did not identify any potential sites in the Gloucester area.
- Gloucester falls within the Gloucester Basin groundwater source as per the Water Sharing Plan for the Lower North Coast. This basin covers an area extending from Gloucester to Stroud in the south. Local water utility licence for water supply to townships has a limitation of 50 ML/yr for this specific basin, which is an insufficient yield for the township of Gloucester, even when assuming 100% allocation.
- Principal items include bore field, water treatment plant, and pipeline to nearest reservoir.

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Groundwater

Risks

- Groundwater availability
- Approvals and permits

Issues

- No prospective sites have been identified in previous studies for the Gloucester region

Opportunities

- Further investigation to investigate potential for unidentified groundwater resources

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Recycled Water for Restricted Use (Agriculture)

- Current approach – recycled water supplied for pasture irrigation using 25 – 40% of treated effluent
- Expansion of recycled water supply to new users for agriculture purposes
- 4 potential users identified in previous investigations within Gloucester area
- Principal items include expansion of recycled water distribution infrastructure to new users

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Recycled Water for Restricted Use (Agriculture)

Risks

- Insufficient recycled water demand due to low growth in catchment
- Approvals and permits

Issues

- Increased operation and maintenance costs
- Usage not guaranteed over longer term
- Significant infrastructure required to maximise use
- Greenhouse gas emissions
- Rainfall dependent demand

Opportunities

- Promotes community education and acceptance
- Effluent management
- No upgrade to RTP treatment
- Increases reliability with increased users

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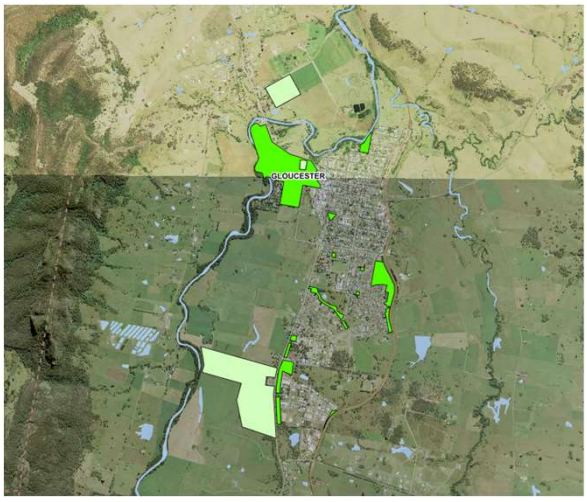
Recycled Water for Unrestricted Use (Public Open Spaces)

- Upgrade of STP to Australian recycling water standards for unrestricted use for public open space irrigation
- 5 potential open spaces identified in previous investigation including Gloucester showgrounds, District Park, Billabong Native Park, Minimbah Native Garden, and Golf Course
- Provision for upgrades at STP for higher level treatment for recycled water
- Principle items include membrane filtration, chlorination and treated water storage tanks at the STP, transfer infrastructure including pipeline/s and pumps, storage and recycled water irrigation infrastructure at end users



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Recycled Water for Unrestricted Use (Public Open Spaces)

Risks

- Approvals and permits
- Community acceptance

Issues

- Significant distribution infrastructure
- Usage not guaranteed over longer term
- Rainfall dependent demand
- Increased operation and maintenance costs
- Increased greenhouse gas emissions

Opportunities

- Rainfall independent yield
- Promotes community education and acceptance
- Effluent management
- Maintains aesthetic values during drought
- Increases reliability with increased users

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Recycled Water for Non-potable Use via Dual Reticulation

- Provide reticulated recycled water to new development areas only to offset potable water use
- Used for outdoor uses, toilet flushing and laundry purposes
- Principle items include upgrade of the STP to meet recycled water quality suitable for unrestricted public access with membrane filtration and transfer pumping systems including pipeline/s to development

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Recycled Water for Non-potable Use via Dual Reticulation

Risks

- Cross-contamination
- Approvals and permits
- Community acceptance
- Insufficient recycled water demand due to low growth
- Public health - potential misuse of recycled water

Issues

- Only suitable for new residential developments (not practical to retrofit existing properties)
- Partially rainfall dependent demand
- Developer driven
- Increase in greenhouse gas emissions
- High operation and maintenance costs with dual network

Opportunities

- Rainfall independent yield
- Promotes community education and acceptance
- Effluent management
- Maintains aesthetic values during drought

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Recycled Water for Environmental Flow Replacement

- Substitution of flows downstream of Gloucester WTP Barrington River offtake point to enable greater extraction upstream
- Replacement flows supplied from Gloucester STP – may need to increase effluent quality
- Replacement of flows to potentially enable increased extraction rates under normal conditions for storage in future off-stream storage dam
- Principle items include upgrade of Gloucester STP to achieve required water quality suitable for Barrington River's ecosystem with membrane filtration, transfer infrastructure including pipeline and pumps, and construction of additional off-stream storage

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Recycled Water for Environmental Flow Replacement

Risks

- River health and ecology – substitution flow
- River health and ecology – increased offtake
- Approvals and permits – pipeline corridor through Mill creek
- Community acceptance

Issues

- May not improve yield / supply – river extraction limits
- High capital costs
- High operation and maintenance costs
- Requires additional off-stream storage to enable increased extraction

Opportunities

- Effluent management
- May improve river flow
- Adaptable to growth

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Purified Recycled Water

- High quality recycled water from STP redirected to future off-stream storage, to mix with raw water extracted from Barrington River
- A new WTP is required in 5 - 10 years
- The current Gloucester STP upgrade has provision for future treatment to be added, to reach a higher quality recycled water
- Principle items include treatment addition to the STP that achieves advanced water treatment, including membrane filtration, reverse osmosis, UV advanced oxidation, treated water storage tank, transfer infrastructure connecting STP to future off-stream storage (~ 4.0km if the future off-stream storage is located close to the WTP)

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Purified Recycled Water

Risks

- Community acceptance
- Environmental impacts
- Approvals and permits
- Land acquisition
- Severe public health consequences

Issues

- Greenhouse gas emission
- Supporting legislation
- High operation and maintenance costs
- Brine discharge from RO

Opportunities

- Effluent management
- Rainfall independent
- Increased reliability of supply
- Utilises existing water and sewer network infrastructure
- STP upgrade has provision for additional treatment

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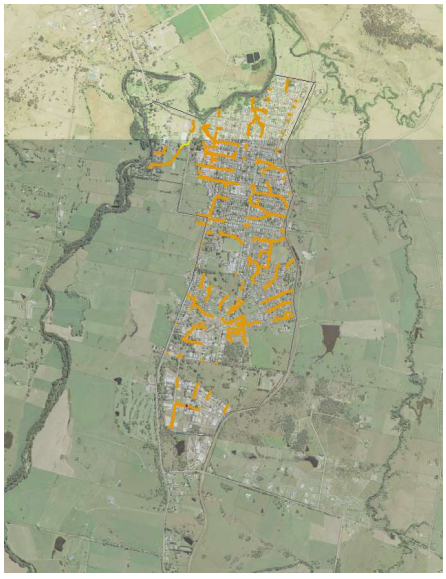
Stormwater Harvesting

- This option involves capturing this stormwater and transferring it to a future off-stream storage, to supplement the extraction of raw water from the Barrington River.
- A study completed in 2021 on Gloucester's stormwater harvesting potential identified the town is effectively split in two, due to a high ridge that runs in a north south direction through the centre. On each side of the ridge, there are multiple smaller stormwater catchments, which predominately directs flow to the Barrington River.
- Principle items for this option include multiple collection basins for each catchment and pumping and transfer infrastructure from each collection basin to a future off-stream storage, to store the stormwater when available.



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Stormwater Harvesting

Risks

- Approvals and permits
- Stormwater yield
- Water quality and associated level of treatment
- Mosquito breeding at collection points and storage basins

Issues

- Rainfall dependent
- High operation and maintenance costs
- Multiple catchments
- Minimal growth in Gloucester for developer driven opportunities
- Significant infrastructure for retrofitting, including collection basins, pumps and pipelines
- This option still requires off stream storage to be constructed to collect stormwater when available

Opportunities

- Utilisation of some exiting stormwater network
- Flow attenuation in low flow events
- Reduced pollutants in natural waterways

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Coarse Screening of Options - Interactive

Break into 3 groups.

Each group to evaluate 5 options based on the assessment criteria.

Present findings to the group for challenge and discussions.

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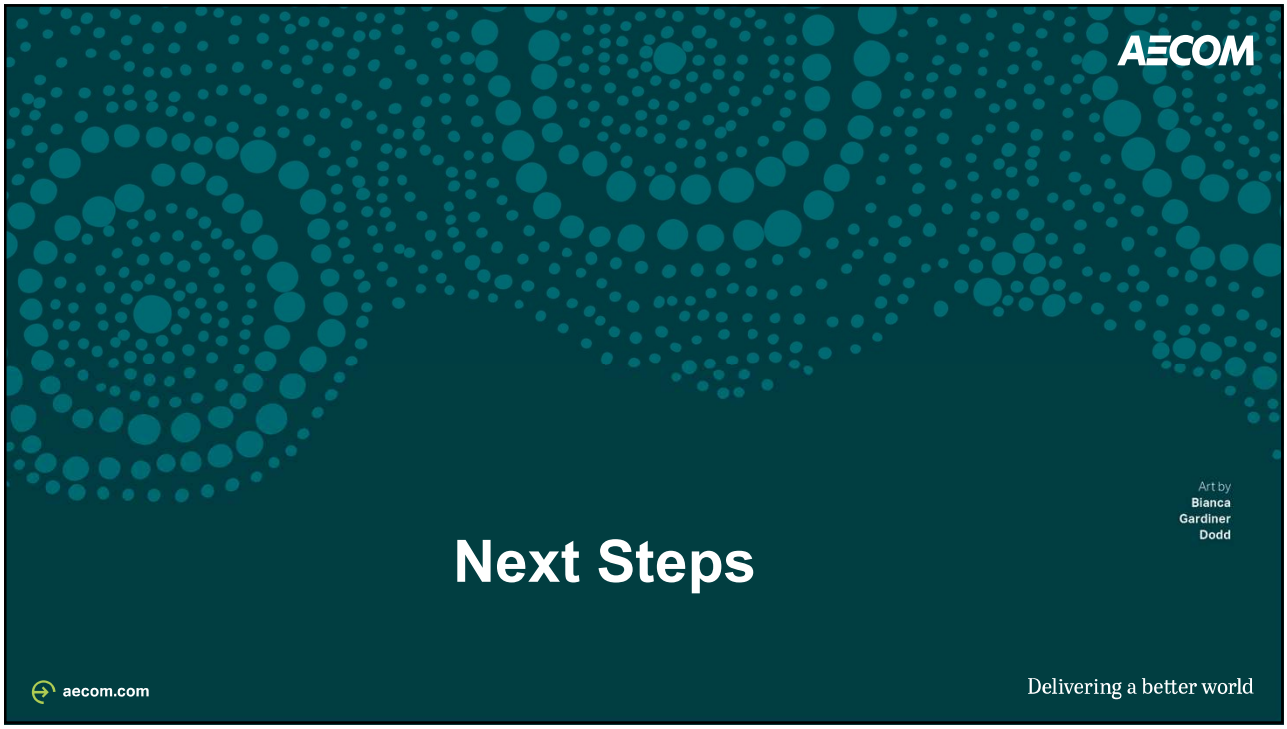
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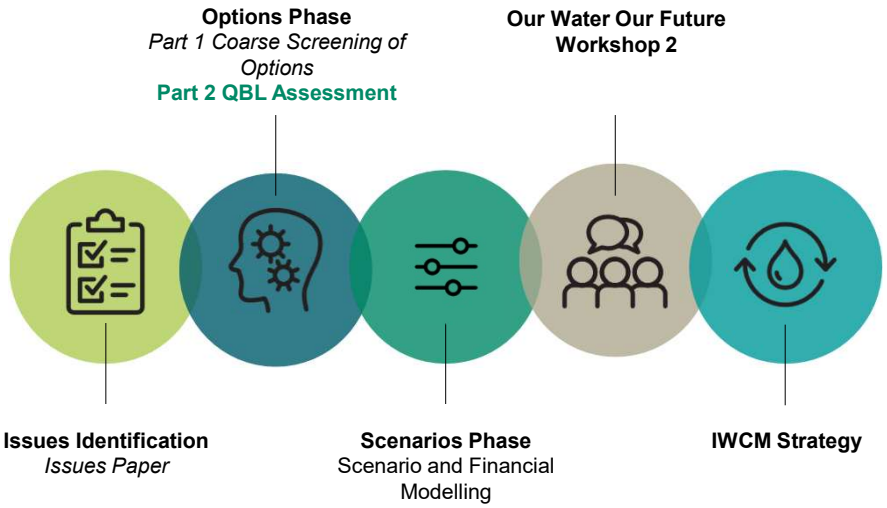

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Thank You!

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About the artwork

Sydney CBD stands on the Traditional Lands and waterways of the Gadigal people of the Eora nation. AECOM's Sydney office resides over these lands and waterways, and we also respectfully pay homage to the memories and Traditional spirits within the land, and pay respect to those from the past, those in the present and those to come.

The palette of this work reflects both AECOM's interior design vision and the artist's own tonal impression of the lands and waterways of the Gadigal People. The six rings around the AECOM site represent AECOM's six core values. These core value rings can be seen radiating southwest along George Street out of the city into the broader community.

Today, George Street gently aligns itself over the path of the 'Tank Stream'. Its intersections often follow the pathways, eons in formation, from the passage of the Gadigal People. Having supplied fresh water and fish to the original Gadigal People for tens of thousands of years, it would serve as the main fresh water supply for the first 40 years of Sydney's European life.

The design respectfully acknowledges the 29 clans of the Eora nation represented by the various circles depicting meeting places, connecting them spiritually and physically over the Traditional paths and landforms that intertwine their worlds.

Here in the Sydney region, the 29 Eora clans share the land and its bounty. Each clan is unique, yet intrinsically linked, existing in perfect harmony with the spiritual & natural world.

Images of spears represent local Warriors, particularly Bennelong standing proudly over his Traditional Lands. Further down the stream, are the areas of Women's Business - birthing, celebrating, sharing & embracing their unique world. The sandy pebbles on the left bank signify the sandstone cliffs and ledges upon which Barangaroo now proudly sits, further identifying the connection between one of the wives of Bennelong with the land and water of the Gadigal People.

Bianca Gardiner Dodd

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Bulahdelah Water Security Workshop Scoring

Council Values	Council Risk Category	Indicator	Description and Objectives of Indicator	Off-Stream Storage	Desalination of Sea Water	Regional connection (pipeline from Manning via Smiths Lake)	Regional connection (pipeline from Tea Gardens)	Regional connection (water carting from Tea Gardens)	Stormwater Harvesting
Wellbeing	Worker and public health & wellbeing	Health and wellbeing	Fit for purpose water quality - meetings legislative requirements Construction and operating/maintenance risks Delivering the option in a safe manner to customers - both during construction and service delivery	Pass	Pass	Pass	Pass	Pass	Unknown – water quality investigations required
	Service delivery & infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)	Pass	Pass	Pass	Unknown – dependent on water security within Tea Gardens scheme with additional demand from Bulahdelah	Unknown – dependent on supply availability	Unknown – rainfall dependent source, will require significant storage
		Yield / beneficial to pursue / supply	Option will give either a measurable improvement in water security by either reducing demand or increasing supply (option improved long-term water security) based on future water supply and demand forecasts	Pass	Pass	Pass	Pass	Fail – does not provide permanent secure yield	Unknown – significant storage required to provide material impact on potable water demand
		Practically viable	Option can be delivered by Council / external support	Pass	Fail – long pipeline, likely requiring underbore for part due to limited road corridor and through National Park	Fail – long pipeline, likely requiring underbore for part due to limited road corridor and through National Park	Pass	Fail – not viable for a long-term solution	Pass
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations	Pass	Fail – poor integration with wider MidCoast network	Fail – poor integration with Manning scheme, operational complexity associated with extending the scheme at Smiths Lake	Pass	Pass	Unknown – significant storage, transfer infrastructure and potential water treatment upgrades required
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework	Pass	Unknown – approvals required for intake and outfall, pipeline through National Park	Unknown – approvals required for pipeline though National Park	Pass	Pass	Pass
	Project timeline	Timeline for planning and delivery	Adaptive planning considerations. Is the timeline required for planning pathways and delivery known? Are there any unknowns about the planning and delivery pathway for this option?	Pass	Unknown – long lead time from planning to construction	Unknown – long lead time from planning to construction	Pass	Unknown – availability of transport freight cannot be confirmed	Pass
	Financial Project budget	Cost- capital	Capital costs (qualitative only)	Unknown	Unknown – likely significant capital cost to service only small community	Unknown – likely significant capital cost to service only small community	Unknown – likely significant capital cost to service only small community	Pass	Unknown - likely high capital cost to provide measurable impact on water security
		Cost – O&M	Operating and maintenance costs (qualitative only)	Unknown	Unknown – likely significant operation and maintenance (O&M) cost to service only small community	Unknown – likely significant O&M cost to service only small community	Unknown – likely significant O&M cost to service only small community	Fail – high costs for daily water carting and disinfection as permanent water security solution.	Unknown - likely high O&M cost to provide measurable impact on water security
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts	Unknown – environmental impact needs to be assessed in Environmental impact statement (EIA)	Unknown – environmental impact needs to be assessed in EIA	Unknown – environmental impact needs to be assessed in EIA	Unknown – environmental impact needs to be assessed in EIA	Unknown – daily emissions from water carting	Unknown – footprint of treatment and transfer infrastructure to be assessed in EIA
		Sustainability and resource consumption	Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact) Option aligns with principles of ecologically sustainable development and intergenerational equity	Unknown – ongoing carbon footprint needs to be assessed	Unknown – ongoing carbon footprint needs to be assessed	Unknown – ongoing carbon footprint needs to be assessed	Unknown – ongoing carbon footprint needs to be assessed	Fail – does not provide secure yield for intergenerational equity	Unknown – stormwater currently discharges to swamp, impacts from reduced flows unknown; ongoing carbon footprint needs to be assessed
Respect	Reputation	Community acceptance	Option likely to have community support (based on assumption that there is enough information for the community to make a balanced judgement)	Unknown	Unknown – construction disturbances along Lakes Way due to limited road reserves	Unknown – potential opposition to integration with Manning scheme, construction disturbances	Unknown – potential opposition to integration with Tea Gardens scheme	Unknown – potential opposition as a permanent water security solution	Unknown – potential opposition as a permanent water security solution
Outcome				**Pass**	**Fail**	**Fail**	**Fail – pending cost confirmation**	**Fail – will progress in strategy as an emergency measure only**	**Fail – pending cost confirmation**

Council Values	Council Risk Category	Indicator	Description and Objectives of Indicator	Groundwater	Reticulated Recycled Water	Recycled Water for Restricted Use	Recycled Water for Unrestricted Use	Recycled Water for Environmental Flows	Purified Recycled Water
Wellbeing	Worker and public health & wellbeing	Health and wellbeing	Fit for purpose water quality - meetings legislative requirements Construction and operating/maintenance risks Delivering the option in a safe manner to customers - both during construction and service delivery	Unknown – dependent on source quality	Pass	Pass	Pass	Pass	Pass
	Service delivery & infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)	Unknown – known private bores in community, requires further investigation with Water NSW	Fail – existing customers used all effluent in 19/20 drought, low growth forecast to provide additional effluent	Fail – existing customers used all effluent in 19/20 drought, low growth forecast to provide additional effluent	Fail – existing customers utilized all effluent in 19/20 drought, low growth forecast to provide additional effluent	Fail – existing customers utilized all effluent in 19/20 drought, low growth forecast to provide additional effluent	Fail – existing customers utilized all effluent in 19/20 drought, low growth forecast to provide additional effluent
		Yield / beneficial to pursue / supply	Option will give either a measurable improvement in water security by either reducing demand or increasing supply (option improved long-term water security) based on future water supply and demand forecasts	Unknown – requires investigation of aquifer potential	Fail – suitable for new developments only, low greenfield development forecast, limited impact on water security	Fail – insufficient material impact on potable water demand, does not resolve water security	Fail – insufficient material impact on potable water demand, does not resolve water security	Unknown – will require approvals for increased extraction	Unknown – impact on water security limited by effluent available for purified recycled water (PRW)
		Practically viable	Option can be delivered by Council / external support	Pass	Pass	Pass	Pass	Pass	Pass
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations	Pass	Pass	Pass	Pass	Pass	Pass
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework	Pass	Pass	Pass	Pass	Fail – regulatory framework not fully developed for environmental flow replacement	Fail – no supporting regulatory framework
	Project timeline	Timeline for planning and delivery	Adaptive planning considerations. Is the timeline required for planning pathways and delivery known? Are there any unknowns about the planning and delivery pathway for this option?	Unknown – Nabiac borefield supply required 20+ years in planning and delivery	Unknown – influenced by developer	Unknown – influenced by end user	Unknown – influenced by end user	Unknown	Unknown – requires extensive consultation with community and regulatory stakeholders
	Financial Project budget	Cost- capital	Capital costs (qualitative only)	Unknown – required infrastructure for extraction and transfer to water treatment plant (WTP); possible WTP upgrade	Unknown – high capital cost for limited water security benefit (new development only)	Pass	Unknown – requires RTP upgrade, transfer mains and storage infrastructure at end user site	Unknown – may require significant storage	Unknown – likely significant capital cost to service only small community
		Cost – O&M	Operating and maintenance costs (qualitative only)	Unknown	Unknown – high O&M cost for limited water security benefit (new development only)	Unknown – increased O&M costs with extending current recycled water (RW) scheme to supply Bulahdelah town	Unknown – increased O&M costs with higher level treatment and transfer	Unknown	Unknown – likely significant O&M cost to service only small community
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts	Unknown - footprint of treatment and transfer infrastructure needs to be assessed in EIA	Unknown – footprint of treatment and transfer infrastructure needs to be assessed in EIA	Unknown – footprint of treatment and transfer infrastructure needs to be assessed in EIA	Unknown – footprint of treatment and transfer infrastructure needs to be assessed in EIA	Unknown - footprint of treatment, transfer and river discharge infrastructure needs to be assessed in EIA	Unknown – footprint of treatment and transfer infrastructure needs to be assessed in EIA
		Sustainability and resource consumption	Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact) Option aligns with principles of ecologically sustainable development and intergenerational equity	Unknown – ongoing carbon footprint, long-term impact to aquifer and dependent ecosystems needs to be assessed	Unknown – risk of increased water usage with availability of 'additional' source, ongoing carbon footprint needs to be assessed	Unknown – ongoing carbon footprint needs to be assessed	Unknown – ongoing carbon footprint needs to be assessed	Unknown – ongoing carbon footprint, short-and long-term impact to river and dependent ecosystems during different flow regimes needs to be assessed	Fail – highly energy intensive treatment; ongoing carbon footprint needs to be assessed
Respect	Reputation	Community acceptance	Option likely to have community support (based on assumption that there is enough information for the community to make a balanced judgement)	Unknown – dependent on impact of groundwater extraction	Unknown – driven by developer, community acceptance unknown	Unknown – dependent on end user	Unknown – dependent on end user	Unknown	Unknown – consultation required to determine community's appetite for option
Outcome				**Pass – requires further investigation**	**Fail**	**Fail**	**Fail**	**Fail**	**Fail**

Stroud Water Security Workshop Scoring

Council Values	Council Risk Category	Indicator	Description and Objectives of Indicator	Off-Stream Storage	Desalination of Sea Water	Regional connection (pipeline from Hunter via Dungog)	Regional connection (water carting from Tea Gardens)	Stormwater Harvesting	Groundwater
Wellbeing	Worker and public health & wellbeing	Health and wellbeing	Fit for purpose water quality - meetings legislative requirements Construction and operating/ maintenance risks Delivering the option in a safe manner to customers - both during construction and service delivery	Pass	Pass	Pass	Pass	Unknown – water quality investigations required	Unknown – dependent on source quality
	Service delivery & infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)	Pass	Pass	Unknown – water source operated by Hunter Water	Unknown – dependent on supply availability	Unknown – rainfall dependent source, will require significant storage	Unknown – requires investigation of aquifer potential and known bores with Water NSW
		Yield / beneficial to pursue / supply	Option will give either a measurable improvement in water security by either reducing demand or increasing supply (option improved long-term water security) based on future water supply and demand forecasts	Pass	Pass	Unknown – dependent on water security within Hunter Water system	Fail – does not provide permanent secure yield	Unknown – significant storage required to provide material impact on potable water demand	Unknown
		Practically viable	Option can be delivered by Council / external support	Pass	Fail – long pipeline, likely requiring underbore for part due to limited road corridor and through National Park	Unknown – pipeline corridor undefined	Fail – not viable for a long-term solution	Pass	Pass
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations	Pass	Fail – poor integration with wider MidCoast network	Unknown	Pass	Unknown – multiple discharge locations for stormwater runoff, significant storage, transfer infrastructure and potential water treatment upgrades	Pass
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework	Pass	Unknown – approvals required for intake and outfall	Pass	Pass	Pass	Pass
	Project timeline	Timeline for planning and delivery	Adaptive planning considerations. Is the timeline required for planning pathways and delivery known? Are there any unknowns about the planning and delivery pathway for this option?	Pass	Unknown – long lead time from planning to construction	Unknown – requires discussion and investigation with Hunter Water	Unknown – availability of transport freight cannot be confirmed	Pass	Unknown – Nabiac borefield supply required 20+ years in planning and delivery
	Financial Project budget	Cost- capital	Capital costs (qualitative only)	Pass	Unknown – likely significant capital cost to service only small community	Unknown	Pass	Unknown - likely high capital cost to provide measurable impact on water security	Unknown – require infrastructure for extraction and transfer to WTP, possible WTP upgrade
		Cost – O&M	Operating and maintenance costs (qualitative only)	Pass	Unknown – likely significant O&M cost to service only small community	Unknown	Fail – high costs for daily water carting and disinfection as permanent water security solution.	Unknown - likely high O&M cost to provide measurable impact on water security	Unknown
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts	Unknown – environmental impact needs to be assessed in (EIA)	Unknown – environmental impact statement needs to be assessed in EIA	Unknown – footprint of transfer infrastructure needs to be assessed in EIA	Unknown – daily emissions from carting	Unknown – footprint of treatment and transfer infrastructure needs to be assessed in EIA	Unknown – footprint of treatment and transfer infrastructure needs to be assessed in EIA
		Sustainability and resource consumption	Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact) Option aligns with principles of ecologically sustainable development and intergenerational equity	Unknown – ongoing carbon footprint needs to be assessed	Unknown - ongoing carbon footprint needs to be assessed	Unknown – ongoing carbon footprint needs to be assessed	Fail – does not provide secure yield for intergenerational equity	Unknown – stormwater currently discharges to river, impacts from reduced flows unknown; ongoing carbon footprint needs to be assessed	Unknown – ongoing carbon footprint and long-term impacts to aquifer and dependent ecosystems needs to be assessed
Respect	Reputation	Community acceptance	Option likely to have community support (based on assumption that there is enough information for the community to make a balanced judgement)	Pass	Unknown – construction disturbances along Lakes Way due to limited road reserves	Unknown – consultation with Stroud and Stroud Road community forming part of Hunter Water utility needs to be completed	Unknown	Unknown	Unknown – dependent on impact of groundwater extraction
Outcome				**Pass**	**Fail**	**Pass**	**Fail – will progress in strategy as an emergency measure only**	**Fail – pending cost confirmation**	**Pass – requires further investigation**

Council Values	Council Risk Category	Indicator	Description and Objectives of Indicator	Reticulated Recycled Water	Recycled Water for Restricted Use	Recycled Water for Unrestricted Use	Recycled Water for Environmental Flows	Purified Recycled Water
Wellbeing	Worker and public health & wellbeing	Health and wellbeing	Fit for purpose water quality - meetings legislative requirements Construction and operating/maintenance risks Delivering the option in a safe manner to customers - both during construction and service delivery	Pass	Pass	Pass	Pass	Pass
	Service delivery & infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)	Fail – existing customer uses majority of effluent (70-80%), low growth in town to provide additional effluent.	Fail – existing customer uses majority of effluent (70-80%), low growth in town to provide additional effluent.	Fail – existing customer uses majority of effluent (70-80%), low growth in town to provide additional effluent.	Fail – existing customer uses majority of effluent (70-80%), low growth in town to provide additional effluent.	Fail – existing customer uses majority of effluent (70-80%), low growth in town to provide additional effluent.
		Yield / beneficial to pursue / supply	Option will give either a measurable improvement in water security by either reducing demand or increasing supply (option improved long-term water security) based on future water supply and demand forecasts	Fail – suitable for new developments only, low greenfield development forecast, limited impact on water security	Fail – insufficient material impact on potable water demand, does not resolve water security	Fail – insufficient material impact on potable water demand, does not resolve water security	Unknown – will require approvals for increased extraction	Unknown – impact on water security limited by effluent available for PRW
		Practically viable	Option can be delivered by Council / external support	Pass	Pass	Pass	Pass	Pass
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations	Pass	Pass	Pass	Pass	Pass
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework	Pass	Pass	Pass	Fail – regulatory framework not fully developed for environmental flow replacement	Fail – no supporting regulatory framework
	Project timeline	Timeline for planning and delivery	Adaptive planning considerations. Is the timeline required for planning pathways and delivery known? Are there any unknowns about the planning and delivery pathway for this option?	Unknown – influenced by developer	Unknown – influenced by end user	Unknown – influenced by end user	Unknown	Unknown – requires extensive consultation with community and regulatory stakeholders
	Financial Project budget	Cost- capital	Capital costs (qualitative only)	Unknown – high capital cost for limited water security benefit (new development only)	Pass	Unknown – requires upgrade to RTP, transfer mains and storage infrastructure at end user site	Unknown – may require significant storage	Unknown – likely significant capital cost to service only small community
		Cost – O&M	Operating and maintenance costs (qualitative only)	Unknown – high O&M cost for limited water security benefit (new development only)	Unknown – increased O&M costs with extending network	Unknown – increased O&M costs with extended network and treatment	Unknown	Unknown – likely significant O&M cost to service only small community
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts	Unknown – footprint of treatment and transfer infrastructure needs to be assessed in EIA	Unknown – footprint of treatment and transfer infrastructure needs to be assessed in EIA	Unknown – footprint of treatment and transfer infrastructure needs to be assessed in EIA	Unknown – footprint of treatment, transfer and river discharge infrastructure needs to be assessed in EIA	Unknown – footprint of treatment and transfer infrastructure needs to be assessed in EIA
		Sustainability and resource consumption	Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact) Option aligns with principles of ecologically sustainable development and intergenerational equity	Unknown – risk of increased water usage with availability of 'additional' source, ongoing carbon footprint needs to be assessed	Unknown - ongoing carbon footprint needs to be assessed	Unknown – ongoing carbon footprint needs to be assessed	Unknown – ongoing carbon footprint, short- and long- term impact to river and dependent ecosystems during different flow regimes needs to be assessed	Fail – highly energy intensive treatment; ongoing carbon footprint needs to be assessed
Respect	Reputation	Community acceptance	Option likely to have community support (based on assumption that there is enough information for the community to make a balanced judgement)	Unknown – driven by developer, community acceptance unknown	Unknown – dependent on end user	Unknown – dependent on end user	Unknown	Unknown – consultation required to determine community's appetite for option
Outcome				**Fail**	**Fail**	**Fail**	**Fail**	**Fail**

Gloucester Water Security Workshop Scoring

Council Values	Council Risk Category	Indicator	Description and Objectives of Indicator	Off-Stream Storage	Stratford Mine Dam	Groundwater	Desalination of Sea Water	Reticulated Recycled Water	Recycled Water for Restricted Use
Wellbeing	Worker and public health & wellbeing	Health and wellbeing	Fit for purpose water quality - meetings legislative requirements Construction and operating/maintenance risks Delivering the option in a safe manner to customers - both during construction and service delivery	Pass	Pass	Unknown – dependent on source quality	Pass	Pass	Pass
	Service delivery & infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)	Pass	Unknown – requires investigation of water profile and source	Unknown – requires investigation of aquifer potential including for known bores with Water NSW	Pass	Fail – existing customers used approximately 90% effluent in 19/20 drought, low growth to provide additional effluent	Fail – existing customers used approximately 90% effluent in 19/20 drought, low growth to provide additional effluent
		Yield / beneficial to pursue / supply	Option will give either a measurable improvement in water security by either reducing demand or increasing supply (option improved long-term water security) based on future water supply and demand forecasts	Pass	Pass	Unknown	Pass	Fail – suitable for new developments only, low greenfield development forecast, limited impact on water security	Fail – insufficient material impact on potable water demand, does not solve water security
		Practically viable	Option can be delivered by Council / external support	Pass	Pass	Pass	Fail – significant distance from coast (>100km)	Pass	Pass
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations	Pass	Pass	Pass	Fail – poor integration with wider MidCoast network	Unknown – potential issue with insufficient space in existing underground utility corridors	Pass
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework	Pass	Unknown – approvals required to repurpose Stratford Mine Dam	Pass	Unknown – approvals required for intake and outfall	Pass	Pass
	Project timeline	Timeline for planning and delivery	Adaptive planning considerations. Is the timeline required for planning pathways and delivery known? Are there any unknowns about the planning and delivery pathway for this option?	Pass	Unknown – Dam site currently owned by Stratford Coal	Unknown – Nabiac borefield supply required 20+ years in planning and delivery	Unknown – long lead time from planning to construction	Unknown – influenced by developer	Unknown – influenced by end user
	Financial Project budget	Cost- capital	Capital costs (qualitative only)	Pass	Unknown – pipeline and new PS to connect dam to WTP	Unknown –required infrastructure for extraction and transfer to WTP; possible WTP upgrade	Unknown – likely significant capital cost to service only small community	Unknown – likely high capital cost for limited water security benefit (new development only)	Pass
		Cost – O&M	Operating and maintenance costs (qualitative only)	Pass	Unknown	Unknown	Unknown – likely significant O&M cost to service only small community	Unknown – likely high O&M cost for limited water security benefit (new development only)	Unknown – increased O&M costs with extending current RW scheme into town
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts	Unknown – environmental impact needs to be assessed in EIA	Unknown – environmental impact needs to be assessed in EIA	Unknown – footprint of treatment and transfer infrastructure needs to be assessed in EIA	Unknown – footprint of treatment and transfer infrastructure needs to be assessed in EIA	Unknown	Unknown
		Sustainability and resource consumption	Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact) Option aligns with principles of ecologically sustainable development and intergenerational equity	Unknown – ongoing carbon footprint needs to be assessed	Unknown – ongoing carbon footprint needs to be assessed	Unknown – ongoing carbon footprint, long-term impact to aquifer and dependent ecosystems needs to be assessed	Unknown – ongoing carbon footprint needs to be assessed	Unknown – risk of increased water usage with availability of 'additional' source, ongoing carbon footprint needs to be assessed	Unknown - ongoing carbon footprint needs to be assessed
Respect	Reputation	Community acceptance	Option likely to have community support (based on assumption that there is enough information for the community to make a balanced judgement)	Unknown	Unknown	Unknown – dependent on source site	Unknown – acceptance on desalination and impacts during construction	Unknown – driven by developer, community acceptance unknown	Unknown – dependent on end user
Outcome				**Pass**	**Pass**	**Pass**	**Fail**	**Fail**	**Fail**

Council Values	Council Risk Category	Indicator	Description and Objectives of Indicator	Recycled Water for Unrestricted Use	Recycled Water for Environmental Flows	Purified Recycled Water for Drinking	Stormwater Harvesting	Regional connection (pipeline from Manning via Krambach)	Regional connection (water carting from Tea Gardens)
Wellbeing	Worker and public health & wellbeing	Health and wellbeing	Fit for purpose water quality - meetings legislative requirements Construction and operating/maintenance risks Delivering the option in a safe manner to customers - both during construction and service delivery	Pass	Pass	Pass	Unknown – water quality investigations required	Pass	Pass
	Service delivery & infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)	Fail – existing customers used approximately 90% effluent in 19/20 drought, low growth to provide additional effluent	Fail – existing customers used approximately 90% effluent in 19/20 drought, low growth to provide additional effluent	Fail – existing customers used approximately 90% effluent in 19/20 drought, low growth to provide additional effluent	Unknown – rainfall dependent source, will require significant storage	Pass	Unknown – dependent on supply availability
		Yield / beneficial to pursue / supply	Option will give either a measurable improvement in water security by either reducing demand or increasing supply (option improved long-term water security) based on future water supply and demand forecasts	Fail – insufficient material impact on potable water demand, does not solve water security	Unknown – will require approvals for increased extraction	Unknown – impact on water security limited by effluent available for PRW	Unknown – significant storage required to provide material impact on potable water demand	Pass	Fail – does not provide permanent secure yield
		Practically viable	Option can be delivered by Council / external support	Pass	Pass	Pass	Pass	Pass	Fail – not viable for a long-term solution
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations	Pass	Pass	Pass	Unknown – multiple discharge locations for stormwater runoff, significant storage, transfer infrastructure and potential water treatment upgrades required	Pass	Pass
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework	Pass	Fail – regulatory framework not fully developed for environmental flow replacement	Fail – no supporting regulatory framework	Pass	Pass	Pass
	Project timeline	Timeline for planning and delivery	Adaptive planning considerations. Is the timeline required for planning pathways and delivery known? Are there any unknowns about the planning and delivery pathway for this option?	Unknown – influenced by end user, minor benefit from aligning with STP upgrade	Unknown	Unknown – requires extensive consultation with community and regulatory stakeholders	Pass	Pass	Unknown – availability of transport freight cannot be confirmed
	Financial Project budget	Cost- capital	Capital costs (qualitative only)	Unknown – upgrade to RTP, transfer mains and storage infrastructure at end user site	Unknown – may require significant storage	Unknown – likely significant capital cost to service only small community	Unknown - likely high capital cost to provide sufficient storage for measurable impact on water security	Unknown	Pass
		Cost – O&M	Operating and maintenance costs (qualitative only)	Unknown	Unknown	Unknown – likely significant O&M cost to service only small community	Unknown - likely high O&M cost to provide sufficient storage for measurable impact on water security	Unknown	Fail – high costs for daily water carting and disinfection as permanent water security solution.
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts	Unknown – footprint of treatment and transfer infrastructure needs to be assessed in EIA	Unknown – footprint of treatment, transfer and river discharge infrastructure needs to be assessed in EIA	Unknown – footprint for treatment and transfer infrastructure needs to be assessed in EIA	Unknown – footprint for treatment and transfer infrastructure needs to be assessed in EIA	Unknown – footprint for treatment and transfer infrastructure needs to be assessed in EIA	Pass
		Sustainability and resource consumption	Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact) Option aligns with principles of ecologically sustainable development and intergenerational equity	Unknown - ongoing carbon footprint needs to be assessed	Unknown – ongoing carbon footprint, short- and long-term impact to river and dependent ecosystems during different flow regimes need to be assessed	Fail – highly energy intensive treatment; ongoing carbon footprint needs to be assessed	Unknown – stormwater currently discharges to river, impact from reduced flows unknown; ongoing carbon footprint needs to be assessed	Unknown - ongoing carbon footprint needs to be assessed	Unknown - ongoing carbon footprint needs to be assessed
Respect	Reputation	Community acceptance	Option likely to have community support (based on assumption that there is enough information for the community to make a balanced judgement)	Unknown – dependent on end user	Unknown	Unknown – consultation required to determine community's appetite for option	Unknown	Unknown	Unknown
Outcome				**Fail**	**Fail**	**Fail**	**Pass – pending cost confirmation**	**Pass**	**Pass – will progress in strategy as an emergency measure only**

AECOM

IWCM Strategy
Coarse Screening of Sustainable Effluent Management Options

Workshop 3

To	MidCoast Council	Page	7
CC	Workshop Attendees		
Subject	IWCM Strategy Workshop 3 – Coarse Screening of Sustainable Effluent Management Options		
From	AECOM		
File/Ref No.	60696228	Date	8-Dec-2022

Introduction

The Coarse Screening of Sustainable Effluent Management Options is the first step in the "all options on the table" approach for sewage treatment as part of MidCoast Council's (Council) Integrated Water Cycle Management (IWCM) Strategy. A comprehensive list of sustainable effluent management options has been evaluated for each system. Each option has been investigated to identify the key risks, issues and opportunities, prior to completing a coarse screening assessment based on a fatal flaw approach. The outcome of the project will be a short-list of options that pass the coarse screening and move into a quadruple bottom line investigation, for consideration in the scenarios phase of the IWCM strategy.

The coarse screening workshop will present the list of sustainable effluent management options for discussion and endorsement of a short-list of options for further investigation. This briefing paper provides background information for workshop attendance.

Background

IWCM takes a holistic approach to effective and sustainable urban water supply and sewerage business. The IWCM Strategy sets the objectives, performance standards and associated performance indicators, while ensuring infrastructure meets the needs and priorities of the community and stakeholders. The outcome is a 30-year IWCM scenario that best meets the needs of the region on a social, environmental, economic and governance (quadruple bottom line) basis.

Council is currently reviewing their IWCM Strategy. One of the key issues identified was sustainable management of effluent at each of Council's sewage treatment plants.

Bulahdelah The Bulahdelah scheme services the town of Bulahdelah with a total permanent population of approximately 1,400 people (675 connections). Treated effluent is pumped to the nearby golf course for irrigation use, with excess discharged to Fry's creek, a tributary of the Myall River.

Coopernook The Coopernook scheme services the town of Coopernook with a total permanent population of approximately 540 people (240 connections). Treated effluent is pumped to the effluent storage pond before disinfection and reuse for private irrigation, with excess discharged to the Lansdowne River.

Forster The Forster scheme services the towns of Forster, Green Point, Pacific Palms and Smiths Lake with a total permanent population of approximately 15,700 people (8,000 connections). There is no current reuse and treated effluent is discharged via near-shore outfall at Janie's Corner.

Gloucester	The Gloucester scheme services the towns of Gloucester and Barrington with a total permanent population of approximately 4,500 people (2,100 connections). Treated effluent is stored in an artificial wetland before reuse for pasture irrigation, with excess discharged into the Gloucester River, a tributary of the Manning River. The STP is due for renewal and a new STP is currently in detailed design.
Hallidays Point	The Bulahdelah scheme services the towns of Tuncurry, Nabiac, Wallamba and Hallidays Point with a total permanent population of approximately 12,500 people (7,300 connections). Treated effluent is pumped to the Tuncurry RTP where it is treated to a quality suitable for public space irrigation. The RTP has a current capacity of 3.5 ML/day, upgradable to 7 ML/day. Excess treated effluent is discharged via exfiltration beds at the STP.
Harrington	The Harrington scheme services the towns Harrington and Crowdy Head with a total permanent population of approximately 3,500 people (1,900 connections). Treated effluent is pumped to the nearby golf course for irrigation use, with excess discharged to exfiltrated via two effluent ponds at the STP.
Hawks Nest	The Hawks Nest scheme services the towns of Hawks Nest and Tea Gardens with a total permanent population of approximately 4,600 people (3,800 connections). Treated effluent is pumped to the co-located RTP where it is treated to a quality suitable for public space irrigation. The RTP has a current capacity of 2 ML/day, upgradable to 6 ML/day. Excess treated effluent is discharged via exfiltration ponds located at the STP.
Lansdowne	The Lansdowne scheme services the town of Lansdowne with a total permanent population of approximately 600 people (300 connections). Treated effluent is stored prior to private irrigation reuse, with excess discharged to Lansdowne River.
Manning Point	The Manning Point scheme services the town of Manning Point and Pelican Bay with a total permanent population of approximately 240 people (280 connections). Treated effluent is reused onsite, with wet weather flows stored for future use.
Old Bar	The Old Bar scheme services the towns of Old Bar and Wallabi Point with a total permanent population of approximately 4,400 people (2,600 connections). There is no current reuse and treated effluent is discharged via exfiltration beds located within the sand dunes 1.2 km south-east of the STP. The exfiltration beds are within the forecast 2100 sea level.
Stroud	The Stroud scheme services the towns of Stroud and Stroud Road with a total permanent population of approximately 900 people (550 connections). Treated effluent is reused for private irrigation, with excess discharged to the Karuah River.
Taree (Dawson)	The Taree (Dawson) scheme services the town of Taree, Taree South, Tinonee and Cundletown with a total permanent population of approximately 21,500 people (9,700 connections). The scheme comprises of two plants, with Taree STP providing preliminary treatment and wet weather storage, while Dawson STP provides secondary and tertiary treatment. Taree (Dawson) is part of the Taree Wingham Effluent Management Scheme (TWEMS), which facilitates beneficial reuse for irrigation on farmland. Excess effluent is discharged to the Manning River.
Wingham	The Wingham scheme services the town of Wingham with a total permanent population of approximately 5,400 people (2,200 connections). Treated effluent is reused for farmland irrigation via the TWEMS, with excess discharged to the Manning River.

The sewerage systems are presented in Figure 1.

Figure 1 Sewerage Systems

Assessment Approach and Criteria

The coarse screening will be based on a fatal flaw approach. Each sustainable effluent management option will be assessed against the agreed assessment criteria as assigned a score:

Pass Option meets the criteria and should progress for further investigation

Fail Option does not meet the criteria and should not progress for further investigation

Unknown Option not scored due to lack of information, therefore progress for further investigation

The assessment criteria are provided in Table 1. The criteria were developed by the project team based on:

- Council's values,
- Council's Risk Management Framework,
- AECOM's experience with similar projects, and
- Advice from Department of Planning and Environment (DPE).

Table 1 Assessment Criteria

Council Values	Council Risk Category	Indicator for Coarse Screening	Description and Objectives of Indicator
Wellbeing	Worker and public health & wellbeing	Health and wellbeing	Fit for purpose water quality- meetings legislative requirements Construction and operating/maintenance risks Delivering the option in a safe manner to customers- both during construction and service delivery
	Service delivery & infrastructure	Beneficial to pursue	Option will provide beneficial and sustainable effluent reuse. Reduce environmental discharges. Meet existing and future recycled water demand forecast at appropriate water quality.
		Practically viable	Option can be delivered by Council and external support
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework
	Project timeline	Timeline for planning and delivery	Adaptive planning considerations. Is the timeline required for planning pathways and delivery known? Are there any unknowns about the planning and delivery pathway for this option?
	Financial Project budget	Cost- capital	Capital costs (qualitative only)
		Cost – O&M	Operating and maintenance costs (qualitative only)
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts
		Sustainability and resource consumption	Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact) Option aligns with principles of ecologically sustainable development and intergenerational equity
Respect	Reputation	Community acceptance	Option likely to have community support (based on assumption that there is enough information for the community to make a balanced judgement)

Long list of Sustainable Effluent Management Options

A wide range of sustainable effluent management options have been investigated, taking an “all options on the table” approach. These include:

- Flow reduction, including
    - Demand management
    - Inflow and Infiltration Management
- Biosolids management and reuse
- Effluent reuse, including:
    - Recycled water for restricted use
    - Recycled water for unrestricted use
    - Purified recycled water for drinking
- Discharge to environment, including:
    - Discharge to wetlands
    - Water features i.e., water landscaping
    - Exfiltration
    - River discharge
    - Ocean outfall

These options will be discussed for each sewerage scheme during the workshop. A summary of the options considered is presented in Table 2.

Coarse Screening Workshop

During the coarse screening workshop, we will present the evaluation of each sustainable effluent management option that was investigated. We will present the outcome of a preliminary coarse screening completed by the project team for discussion with the workshop group. The outcome of this workshop will be an endorsed short-list of sustainable effluent management options for further investigation prior to development of the IWCM Strategy.

Next steps

Following the workshop, the project team will progress with development and assessment of IWCM scenarios, including quadruple bottom line analysis and financial modelling to inform the identification of the preferred IWCM Strategy.

Table 2 Long-list of sustainable effluent management options

Option Type	Option	Description	Risks	Issues	Opportunities
Flow reduction	Demand management	Demand management programs including smart metering and community education to reduce water used and returned to sewer. Demand management is business as usual.	• Requires community to be engaged with the process.	• Community is already quite water conscious, may be limited opportunity for further reductions.	• Potential for demand-based pricing or other measures to reduce water usage.
	Inflow and Infiltration Management	I/I management to reduce dry weather baseflow, sea water ingress and wet weather ingress to sewer. I/I management is business as usual for areas identified with high I/I.		• May require significant effort to pinpoint specific sources of I/I and appropriately target for reduction.	• Reducing flow volume to STP would also reduce treatment and pumping costs (energy / chemicals / emissions)
Biosolids management and reuse	The Draft Biosolids Framework is currently under review by the NSW EPA, with the final framework and new legislation due for release in September 2023. No biosolids options will be pursued until the new guidelines have been adopted.				
Effluent reuse	Recycled water for restricted use	Suitable for agricultural application such as pasture grazing and crop irrigation, as well as open space irrigation with appropriate controls (managed access). Current approach at majority of STP's.	• Requires appropriate controls to protect public health.	• Current approach for effluent reuse at most MidCoast STP's. • Low-cost approach to reuse, no additional treatment required, only transfer infrastructure/cost. • Potential inequity if recycled water is supplied at low/no cost to certain (private) customers but not available to all	• Opportunity to expand existing schemes
	Recycled water for unrestricted use	Suitable for irrigation for public open spaces, including sports grounds, schools, as well as some industrial and commercial uses, and construction and maintenance activities such as dust suppression, road maintenance and routine sewer main flushing. Requires a higher level of treatment along with transfer infrastructure. Can be supplied to dwellings via dual reticulation networks; increased non-rainfall dependent demand and potential drinking water offset.	• Requires appropriate controls to protect public health.	• Higher treatment cost compared to unrestricted use. • Dual reticulation only appropriate for new development areas due to need for separate distribution network and specific internal plumbing; not appropriate/practical to retrofit in existing areas.	• Public open space irrigation can offset drinking water demand during normal conditions and protect community amenity during drought • Opportunity to expand existing schemes at Tuncurry and Hawks Nest
	Purified recycled water (PRW) for drinking	Purified recycled water from STP / RTP's to augment water supply. Can be direct to network or indirect via managed aquifer recharge.	• Risk of significant public health impact; requires stringent controls. • Community acceptance. • Regulatory / legislative framework not yet developed to support PRW.	• High cost of treatment required to protect public health. • Would only consider PRW where already shortlisted as a viable water security option.	• Rainfall-independent water source to provide water security. • Potential opportunity for managed aquifer recharge at Nabiac (Tuncurry RTP) and/or Tea Gardens (Hawks Nest RTP)

Option Type	Option	Description	Risks	Issues	Opportunities
Discharge to environment	Discharge to wetlands	Part of current approach at Harrington STP, opportunity to expand passive treatment of effluent via wetlands and nature-based solutions.			• Provides ecological habitat for water birds, etc.
	Water features i.e., water landscaping	Opportunity to consider incorporating passive treatment via wetlands with water features, nature-based solutions to provide community amenity, maintain water in the landscape to assist with urban greening.	• Requires appropriate controls to protect public health.	• Option best suited to new developments with opportunity to incorporate water features into master planning	• Provide community amenity, maintain water in the landscape to assist with urban greening. • Provides ecological habitat for water birds, etc.
	Exfiltration	Current approach at many of Council's coastal STPs to manage excess flow.	• Some exfiltration bed at risk of erosion / future sea level impacts	• Low-cost approach that avoids discharge to waterways.	• Opportunities at coastal plants to manage increased flows due to growth
	River discharge	Current approach at many of Council's inland STPs to manage excess flow that cannot be reused for restricted use.	• Environmental impact. • Potential structural risk for outlet during extreme storms / flooding conditions.		• Opportunity to provide Environmental flow
	Ocean outfall	Currently only ocean outfall (Forster). May be a consideration for Old Bar where exfiltration beds are at potential risk of erosion and future sea level rise.	• Environmental approvals for new outfall. • Potential structural risk for outfall pipe during extreme storm events.	• Community acceptance; likely require effective community engagement.	• Opportunities at coastal plants to manage increased flows due to growth

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Minutes of Meeting

IWCM Strategy Options and Scenarios

Subject	Sustainable Effluent Management Coarse Screening Workshop	Page	4
Venue	Yalawanyi Ganya & Zoom	Time	9:30am - 15:30pm
Participants	Rachael Abberton, MidCoast Project Manager and Water Planning Engineer Nathan Bakewell, MidCoast Coordinator Water Management and Treatment Central Shane Beeton, MidCoast Manager Water Operations Marnie Coates, MidCoast Executive Manager Water and Systems Patrick Duiveman, MidCoast Process Engineer Tracey Hamer, MidCoast Manage Water Planning & Assets Daniel Harris, MidCoast Coordinator Water Management and Treatment North & West Roshan Iyadurai, DPE Principal Urban Water Planner Valerie Masterton, DPE Principal Urban Water Planner Jose Pante, DPE Principal Technical Advisor Mitchell Stace, MidCoast Water Manager Water Project Delivery Sara Wilson, MidCoast Community Relations and Education Coordinator Chenxi Zeng, MidCoast Manager Water Management and Treatment Zena Smith-White, AECOM Project Manager and Strategic Planning Lead Wastewater Lakshu Suri, AECOM Water and Wastewater Planner		
Apologies			
File/Ref No.	60696228	Date	08-Dec-2022
Distribution	As above		

No	Item	Action	Date
1.	**Opening – acknowledgement of Country and workshop agenda** Refer **Attachment A** for presentation slides		
2.	**Values Moment** AECOM shared an ESG moment for Inclusive Communications, outlining the importance of enabling contribution from all diverse perspectives by being respectful, accurate and inclusive of all.		
3.	**Introductions and workshop objectives and outcomes** Workshop objectives: • Present the long list of sustainable effluent management options for discussion • Undertake a coarse screening of the long list of options • Agree the short-list of options for further investigation Workshop outcome: • To endorse a short-list of sustainable effluent management options for further investigation prior to development of the IWCM Strategy.		

No	Item	Action	Date
4.	**Project background** The journey to date for the Integrated Water Cycle Management strategy was provided.		
5.	**Assessment Approach and Criteria** The assessment criteria and assessment methodology were shared. Scoring descriptors, Pass, Fail or Unknown were described for application in assessing each category of the criteria.		
6.	**Long-list of Options** The long-list of options were presented with an 'all options on the table' approach. The different options were described at a high level and the viability of options for MidCoast were discussed. During the discussions: • Purified recycled water: agreed not be considered as an effluent management option if it did not pass through the coarse screening for water security. due to significant costs involved and economies of scale for smaller scale schemes. • Biosolids: The IWCM Strategy review will not assess options for biosolids management at this time. The biosolids guidelines are currently under review by the NSW EPA. Council will investigate options for biosolids when the guideline review is completed. • Dual reticulation: DPE noted that dual reticulation should be included in long-list of options. Council is happy to consider dual reticulation schemes for new developments where developer driven, but is not investigating the retrofitting of existing properties to implement a third pipe recycled water scheme. A number of similar schemes have been implemented elsewhere (i.e. Sydney Water Rouse Hill scheme) and operators have found them expensive to operate, based on current pricing models for recycled water, the need to run two distribution networks and provide potable top-up to maintain supply during peak demand. • Wetlands: Council stakeholders advised that discharge to wetlands is only applicable for constructed wetlands, unless otherwise noted. • Ocean outfall: Need to clarify ocean vs shoreline outfall when discussing for specific sewerage schemes. • Taree/Dawson: Climate Change workshop noted potential opportunity to develop a resource recovery hub at Dawson by bringing Wingham STP (flooding risk) and Old Bar STP (effluent management issues) with additional flow helping to achieve economies of scale. Consider Taree/Dawson Wastewater Masterplan.		
7.	**Coarse Screening of Options** Each of the 13 MidCoast sewerage schemes were presented with a background on the current treatment process and effluent management system. Options on effluent reuse were then presented		

No	Item	Action	Date
	in detail with a short description, and identified risks, issues, and opportunities. An interactive group discussion was undertaken for each scheme, for all long list options. The results of the coarse screening are presented in **Attachment B**. Key Outcomes from the coarse screening include: • Demand management, and inflow and infiltration management were identified as business as usual activities within Council's operations and will continue to be managed as such in the future. o Targeted investigations were specifically identified for inflow management at Coopernook and Bulahdelah, and infiltration management at Harrington. Council has two dedicated I&I teams (each comprised two staff and a truck) who are responsible for undertaking I&I investigation and reduction actions. • Biosolids management and reuse will not be pursued beyond the current approach. NSW EPA are currently reviewing the Biosolids Framework, with the final framework and supporting legislation due for release in September 2023. Management of biosolids across the treatment plants in MidCoast will be subsequently reviewed. A description and benefits of the current approach will be included in the final report. • Recycled water for dual reticulation was not identified as a viable option for Council to adopt. The upgrade and ongoing operation and maintenance costs of infrastructure is cost-prohibitive and poses equity concerns in the community. Council is open to consideration of developer-led dual reticulation schemes for new developments but will not consider dual reticulation schemes that require retrofitting of existing dwellings. • Purified recycled water failed as an option for most schemes as economies of scale cannot be achieved for the smaller sewerage schemes. For those schemes located within the Manning Water Supply Scheme, purified recycled water will be considered on a broader scale as an option for water security with water sourced from Forster, Dawson and Wingham STPs and Tuncurry RTP. • Recycled water for restricted and unrestricted use, where failed, was primarily due to: o insufficient users identified in comparison with the scale of infrastructure required to treat the recycled water and distribute to customers; and / or o insufficient supply available due to high demand from existing customers based on usage in the recent drought. • Recycled water for restricted use at Hallidays Point and Harrington is dependent on identification of potential users. In the case of Hallidays Point, the users would be located within the vicinity of both Hallidays Point and Nabiac STPs (which currently pumps treated effluent to Hallidays Point sewerage system). • Options to discharge to the environment were placed low in		

No	Item	Action	Date
	prioritisation if effluent reuse was a viable option for majority of the available flow. o Water features / landscaping, and discharge to wetlands were identified as an opportunistic option. Council will only be pursing this for implementation where the opportunity presents itself, most likely within greenfield developments, to fully benefit from an appropriately planned asset. Discharge to manufactured wetlands adjacent to Dawson STP was identified as a potential option. o Exfiltration and river discharge were only considered as options if they were included in the existing effluent management scheme. Some sewerage schemes are licenced to discharge into the river on a precautionary basis. It was agreed that these specific schemes require additional options for effluent reuse. o Ocean / shoreline outfall was not considered for most schemes as other viable options were identified. An exception was made for Forster, where it is included in the current effluent management system (albeit the current shoreline outfall is difficult to access and presents operational risk), and for Old Bar due to impact on the exfiltration beds from climate change, proximity of site to the ocean, and limited effluent reuse opportunities. • No options were identified for Manning Point beyond the current approach. A broader, strategic level conversation is required for the township to mitigate impacts of climate change. • Decommissioning of Wingham STP and diversion of flow to Dawson STP in the longer-term was discussed as a potential climate change option to manage flood risk, this would also remove the need to manage effluent at Wingham STP and potentially provide economy of scale for resource recovery at Dawson.		
8.	**Next Steps** AECOM to identify scenarios and undertake scenario modelling and Quadruple Bottom Line Analysis	**AECOM**	

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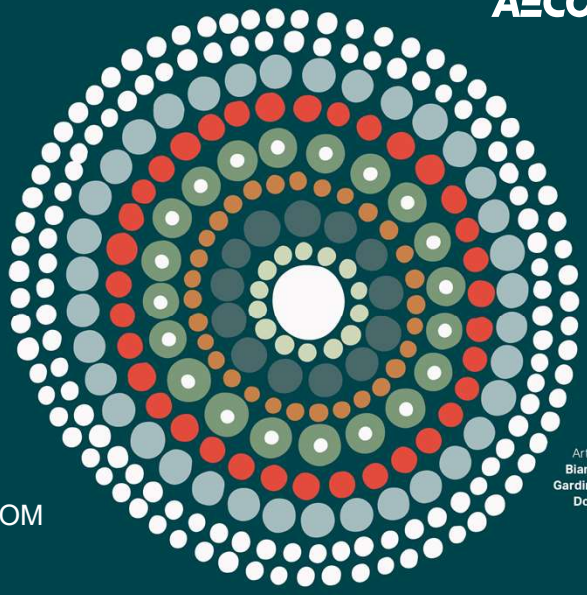
IWCM Strategy

Coarse Screening of Sustainable Effluent Management Options

Workshop 3

Workshop facilitated by Zena Smith-White, AECOM



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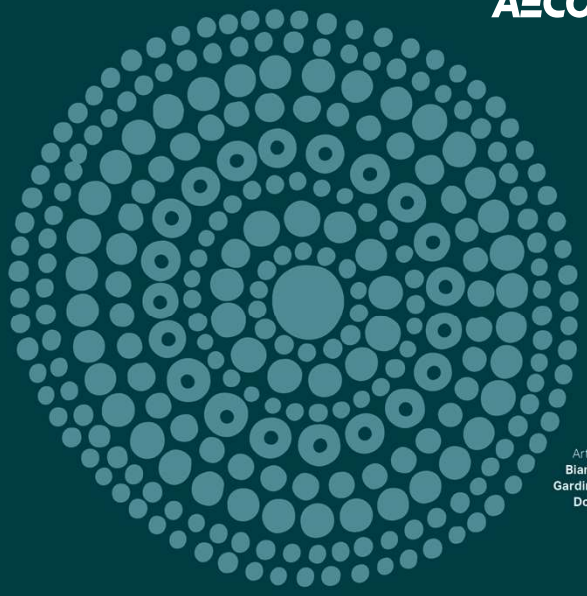
Acknowledgment of Country

We acknowledge the **Gathang-speaking (Biripi and Worimi)** people as the Traditional Custodians of the land on which we meet today, and recognise their connections to land, sea and community.

We pay our respect to their elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples today.



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Workshop 3 Agenda

1.	Welcome and Values Moment	09:30
2.	Introductions	09:35
3.	Project Background and Workshop Objectives	09:40
4.	Assessment Approach and Criteria	09:45
5.	Long-list of Options	09:50
6.	Coarse Screening of Options by STP location	10:30
7.	Lunch break	12:30
8.	Coarse Screening of Options Continued	13:30
9.	Conclusion	15:20
10.	Close	15:30

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Values Moment - Inclusive Communications

Inclusive language

- Use person-first language
- Avoid using gendered language
- Think about the context
- Focus on the person
- Listen to the language they use to describe themselves
- If in doubt – ask the person

A Thrive Moment

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Introductions

- What is your name and role?
- What are you hoping to contribute to the workshop?
- What would you like to achieve today?

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Workshop Objectives and Outcomes

The objective of the workshop is to:

- Present the long-list of sustainable effluent management options for discussion
- Undertake a coarse screening of the long-list of options
- Agree the short-list of options for further investigation

The outcome of this workshop will be to an endorsed short-list of sustainable effluent management options for further investigation prior to development of the IWCM Strategy

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Project Background – Integrated Water Cycle Management

- IWCM integrates water supply, sewerage and stormwater services within 30-year whole-of-catchment strategy
- Sets the objectives, performance standards and associated performance indicators for the water and sewer business
- Identifies needs and issues based on evidence and sound analysis and ensures infrastructure matches need
- Determines investment priority in consultation with community and stakeholders
- Identifies the 'best value 30-year' IWCM scenario on a social, environmental and financial basis

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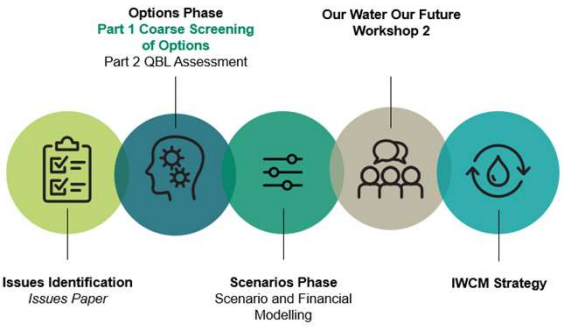
Project Background – MidCoast IWCM Journey to date

- MidCoast Water prepared 'Our Water Our Future 2045' in 2015 (water and sewerage only).
- Council is currently reviewing the IWCM, with final IWCM Strategy due May 2023
- Key outcome of the Issue Identification Phase:
  Sustainable Effluent Management at Council's sewerage treatment plants



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Assessment Approach and Criteria

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Assessment Approach

Each option assessed against the criteria and assigned a score:

- Pass: Option meets the criteria and should progress to short-list
- Fail: Option does not meet criteria and should not progress to short-list
- Unknown: Option cannot be scored and further investigation is required

Assessment criteria developed based on:

- Council Vision and Mission statements
- Risk Management Framework
- AECOM experience with similar projects
- Advice from DPE

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Assessment Criteria

Council Values	Council Risk Category	Indicator	Description and Objectives of Indicator
Wellbeing	Worker & public health and wellbeing	Health and wellbeing	Fit for purpose water quality - meetings legislative requirements Construction and operating/maintenance risks Delivering the option in a safe manner to customers - both during construction and service delivery
	Service delivery and infrastructure	beneficial to pursue	Option will provide beneficial and sustainable effluent reuse and/or reduce environmental discharges. Meet existing and future recycled water demand forecast at appropriate quality.
		Practically viable	Option can be delivered by Council / external support
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework
	Project timeline	Timeline for planning and delivery	Adaptive planning considerations. Is the timeline required for planning pathways and delivery known? Are there any unknowns about the planning and delivery pathway for this option?
	Financial	Cost - capital	Capital costs (qualitative only)
	Project budget	Cost - O&M	Operating and maintenance costs (qualitative only)
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts
		Sustainability and resource consumption	Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact) Option aligns with principles of ecologically sustainable development and intergenerational equity
Respect	Reputation	Community acceptance	Option likely to have community support (based on assumption that there is enough information for the community to make a balanced judgement)

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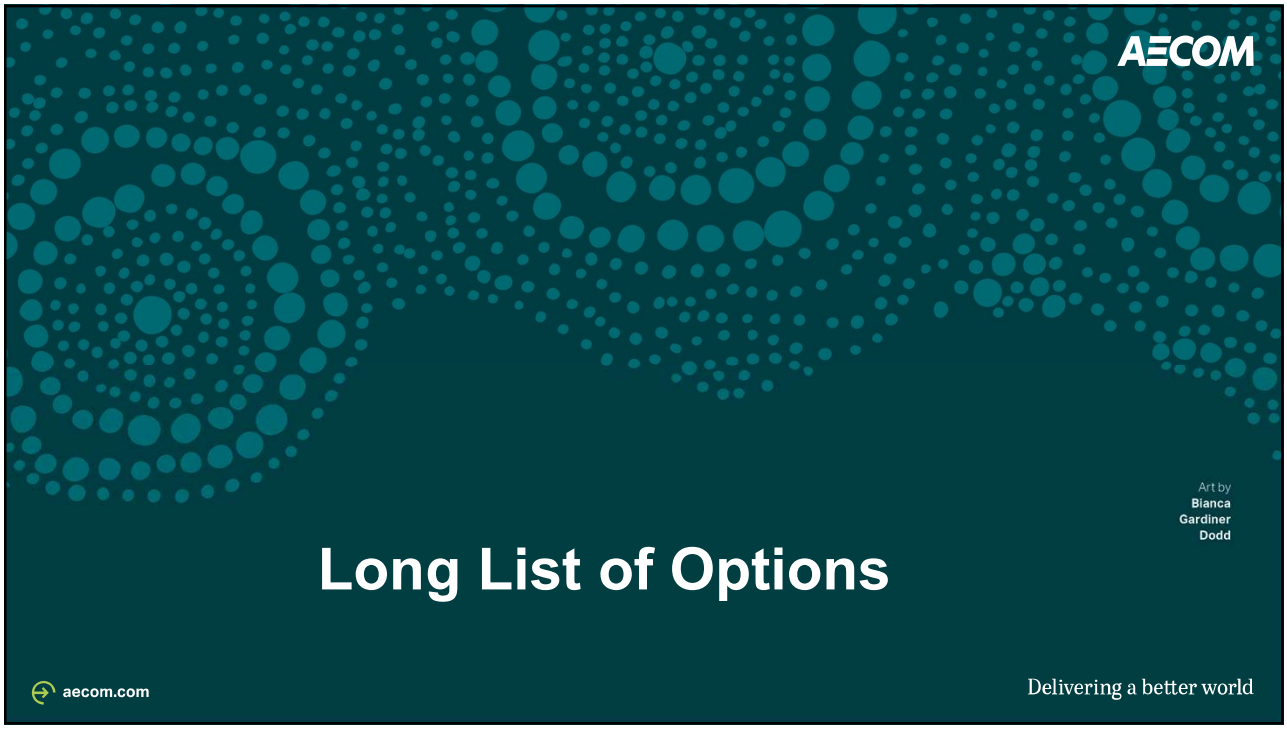

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Long-list of Options for Sustainable Effluent Management

- Flow reduction
- Biosolids
- Effluent reuse
- Discharge to environment

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Flow Reduction

- Source control options that consider reducing flows into the STP
- Demand management, including smart meter rollout, education and behaviour change
- Inflow & infiltration management – dry and wet weather conditions

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Flow reduction

Risks

- Behaviour change - community participation for water conscious community

Issues

- Reduces but does not eliminate inflow and infiltration
- May require certain incentives for trade waste vs domestic waste
- Efforts required by Council to educate community and raise awareness

Opportunities

- Potential for improvement in water quality through reduction of contaminants
- Sewage overflow management

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Biosolids Management

- The Draft Biosolids Framework is currently under review by the NSW EPA, with the final framework and new legislation due for release in September 2023.
- No biosolids options will be pursued until the new guidelines have been adopted.

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Effluent reuse

- Recycled water for restricted use
  - Agricultural application such as pasture grazing, crop irrigation
  - Open space irrigation with appropriate controls
- Recycled water for unrestricted use
  - Irrigation for open spaces, sports grounds, schools
  - Industrial and commercial uses
  - Construction and maintenance activities such as dust suppression, roads maintenance, routine sewer mains flushing
- Purified recycled water for drinking
  - Aquifer recharge
  - Direct to network

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Effluent reuse

Risks

- Potential public health consequences
- Impacts on receiving water bodies from reduce flow – ecosystems, river geology, river hydrology
- Community acceptance

Issues

- Expansion of treatment infrastructure at high capital costs
- Distribution infrastructure for small group of users
- Increased operation and maintenance costs for additional network
- Gaps in legislation
- Increase in greenhouse gas emissions from increased treatment

Opportunities

- Resource for water security
- Potential for revenue
- Promotes community education
- Raises water conscious community
- Reduction of pollutants in waterways
- Community benefit / amenity

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Discharge to environment

- Discharge to wetlands
- Water features i.e. water landscaping
- Exfiltration
- River discharge
- Ocean outfall / shore line discharge

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Hallidays Point Sewerage Scheme

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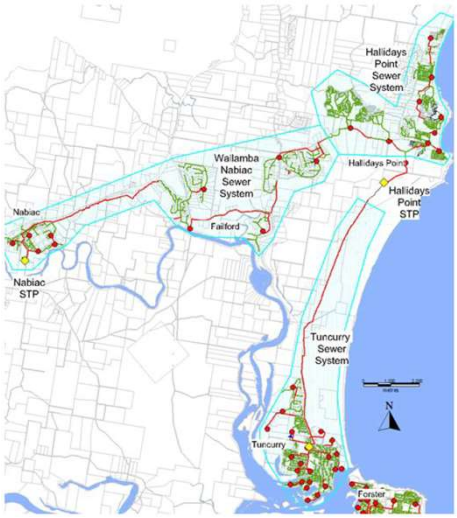
Halliday's Point Sewerage Scheme

- Receives flows from Nabiac STP
- Effluent from Halliday's Point STP is currently either directed to the exfiltration beds or Tuncurry RTP
- Tuncurry RTP uses membrane filtration and chlorination to treat the effluent to an unrestricted access standard
  - RTP upgradable to 7 ML/day
  - Existing users include Tuncurry Golf Course, cemetery, TAFE and high school, Sporties club, and cricket ovals

- 2020: **3120 kL/ day** ----> 2050: **4550 kL/day**
- In 2017/18: ~ 30% reused for open space irrigation
- In 2019/20 drought: ~ 65% reused



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Hallidays Point Effluent Management Options

Option		Description	Risks	Issues	Opportunities
1a	Recycled water for restricted use – Nabiac STP	Provide restricted recycled water to users at Nabiac and reduce load to Hallidays STP. Potential customers may include Wallamba Football Club, cattle grazing and other farmlands. Infrastructure required includes upgrade to Nabiac STP with disinfection process and infrastructure for distribution of recycled water.	- Community acceptance - Public health consequences if accessed during or before allowable hours - Potentially significant infrastructure to maximise use - Reduces available recycled water for Tuncurry RTP existing users	- Increased operation and maintenance costs - Rainfall dependent demand	- Reduces stress on Hallidays Point STP - Promotes community education and acceptance
1b	Recycled water for restricted use – Hallidays Point	Provide restricted recycled water to users at Hallidays Point before conveying the effluent to the Tuncurry RTP. Potential customers may include resorts / holiday parks. No additional infrastructure required for treatment processes, but distribution infrastructure and storage will be required.	As per Option 1a	As per Option 1a	- No upgrade to STP treatment - Promotes community education and acceptance

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Hallidays Point Effluent Management Options

Option		Description	Risks	Issues	Opportunities
2	Recycled water for unrestricted use – Expansion of Tuncurry RTP	Expansion of current recycled water to new users. Potential users include Tuncurry Skate Park (Vincent Fazio Park), local parks such as Lone Pine Memorial Park, John Wright Park, and Forster Tuncurry Golf driving range, Tuncurry Lakes resort, and Tuncurry waste management centre. May require either expansion of distribution network or offtake points, and/or expansion of membrane filtration units at RTP	- Approvals and permits - Community acceptance - Significant infrastructure required for conveyance of untreated and treated water across waterways	As per Option 1a	As per Option 1b - Maintains aesthetic values in drought

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Hallidays Point Effluent Management Options

Option		Description	Risks	Issues	Opportunities
3a	Purified recycled water – Direct to network	Upgrade Tuncurry RTP to meet Australian Drinking Water standards for injection into the water supply network through Darawank reservoir. Infrastructure required includes upgrade to membrane filtration, new RO and UV advanced oxidation units, potentially additional raw and treated water storage tanks at the RTP.	- Community acceptance - Approvals and permits - Public health consequences - Pipeline construction across Forster-Tuncurry bridge	- Intensive energy process, increase in greenhouse gas emissions - Expansion of infrastructure at high costs - Supporting legislation - Brine discharge from RO	- Contributes to significant water security to Manning Water Supply Scheme - Opportunity to combine effluent management of Hallidays Point and Forster STPs through staging - Utilises some existing infrastructure
3b	Purified rec ycled water – Aquifer recharge	Managed aquifer recharge of Nabiac borefield for replenishment of groundwater Infrastructure required includes upgrade of Tuncurry RTP to advanced water treatment plant with membrane filtration, RO, and UV advanced oxidation (or as required for water quality suitable for aquifers) and approximately 9km pipeline to Nabiac borefield	- Potential for salinity contamination - Potential for emerging contaminants contamination - Water clogging - Approvals and permits - Recharge flow impacts on surrounding environment - Community acceptance	- Appropriateness of water quality for recharge - Strategic injection points for recharge - Increased operational costs	As per Option 3a - Increases reliability of bores with replenishment - Adaptable to growth

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Forster Sewerage Scheme

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Forster Sewerage Scheme

- Treated to tertiary level UV light disinfection, and sand filtration
- All effluent discharged through ocean outfall at Janie's Corner
- Effluent from Pacific Palms STP proposed for transfer to Forster STP
- Studies completed indicate no issues under adverse conditions provided effluent detention time does not exceed 12 hours
- Existing infrastructure sufficient to meet this criteria

- 2020: **3930 kL/ day** ----> 2050: **5300 kL/day**

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Forster Effluent Management Options

Option		Description	Risks	Issues	Opportunities
1	Recycled water for restricted use	Expansion to new users May require either expansion of distribution network or offtake points	- No identified potential users of restricted water within Forster township - Public health consequences if accessed during or before allowable hours	- Network expansion, increased operation and maintenance costs - Rainfall dependent demand	- Potentially no upgrade to STP treatment - Promotes community education and acceptance
2	Purified recycled water	Pump effluent from STP to Tuncurry RTP and upgrade of Tuncurry RTP to meet Australian Drinking Water standards Infrastructure required includes upgrade to membrane filtration, new RO and UV advanced oxidation units, additional raw and treated water storage tanks at the RTP. Transfer pipeline from Forster STP to the RTP would require either a bridge crossing or underbore at the Forster Tuncurry bridge. A new pipeline will also be required from the RTP to Darawank reservoir.	- Community acceptance - Approvals and permits - Public health consequences - Pipeline construction across Forster-Tuncurry bridge	- Intensive energy process, increase in greenhouse gas emissions - Expansion of infrastructure at high costs - Supporting legislation - Brine discharge from RO	- Contributes to significant water security to Manning Water Supply Scheme - Combines effluent management of Hallidays Point and Forster STP - Utilises some existing infrastructure

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Forster Effluent Management Options

Option		Description	Risks	Issues	Opportunities
3a	Recycled water for unrestricted use – Expansion of Tuncurry RTP	Pump effluent to Tuncurry RTP. Additional users in addition to above include Tuncurry Skate Park (Vincent Fazio Park), local parks such as Lone Pine Memorial Park, John Wright Park, Forster Tuncurry Golf driving range, Tuncurry Lakes resort, Tuncurry waste management centre in Tuncurry Upgrade to Tuncurry RTP with additional membrane filtration and raw and treated water storage tanks. Transfer pipeline from Forster STP to the RTP, and back to Forster from the RTP would require either a bridge crossing or underbore at the Forster Tuncurry bridge	- Approvals and permits - Community acceptance - Significant infrastructure required for conveyance of untreated and treated water across waterways	- Rainfall dependent demand - Increase in greenhouse gas emissions - Increased operation and maintenance costs including staffing resources	- Adaptable to growth - Promotes community education and acceptance - Maintains aesthetics during drought
3b	Recycled water for unrestricted use - New RTP	Open spaces for irrigation may include Forster Tuncurry Golf Club, The Y (Aquatic and Leisure Centre), Pacific Palms Sports Fields, Palms Oasis Caravan Park, Great Lakes College, and local parks. New RTP with membrane filtration and disinfection process units, treated water storage tanks, and infrastructure for transfer of effluent from the STP to the RTP site, and for distribution to customers	As per Option 3a, but no trunk waterway crossings - Potentially insufficient recycled water demand to offset capital investment	As per Option 3a - Land acquisition for RTP site - Increased operation and maintenance costs including staffing resources - Significant increase in greenhouse emissions	As per Option 3a - Potential for dual reticulation scheme for new developments - Potential for revenue

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Taree (Dawson) Sewerage Scheme

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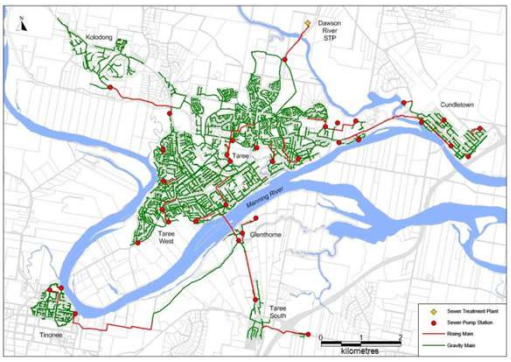
Taree (Dawson) Sewerage Scheme

- Treated to tertiary level with maturation ponds and UV light disinfection
- Effluent reused under TWEMS for farmland irrigation or discharged to Manning River
  - Suitable for pastures and fodder crop production
  - Effluent received by 13 farms

- 2020: **3680 kL/ day** ----> 2050: **4700 kL/day**

**note: this projection does not include Brimbin development*

- In 2017/18: ~20% reused for irrigation, ~80% discharged to river
- In 2019/20 drought: no discharge to river, all reuse for irrigation



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Taree (Dawson) Effluent Management Options

Option		Description	Risks	Issues	Opportunities
1	Recycled water for restricted use	Expansion to new users Requires expansion of distribution network	- Community participation	- Network expansion, increased operation and maintenance costs - Rainfall dependent demand	- No upgrade to STP treatment - Promotes community education and acceptance
2	Recycled water for unrestricted use	Upgrade STP or locate a package RTP plant for unrestricted access effluent water quality suitable for open space irrigation. Potential users include Taree Recreation Centre, Taree Sports Club, St Clare's High School, Taree Showgrounds, Taree Croquet Club, and local parks. Upgrade to STP with membrane filtration, raw and treated water storage tanks, and transfer infrastructure	- Approvals and permits - Community acceptance	- Rainfall dependent demand - Increase in greenhouse gas emissions - Increased operation and maintenance costs	- Adaptable to growth - Promotes community education and acceptance - Maintains aesthetics during drought - Utilises existing infrastructure
3	Purified recycled water	Pump effluent from STP to Bootawa Dam Infrastructure required includes STP upgrade with pre-treatment screening, membrane filtration, RO, UV advanced oxidation, raw and treated water storage tanks, and transfer pipeline from STP to Bootawa dam	-Community acceptance - Public health consequences - Construction through two waterways	- Intensive energy process - Supporting legislation - Brine discharge from RO	- Utilises existing distribution infrastructure

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Wingham Sewerage Scheme

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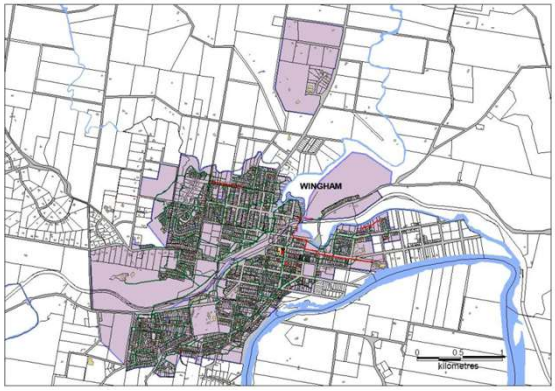
Wingham Sewerage Scheme

- Treated to tertiary level with UV light disinfection
- Effluent reused under TWEMS for farmland irrigation or discharged to Manning River
  - Treated effluent pumped to storage dam on Wingham Bight
  - Effluent supplied to 60 ha farmland across 4 farms
- 2020: **650 kL/ day** ----> 2050: **785 kL/day**
- In 2017/18: ~ 50 % reused for irrigation, ~ 50% discharged to river
- In 2019/20 drought: very small discharge to river (<1%), almost all reused for irrigation



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Wingham Effluent Management Options

Option		Description	Risks	Issues	Opportunities
1	Recycled water for restricted use	Expansion to new users Requires expansion of distribution network	- Community participation	- Network expansion, increased operation and maintenance costs	- No upgrade to STP treatment - Promotes community education and acceptance
2	Recycled water for unrestricted use	Upgrade STP for unrestricted access effluent water quality suitable for open space irrigation. Potential users include Wingham Town Green, Wingham Golf Course (could be restricted). Upgrade STP with minimum membrane filtration and expansion of recycled water pipeline to open space sites	- Approvals and permits - Community acceptance	- Rainfall dependent demand - Increase in greenhouse gas emissions - Increased operation and maintenance costs	- Adaptable to growth - Promotes community education and acceptance - Maintains aesthetics during drought - Utilises existing infrastructure
3	Purified recycled water	Pump effluent from STP to Bootawa Dam Infrastructure required includes STP upgrade with pre-treatment screening, membrane filtration, RO, UV advanced oxidation, raw and treated water storage tanks, and transfer pipeline from STP to Bootawa dam	-Community acceptance - Public health consequences - Construction through two waterways	- Intensive energy process - Supporting legislation - Brine discharge from RO	- Utilises existing distribution infrastructure

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Hawks Nest Sewerage Scheme

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Hawks Nest Sewerage Scheme

- Effluent from Hawks Nest STP is currently either directed to the exfiltration beds or Hawks Nest RTP
- Exfiltration beds have capacity for wet weather flows beyond 2050
  - Currently two are used, and third can be brought online as required
- Hawks Nest RTP uses membrane filtration and chlorination to treat the effluent to an unrestricted access standard
  - Existing users include Golf Course and Myall/Providence Park playing fields

- 2020: **1080 kL/ day** ----> 2050: **1720 kL/day**
- In 2017/18: ~ 40 % reused for irrigation
- In 2019/20 drought: ~ 98% reused for open space irrigation

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Hawks Nest Effluent Management Options

Option		Description	Risks	Issues	Opportunities
1	Recycled water for unrestricted use – Expansion of Hawks Nest RTP	Expansion of current recycled water to new users. Potential users include holiday parks, Tea Gardens cemetery, Tea Gardens skate park, tea gardens soccer club and other local parks. Requires expansion of membrane filtration units at RTP, expansion of distribution network to Tea gardens with pipeline either attached to bridge or bored under Myall river.	- Approvals and permits - Community acceptance - Pipeline construction through challenging corridor	- Rainfall dependent demand - Increased operational costs - Increase in greenhouse emissions, specifically	- Opportunity to integrate recycled water in greenfield development areas - Utilises existing treatment process infrastructure - Raises community awareness - Maintains aesthetic values in drought

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Hawks Nest Effluent Management Options

Option		Description	Risks	Issues	Opportunities
2a	Purified recycled water – Direct to network	Upgrade RTP to meet Australian Drinking Water standards for injection into the water supply network through Tea Gardens reservoir. Infrastructure required includes upgrade to membrane filtration, new RO and UV advanced oxidation units, additional raw and treated water storage tanks at the RTP, pipeline to Tea gardens either attached to bridge or bored under Myall river	- Community acceptance - Approvals and permits - Severe public health consequences - Pipeline construction through challenging corridor	- Intensive energy process, increase in greenhouse gas emissions - Expansion of infrastructure at high costs - Supporting legislation - Brine discharge from RO	- Contributes to water security for Manning Water Supply Scheme - Utilises some existing infrastructure
2b	Purified recycled water – Aquifer recharge	Managed aquifer recharge of Tea Gardens borefield for replenishment of groundwater Infrastructure required includes upgrade of Hawks Nest RTP to advanced water treatment plant with membrane filtration, RO, and UV advanced oxidation (or as required for water quality suitable for aquifers) and approximately 7km pipeline to Tea Gardens borefield	- Potential for salinity contamination - Potential for emerging contaminants contamination - Water clogging - Approvals and permits - Recharge flow impacts on surrounding environment - Community acceptance	- Appropriateness of water quality for recharge - Strategic injection points for recharge - Increased operational costs	As per Option 2a - Increases reliability of bores with replenishment - Adaptable to growth

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Old Bar Sewerage Scheme

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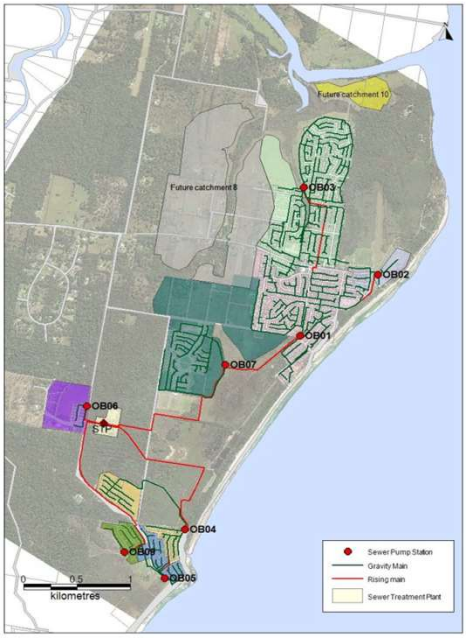
Old Bar Sewerage Scheme

- Treated to tertiary level with UV light disinfection
- Effluent discharged through exfiltration beds
  - Located 1.2km east of site towards coast
  - Potentially impacted by climate change and sea level rise
- 2020: **830 kL/ day** ----> 2050: **1800 kL/day**



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Old Bar Effluent Management Options

	Option	Description	Risks	Issues	Opportunities
1	Recycled water for restricted use	Current treatment suitable for restricted use. Potential users may include land irrigation at Oxley and Mitchell Islands. Requires effluent storage tanks and transfer infrastructure	- Public health consequences if accessed during or before allowable hours - Pipeline corridors through waterways - Community Acceptance	- Network expansion at considerable lengths for potentially small group of users (or Council only) at significant costs - Increased operation and maintenance costs - Rainfall dependent demand	- No upgrade to STP treatment - Promotes community education and acceptance
2	Recycled water for unrestricted use	Open spaces for irrigation may include Old Bar Beach Rugby Club, Chris Dempsey Cricket Ground, Old Bar Beach festival grounds, and local parks. Upgrade to STP with membrane filtration, raw and treated water storage tanks, and transfer infrastructure	- Approvals and permits - Insufficient demand to offset capital investment	As per Option 1 - Increased greenhouse gas emissions - Land acquisition for RTP - Additional staffing resources	As per Option 1, but upgrades required to STP - Potential for dual reticulation for new developments - Potential for revenue - Maintains aesthetic values in drought
3	Purified recycled water	Pump effluent from STP to either WTP or future off-stream storage dam Infrastructure required includes WTP upgrade with pre-treatment screening, membrane filtration, RO, UV advanced oxidation, raw and treated water storage tanks, and transfer pipeline from STP to WTP or dam	- Approvals and permits - Community acceptance - Public health consequences - Economies of scale not achieved	As per Option 2, but demand primarily independent of rainfall - Intensive energy process - Supporting legislation - Brine discharge from RO	- Utilises existing distribution infrastructure

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Harrington Sewerage Scheme

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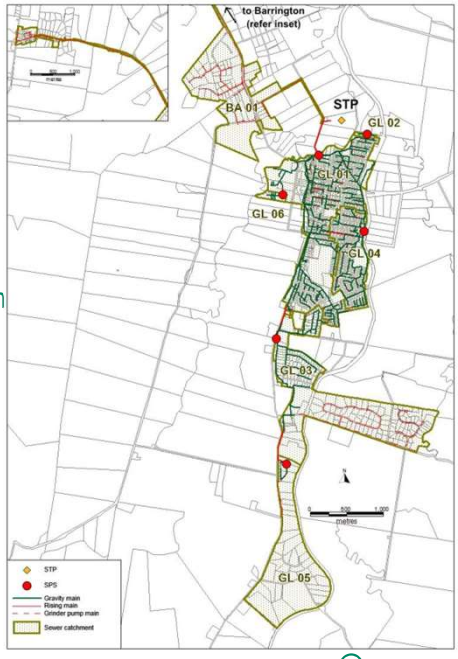
Harrington Sewerage Scheme

- Treated to tertiary level with disc filtration and UV light disinfection
- Effluent reused either for Harrington Waters Golf Course or exfiltration beds
  - Overflows to natural wetlands, Harrinton Swamp, from effluent ponds for exfiltration

- 2020: **1180 kL/ day** ----> 2050: **1660 kL/day**
- In 2017/18: ~ 10% reused for irrigation
- In 2019/20 drought: ~ 40% reused for irrigation



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Harrington Effluent Management Options

	Option	Description	Risks	Issues	Opportunities
1	Recycled water for restricted use	Expansion of reuse for Cattai Wetlands Requires expansion of distribution network to wetlands with approximately 8km pipeline along road corridor	- Pipeline across creek corridor – pipe construction attached to bridge or under creek	- Network expansion, increased operation and maintenance costs - Rainfall dependent demand - High I&I issues, management should lead to reduced flows	- Promotes community education and acceptance - Reduces pollutants in waterways
2	Recycled water for unrestricted use	Upgrade of STP for unrestricted use for open space irrigation. Potential sites include Esmund Hogan Park, and Harrington Public School. Upgrades required include membrane filtration, and treated water storage tanks at STP, as well as transfer infrastructure from STP to end users and storage and irrigation infrastructure for end users.	- Significant infrastructure required to maximise use - Approvals and permits	As per Option 1	As per Option 1, but requires upgrade to STP - Maintains aesthetic values in drought
3	Purified recycled water	Pump effluent from STP to new WTP or off-stream storage dam. Requires WTP with pre-treatment screening, membrane filtration, RO, UV advanced oxidation, raw and treated water storage tanks	- Community acceptance - Public health consequences - Economies of scale not achieved	- Intensive energy process - Expansion of infrastructure at high costs - High operation and maintenance costs - Supporting legislation - Brine discharge from RO - Reduces flows for existing recycled water users	- Utilises existing distribution infrastructure - Incorporate option into planned future upgrades

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Gloucester Sewerage Scheme

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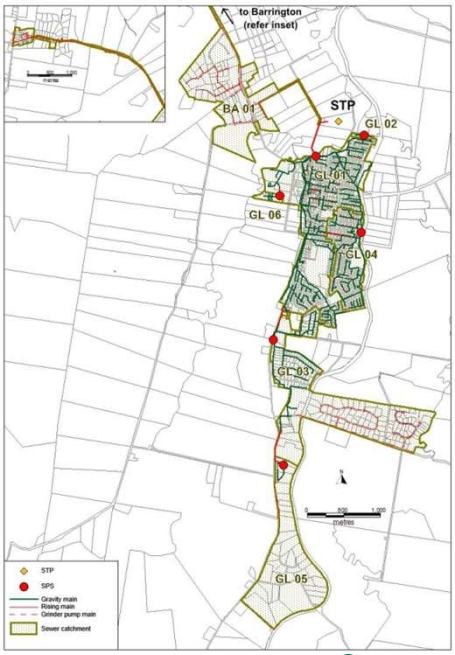
Gloucester Sewerage Scheme

- Treated to tertiary level with artificial wetland
- Effluent either supplied for pasture irrigation preceded b chlorine dosing or discharged to Gloucester River

- 2020: **570 kL/ day** ----> 2050: **720 kL/day**
- In 2017/18: ~ 40% reused for irrigation
- In 2019/20 drought: ~ 90% reused for irrigation



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Gloucester Effluent Management Options

	Option	Description	Risks	Issues	Opportunities
1	Recycled water for restricted use	Expansion to new users Previous investigations identified 4 additional agricultural users May require either expansion of distribution network or offtake points	- Public health consequences if accessed during or before allowable hours	- Network expansion, increased operation and maintenance costs - Rainfall dependent demand	- No upgrade to STP treatment - Promotes community education and acceptance - Removes reliance from single user
2	Recycled water for unrestricted use	Previous investigations identified 5 open spaces for irrigation including Gloucester showground, District Park, Billabong Native Park, Minimbah Native Garden, the Golf Course Upgrades required include membrane filtration, chlorination and treated water storage tanks at STP, as well as transfer infrastructure from STP to end users and storage and irrigation infrastructure for end users	- Approvals and permits	As per Option 1 - Increased greenhouse gas emissions	As per Option 1, but requires upgrade to STP - Provision for future treatment in current STP upgrade - Potential for revenue - Maintains aesthetic values in drought
3	Purified recycled water	Pump effluent from STP to either new WTP (required regardless) or future off-stream storage dam Infrastructure required new WTP (or addition to the new STP) that includes pre-treatment screening, membrane filtration, RO, UV advanced oxidation, raw and treated water storage tanks, transfer pipeline from STP to WTP or dam	As per Option 2 - Community acceptance - Public health consequences - Did not pass water security screening, cost benefit ratio not maximised	- Intensive energy process - Expansion of infrastructure at high costs - High operation and maintenance costs - Supporting legislation - Brine discharge from RO	- Utilises existing distribution infrastructure - Incorporate option into planned future upgrades

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Stroud Sewerage Scheme

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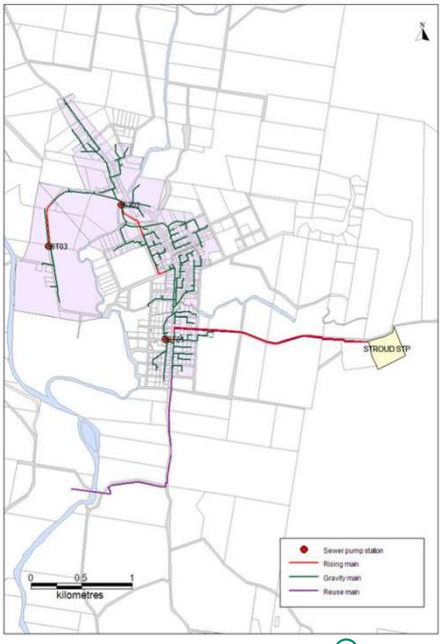
Stroud Sewerage Scheme

- Treated to tertiary level with UV light disinfection
- Effluent reused for dairy cattle grazing
- Surplus flows discharged to Karuah River on a precautionary basis based on river flow conditions for effluent dilution

- 2020: **140 kL/ day** ----> 2050: **160 kL/day**
- In 2017/18: ~ 90 % reused for pasture irrigation
- In 2019/20 drought: no discharge to river, all reuse for irrigation



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Stroud Effluent Management Options

Option		Description	Risks	Issues	Opportunities
1	Recycled water for restricted use	Expansion to new users Potential users may chicken farms for cooling purposes Requires expansion of distribution network	- Community participation	- Network expansion, increased operation and maintenance costs	- No upgrade to STP treatment - Promotes community education and acceptance - Removes reliance from single user
2	Recycled water for unrestricted use	Open spaces for irrigation may include Allen Park, Silo Hill Park, Stroud showground, Mills Creek Lions Park, Stroud Public School Upgrade to STP with membrane filtration, and transfer infrastructure	- Approvals and permits - Insufficient demand to offset capital investment - Land clearing for expansion of STP	As per Option 1 - Increased greenhouse gas emissions - Expansion of infrastructure with significant capital investment	As per Option 1, but upgrades required to STP - Maintains aesthetic values in drought
3	Purified recycled water	Pump effluent from STP to either WTP or future off-stream storage dam Infrastructure required includes WTP upgrade with pre-treatment screening, membrane filtration, RO, UV advanced oxidation, raw and treated water storage tanks, and transfer pipeline from STP to WTP or dam	- Approvals and permits - Community acceptance - Public health consequences - Did not pass water security screening, cost benefit ratio not maximised	As per Option 2, but demand primarily independent of rainfall - Intensive energy process - Supporting legislation - Brine discharge from RO	- Utilises existing distribution infrastructure

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Lansdowne Sewerage Scheme

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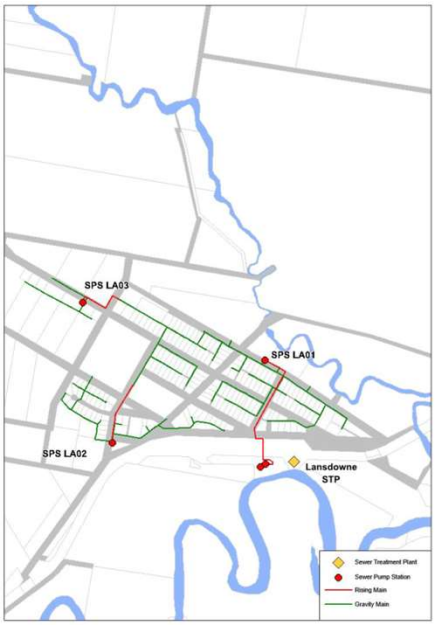
Lansdowne Sewerage Scheme

- Treated to secondary level with intermittent aeration and UV light disinfection, suitable for restricted access use
- Effluent stored in effluent pond and reused for irrigation
- Surplus flows discharged to Lansdowne River

- 2020: **50 kL/ day** ----> 2050: **70 kL/day**
- In 2017/18: ~ 50 % reused for irrigation
- In 2019/20 drought: no discharge to river, all reuse for irrigation



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Lansdowne Effluent Management Options

	Option	Description	Risks	Issues	Opportunities
1	Recycled water for restricted use	Expansion to new users Potential users may include surrounding farms / agricultural properties May require either expansion of distribution network or offtake points	- Public health consequences if accessed during or before allowable hours	- Network expansion, increased operation and maintenance costs - Rainfall dependent demand	- No upgrade to STP treatment - Promotes community education and acceptance
2	Recycled water for unrestricted use	Open spaces for irrigation may include Lansdowne Recreation Reserve, Lansdowne Public School Upgrade to STP with membrane filtration, treated water storage tanks, and transfer infrastructure	- Approvals and permits - Insufficient demand to offset capital investment	As per Option 1 - Increased greenhouse gas emissions - Expansion of infrastructure with significant capital investment	As per Option 1, but upgrades required to STP - Maintains aesthetic values in drought
3	Purified recycled water	Pump effluent from STP to either WTP or future off-stream storage dam Infrastructure required includes WTP upgrade with pre-treatment screening, membrane filtration, RO, UV advanced oxidation, raw and treated water storage tanks, and transfer pipeline from STP to WTP or dam	- Approvals and permits - Community acceptance - Public health consequences - Economies of scale not achieved	As per Option 2, but demand primarily independent of rainfall - Intensive energy process - Supporting legislation - Brine discharge from RO	- Utilises existing distribution infrastructure

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Coopernook Sewerage Scheme

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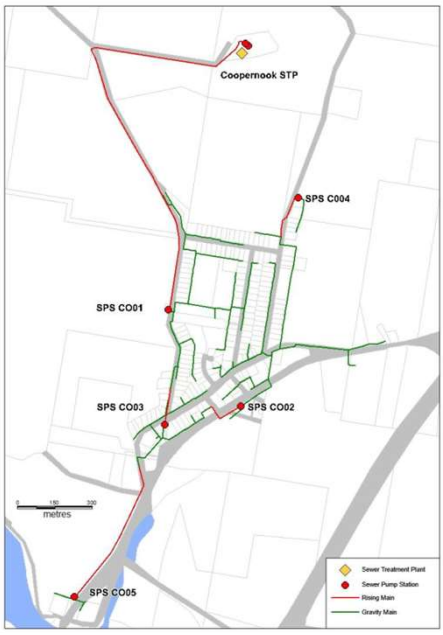
Coopernook Sewerage Scheme

- Treated to secondary level with intermittent aeration and UV light disinfection, suitable for restricted access use
- Effluent stored in storage pond and reused for pasture irrigation
- Surplus wet weather flows discharged to Lansdowne River under precautionary basis governed by river flow conditions

- 2020: **66 kL/ day** ----> 2050: **80 kL/day**
- In 2017/18: ~ 10% reused for irrigation
- In 2019/20 drought:~ no discharge to river, all reuse for irrigation



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Coopernook Effluent Management Options

Option		Description	Risks	Issues	Opportunities
1	Recycled water for restricted use	Expansion to new users Potential users may include surrounding farms / agricultural properties May require either expansion of distribution network or offtake points	- Public health consequences if accessed during or before allowable hours	- Network expansion, increased operation and maintenance costs - Rainfall dependent demand	- Current practices, sustainable approach - No upgrade to STP treatment - Promotes community education and acceptance - Removes reliance from single user
2	Recycled water for unrestricted use	Open spaces for irrigation may include Coopernook Park, Coopernook Public School. Upgrade to STP with membrane filtration, treated water storage tanks, and transfer infrastructure	- Approvals and permits	As per Option 1 - Increased greenhouse gas emissions - Expansion of infrastructure with significant capital investment	As per Option 1, but upgrades required to STP - Maintains aesthetic values in drought
3	Purified recycled water	Pump effluent from STP to either WTP or future off-stream storage dam Infrastructure required includes WTP upgrade with pre-treatment screening, membrane filtration, RO, UV advanced oxidation, raw and treated water storage tanks, and transfer pipeline from STP to WTP or dam	As per Option 2 - Community acceptance - Public health consequences - Economies of scale not achieved	As per Option 2, but demand primarily independent of rainfall - Intensive energy process - Supporting legislation - Brine discharge from RO	- Utilises existing distribution infrastructure

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Bulahdelah Sewerage Scheme

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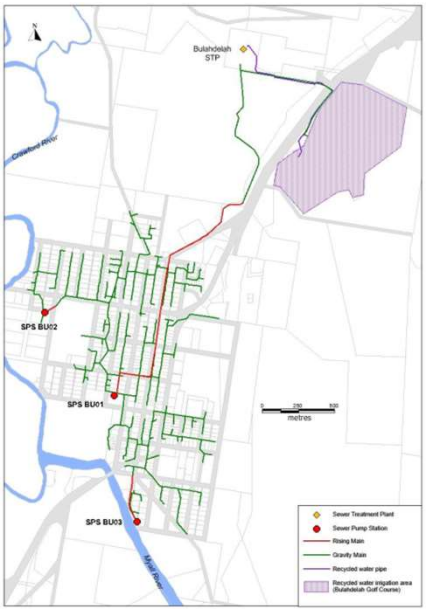
Bulahdelah Sewerage Scheme

- Treated to tertiary level with UV light and sand filtration, suitable for restricted access use
- Effluent either reused or discharged to Fry's Creek
- Current effluent user is Bulahdelah Golf Club

- 2020: **300 kL/ day** ----> 2050: **415 kL/day**
- In 2017/18: ~ 20% reused on Golf Course and ~80% discharge to river.
- In 2019/20 drought (level 3 and 4 restrictions): ~ 95% reused on Golf Course



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Bulahdelah Effluent Management Options

	Option	Description	Risks	Issues	Opportunities
1	Recycled water for restricted use	Option considers expansion to new users Potential users may include surrounding farms / agricultural properties May require either expansion of distribution network or offtake points	- Impact on waterways from reduced flows - Public health consequences if accessed during or before allowable hours	- High demand for golf course FY19/20 drought, all effluent reused - Usage not guaranteed over longer term - Network expansion, increased operation and maintenance costs - Rainfall dependent demand	- Current practices, sustainable approach - No upgrade to STP treatment - Promotes community education and acceptance - Removes reliance from single user
2	Recycled water for unrestricted use	Open spaces for irrigation may include Bulahdelah Showground, Jack Ireland Sports Complex, Bulahdelah Central School Upgrade to STP with membrane filtration, treated water storage tanks, and transfer infrastructure	As per Option 1 - Approvals and permits - Potentially insufficient demand to offset capital investment	As per Option 1 - Increased greenhouse gas emissions	As per Option 1, but upgrades required to STP - Potential for revenue - Maintains aesthetic values in drought
3	Purified recycled water	Pump effluent from STP to either WTP or future off-stream storage dam Infrastructure required includes either WTP or STP upgrade that includes pre-treatment screening, membrane filtration, RO, UV advanced oxidation, raw and treated water storage tanks and 2.5 km transfer pipeline from STP to WTP or dam	- Approvals and permits - Community acceptance - Public health consequences - Did not pass water security screening, cost benefit ratio not maximised	As per Option 2, but demand primarily independent of rainfall - Intensive energy process - Expansion of infrastructure at high costs - Supporting legislation - Brine discharge from RO	- Reduction of pollutants in waterways - Utilises existing distribution infrastructure

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Manning Point Sewerage Scheme

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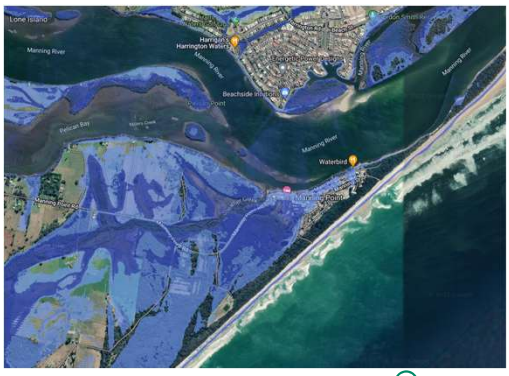
Manning Point Sewerage Scheme

- Manning point area inundated at 2100 sea level rise
  - Some, not all, assets impacted by sea level rise, STP excluding
- Broader issue that requires strategic planning for township of Manning Point



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Next Steps

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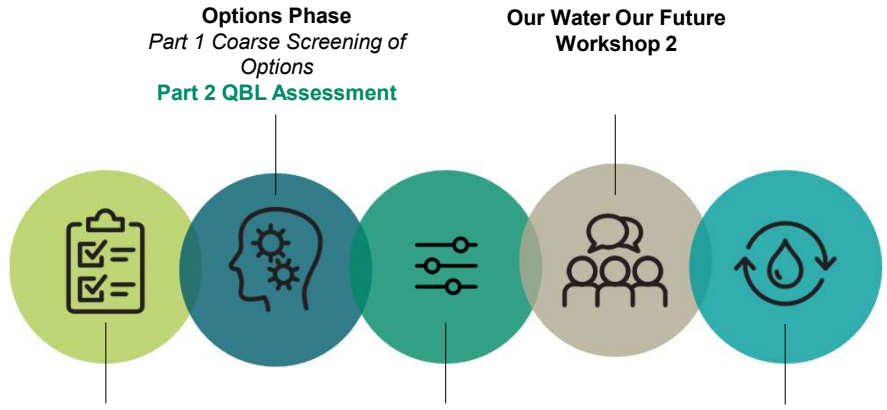
Next Steps



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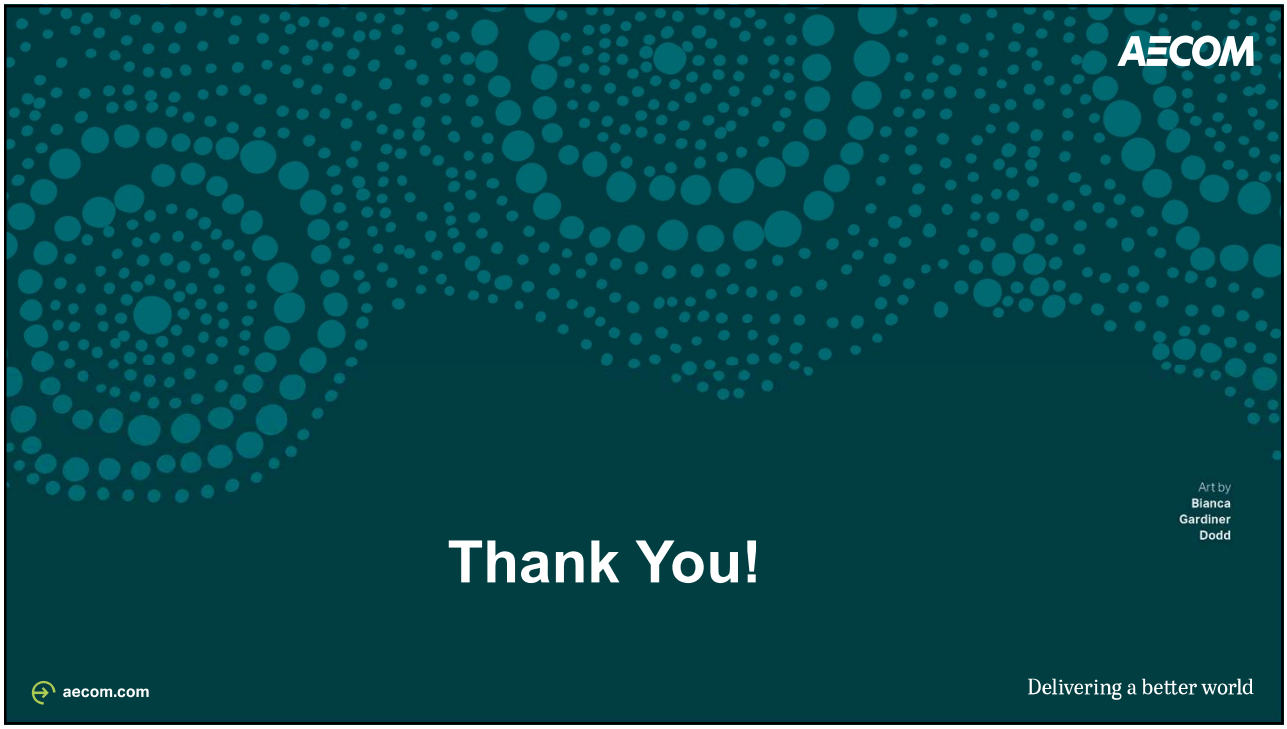

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About the artwork

Sydney CBD stands on the Traditional Lands and waterways of the Gadigal people of the Eora nation. AECOM's Sydney office resides over these lands and waterways, and we also respectfully pay homage to the memories and Traditional spirits within the land, and pay respect to those from the past, those in the present and those to come.

The palette of this work reflects both AECOM's interior design vision and the artist's own tonal impression of the lands and waterways of the Gadigal People. The six rings around the AECOM site represent AECOM's six core values. These core value rings can be seen radiating southwest along George Street out of the city into the broader community.

Today, George Street gently aligns itself over the path of the 'Tank Stream'. Its intersections often follow the pathways, eons in formation, from the passage of the Gadigal People. Having supplied fresh water and fish to the original Gadigal People for tens of thousands of years, it would serve as the main fresh water supply for the first 40 years of Sydney's European life.

The design respectfully acknowledges the 29 clans of the Eora nation represented by the various circles depicting meeting places, connecting them spiritually and physically over the Traditional paths and landforms that intertwine their worlds.

Here in the Sydney region, the 29 Eora clans share the land and its bounty. Each clan is unique, yet intrinsically linked, existing in perfect harmony with the spiritual & natural world.

Images of spears represent local Warriors, particularly Bennelong standing proudly over his Traditional Lands. Further down the stream, are the areas of Women's Business - birthing, celebrating, sharing & embracing their unique world. The sandy pebbles on the left bank signify the sandstone cliffs and ledges upon which Barangaroo now proudly sits, further identifying the connection between one of the wives of Bennelong with the land and water of the Gadigal People.

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Sustainable Effluent Management

	Flow reduction		Resource Recovery	Effluent reuse			Discharge to environment				
	Demand management	Inflow and infiltration management	Biosolids management and reuse	Recycled water restricted use	Recycled water unrestricted use	Purified recycled water for drinking	Discharge to wetlands	Water features / landscaping	Exfiltration	River discharge	Ocean outfall
Hallidays Point	Pass	Pass	N/A	TBC - identify users	Pass	Unknown - long term water security	Fail	Fail	Pass	Fail	Fail
Forster	Pass	Pass	N/A	Fail	Pass	Unknown - long term water security	Fail	Fail	Fail	Fail	Pass
Taree / Dawson	Pass	Pass	N/A	Pass	Pass	Unknown - long term water security	Pass	Fail	Fail	Pass	Fail
Wingham	Pass	Pass	N/A	Pass	Fail	Unknown - long term water security	Fail	Fail	Fail	Pass	Fail
Hawks Nest	Pass	Pass	N/A	Fail	Pass	Fail	Fail	Fail	Pass	Fail	Fail
Old Bar	Pass	Pass	N/A	Pass	Pass	Fail	Fail	Fail	Pass	Fail	Pass
Harrington	Pass	Pass - dry weather flow	N/A	TBC - identify users	Fail	Fail	Pass	Fail	Pass	Pass	Fail
Gloucester	Pass	Pass	N/A	Pass	Pass	Fail	Fail	Fail	Fail	Pass	Fail
Stroud	Pass	Pass	N/A	Pass	Fail	Fail	Fail	Fail	Fail	Pass - highly restricted	Fail
Lansdowne	Pass	Pass	N/A	Pass	Fail	Fail	Fail	Fail	Fail	Pass - highly restricted	Fail
Coopernook	Pass	Pass - wet weather flow	N/A	Pass - need more users	Fail	Fail	Fail	Fail	Fail	Pass - highly restricted	Fail
Bulahdelah	Pass	Pass - flooding infiltration	N/A	Pass	Pass	Fail	Fail	Fail	Fail	Pass	Fail
Manning Point	Pass	Pass	N/A	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail