Report

Smith Drive Pipeline - Options Report

Prepared for Ballina Shire Council (the Client)

By Beca Pty Ltd (Beca)
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1st July 2013

Revision History

Revision N°	Prepared By	Description	Date
A	Susana Simon Mendoza	First issue for client comment	3 June 2013
B	Susana Simon Mendoza	Client comments incorporated	1st July 2013

Limitations Statement

The sole purpose of this report (the "Report") and the associated services (the "Services") performed by Beca Pty Limited ("Beca") is to identify options for water supply to customers currently connected to the Smith Drive water main and recommend a preferred option for implementation by Ballina Shire Council (the "Client"). ("Intended Purpose").

The agreed scope of the Services has been defined by Ballina Shire Council (including by the time and budgetary constraints specified in the offer), and by the availability of access to the site.

In preparing this Report, Beca has relied upon and presumed accurate, complete, current and sufficient the information provided by the Client and others relative to the Smith Drive water main, the customers connected to the main and constraints in the regions surrounding the water main and others (if any) identified in more detail herein. Except as otherwise stated in the Report, Beca has not attempted to verify the accuracy, completeness, currency or sufficiency of any such information.

The findings, observations and conclusions expressed by Beca in this Report are not, and should not be considered a recommendation to modify the pipe. The Client should complete further assessments and obtain required approvals before progressing with any work. The passage of time, manifestation of latent conditions or impacts of future events may require further review of the work and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this Report if any suggestion in the Report is pursued further. Further and more detailed investigation must be undertaken in relation to any particular measure identified in the report prior to its implementation.

No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this Report, and while this Report may express opinions on likely or possible outcomes, we do not guarantee any particular outcome and the decision to proceed with any implementation of the recommendations therein is a commercial decision for the Client. Further, such data, findings, observations and conclusions are based solely upon visual site inspections, previous reports, manuals and drawings supplied by the Client at the time of the investigation.

This Report has been prepared on behalf of the Client, and is subject to and issued in connection with the provisions of the agreement between Beca and the Client. Beca accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this Report by any third party and Beca is not responsible for any use of the Report for purposes other than the Intended Purpose.

Document Acceptance

Action	Name	Signed	Date
Prepared by	Susana Simon Mendoza	Susana Simon Mendoza	20th June 2013
Reviewed by	Dianne Thomas	D J Thomas	1st July 2013
Approved by	Dianne Thomas	D J Thomas	1st July 2013
on behalf of	Beca Pty Ltd		

Executive Summary

Ballina Shire Council provides drinking water to properties in Ballina Shire. The Smith Drive Water Main supplies customers in West Ballina. The main begins at the east end of Waverly Place and continues in alignment with Smith Drive until it crosses Emigrant Creek. From Emigrant Creek, the water main continues until the last customer at Cutting Edge Road. The pipeline has different characteristics on either side of Emigrant Creek. To the east of Emigrant Creek (see Section 1 in Figure A below), there are a larger number of customers closer together and the pipeline is in a better condition. To the west of Emigrant Creek, the pipe is generally in poorer condition, with fewer customers connected to the main (see Section 2 in Figure A below).

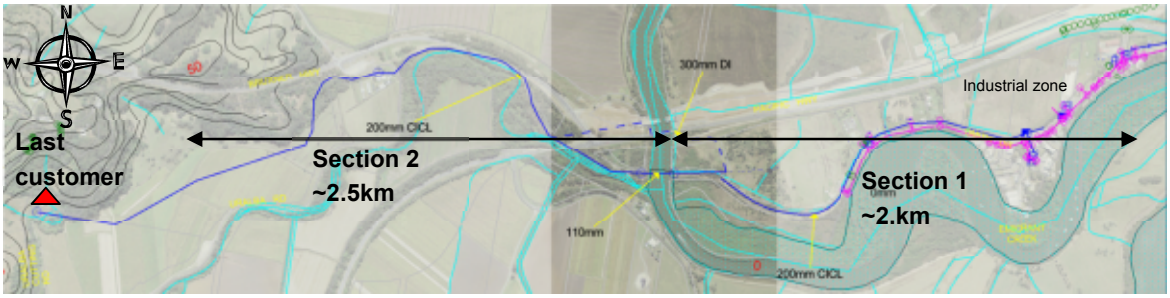

Figure A: Section 1 and 2 of the pipeline.

The pipeline is indicated by the solid blue line. Last customer shown as red triangle

In August 2011, Ballina Shire Council assessed the water mains in West Ballina, as part of an Initial Water Loss Evaluation. The report from this study indicated high levels of leakage (approximately 238.5 ML/year) within the Smith Drive Water Main (West Ballina DMA Summary report, August 2011, SMEC).

In March 2013, the condition of the pipeline was assessed along the 4.5km route from Smith Drive to Uralba. This assessment found the pipeline was near the end of its life, there were a large number of failures and a high probability of more failures due to the generally poor condition of the pipe (Condition Assessment Report, April 2013, Beca).

Consumption records were reviewed to determine current average water demand from the Smith Drive pipeline. Peak demand was calculated.

To gather information about the current/future water use, surveys were conducted in several properties serviced by the Smith Drive Water Main. Customers were asked their opinions on alternative water supply options. This information was incorporated into the assessment of options for supply upgrade.

The purpose of this report is to assess options for the water supply to customers currently connected to the main and recommend the most advantageous option to be implemented.

Options Considered

Considering the different characteristics of the watermain on either side of Emigrant Creek, different options were considered for Section 1 and Section 2 of the watermain. It was important to consider each option individually as each option presented different outcomes in terms of economic, environmental and social impacts.

The options considered for **Section 1** of the Smith Drive Water Main are:

1. Construct a new pipe above ground next to the existing pipe
2. Directionally drill a new pipeline below the existing pipe
3. Trench a new below ground pipeline beside the existing pipe
4. Use the existing pipeline as a conduit to draw a smaller polyethylene (PE) pipe and connect house service lines to the smaller PE pipe.

All options follow the existing alignment and meet the maximum demand which is for fire fighting.

The options considered for **Section 2** of the Smith Drive Water Main are:

1. Construct a new smaller diameter pipe along the existing alignment and use onsite storage at each property to meet daily peaks
2. Use the existing pipeline as a conduit to draw through a smaller PE pipe to meet peak demand
3. Construct a new pipeline along the current pipeline alignment

   a) above ground

   b) below ground using directional drilling

   c) below ground using trenching
4. Construct a new pipeline along a new route below ground using directional drilling and trenching
5. Construct a new reservoir and service houses from the new reservoir
6. Terminate pipeline before Emigrant Creek & properties in Section 2 use rainwater tanks
7. Provide water supply from another Ballina Shire Council water main

The options that apply to **the entire pipeline** include the following.

1. Permanent repairs along the length of the pipeline
2. Update existing reduced pressure zones
3. On-going standard maintenance to pipeline

All these options were assessed against criteria which include economic, social and environmental factors. Each option received a rating for each of the assessment criteria. A high rating was favourable and a low rating less favourable. All the ratings were added for each option to allow a quantitative assessment of each option. In addition, a qualitative assessment of each option was provided to highlight key advantages and disadvantages of each option.

Community Consultation

Community consultation was undertaken as part of this project in the form of surveys for individual properties along the west end of the Smith Drive Water Main. The purpose of the community consultation was to survey the residents/owners of the key properties along the pipeline to establish their service requirements and any other information required for the development and refinement of suitable options for consideration. The results from these surveys assisted to assess:

- how vital the water supply was for the properties
- if the pipe should be sized to accommodate increased future demand
- residents' attitude to alternative water supply.

The results of these surveys were incorporated into the assessment of each option. The key findings of the surveys were strong community resistance against disconnecting properties from the Smith Drive Water Main. The overall comment was that storages such as rainwater tanks would result in high capital, operation and maintenance cost for residents.

Key findings of the multi-criteria assessment

The most advantageous option for upgrading the pipeline is to provide a new above ground ductile iron cement lined pipeline adjacent to the existing pipeline. This option could be implemented for the entire length of the pipeline except for creek and road crossings which would be directionally drilled. The key advantage of this option is relatively lower cost while providing a secure long-term water supply.

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1 Introduction

1.1 Background

Ballina Shire Council (Council) provides drinking water to properties in the Ballina Shire. The Smith Drive Water Main supplies customers in West Ballina. The main begins at the east end of Waverly Place and continues in alignment with Smith Drive until it crosses Emigrant Creek. From Emigrant Creek, the water main continues until the last customer at Cutting Edge Road, Uralba.

The customers being serviced by the Smith Drive Water Main are mainly located on the east side of Emigrant Creek. There are nine (9) customers on the west side of the Emigrant Creek. In general, customers rely on the Smith Drive Water Main for residential, outdoor and agricultural use.

Starting at the east end of Waverly Place and continuing along Smith Drive to Emigrant Creek, there are several businesses and residential houses. There is also a zone of industrial use as shown in Figure 1:1.

On the west of Emigrant Creek, most properties have residential and agricultural use. Agricultural uses for this section of the Smith Drive Water Main include sugar cane and cattle farming as well as orchard farming for hobby use (Figure 1:1). Current water consumption is not particularly high for most customers although 2 were identified as high water users due to agricultural demand.

Historical evidence suggests the main was not originally constructed to service the properties currently connected to the pipe. The watermain provided water from Alstonville to Ballina. When a new water source for Ballina was connected, the main was left in place and residents have opportunistically connected to this piece of legacy infrastructure.

Council is committed to providing a reliable water supply to residents in response to Council's service levels in the region. However, the Smith Drive Water Main is subject to frequent breaks, water loss and service interruptions. The purpose of this report is to assess options for the water supply to customers currently connected to the main and recommend the most advantageous option to be implemented.

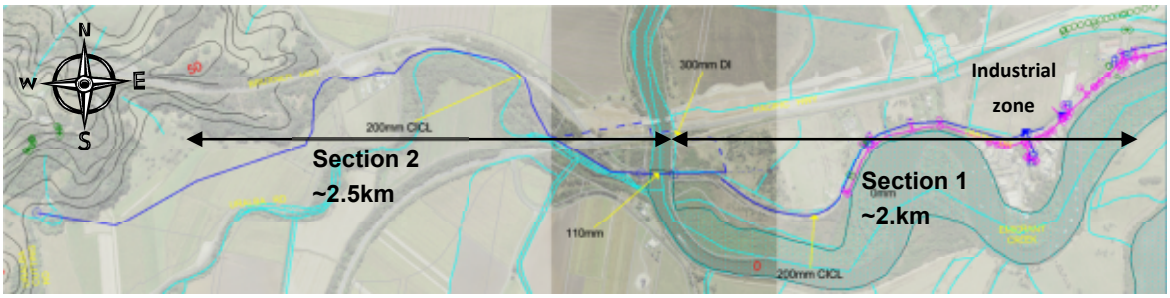

Figure 1:1: Two sections of the pipeline. Pipeline marked in solid blue line

1.2 Purpose of Current Project

The pipeline is in poor condition and requires immediate repair or replacing (Beca, 2013). Section 2 is in a poorer condition than Section 1. Council is considering options for the long term water supply to this region. The purpose of this report is to assess options for the repair/replacement of the main. Options for the water supply in both Section 1 and Section 2 of the pipeline were assessed.

A water consumption review for Section 2 of the Smith Drive Water Main was completed. A water use review was not completed for Section 1 because the demand is expected to remain the same

or increase in the future. Council anticipates that the industrial zone on Smith Drive, which is east of Emigrant Creek, will have the same or increased water demand in the future. Fire demand is the limiting design factor for section 1. The current pipeline is 200mm diameter and the current pressure in the pipeline is approximately 55m before pressure reducing valves.

1.3 Assessment team

The assessment team for this project includes Council engineering team, Council operations team, NSW Public Works and Beca Pty Ltd (Beca). Beca is an engineering consultancy with 2,500 employees in the Asia-Pacific region. This includes 500 people in Australia and 40 specialist water engineers.

2 Water Consumption Review

This section of the report identifies current average demand using Council records. It also identifies peak hour demand using the current average demand estimate and an estimated peaking factor. The average demand data was used to calculate sizing for pipes to meet average demand with peaks met by onsite storage and local pumping (refer to option 1, 2 and 5 for Section 2). Peak demand was calculated to provide pipeline sizing for options 3, 4 and 7 for Section 2. The Section 1 pipe does not require a consumption review considering fire demand is the limiting factor for pipe sizing.

2.1 Current average demand

The current average water consumption was reviewed using Council data from meter readings. The aim of this review was to determine average water demand for the properties starting on the west of Emigrant Creek (Section 2). This information was used to calculate pipe size to supply the average demand with onsite storage required to cater for peak periods.

There are 11 significant properties connected to the Smith Drive Water Main. Each of the 11 properties serviced by the Smith Drive water main could be represented using an ET[1] of 0.63kL/day multiplied by a factor. Figure 2:1 shows the factor for each property and the red line captures the 11 properties. All the ET add up to 53.6.

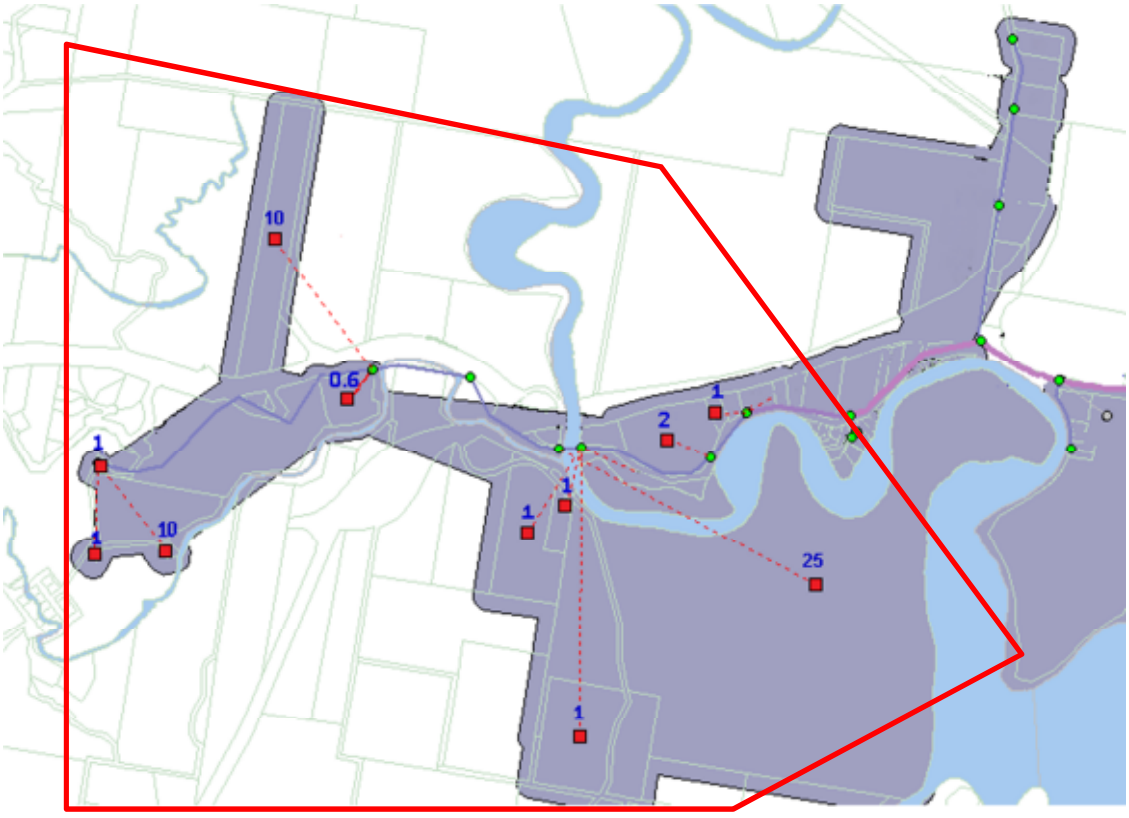

Figure 2:1 Property Water Use

Figures in blue indicate how much water is used on each property as ET

[1] Equivalent Tenement (ET): a measure of the demand or loading a development will have on infrastructure in terms of the average water consumption or average sewage discharge for an average residential dwelling.

This information was used to calculate average demand. A summary of the average water demand is provided by Table 2:1.

Table 2:1 Demand for Average Supply

Daily Average Demand (for all 11 properties)	$= 53.6\ \text{ET} \times 0.63\text{kL/ ET}$ $= 33.8$ kL

2.2 Theoretical peak demand

A peaking factor of two was applied to the current average use. A peaking factor of two was chosen because the peaking factor should be less that that used for domestic use considering the demand is not only domestic use but also agricultural use including irrigation, water for livestock and crop spraying. The water uses on the properties were investigated through the customer surveys.

Table 2:2 Demand Specification for Peak Supply based on current demand

Daily Peak Demand (for all 11 properties based on current use and peaking factor of 2)	$= (0.63\text{kL/ET} \times 2) \times 53.6\text{ET}$ $= 67.5$ kL

2.2.1 Storage implications

Onsite storage: The onsite storage on each property to meet peak domestic demand from a potable supply pipe sized to meet average demand would be 1,000L. This provides slightly more than 1 day's demand. See option 1 for section 2.

Public storage: For option 5, a Council reservoir sized to meet current peak daily demand would be 100kL.

2.3 Pipe Sizing

Information provided by Council indicated the pressure of the pipe is 55m head in the water main at the start of the Smith Drive. To provide a pressure of at least 20m at the properties the head loss along the 4.5 km should be no more than 35m. Using pipe friction factor calculations and the head loss charts from manufactures in Appendix A, a suitable pipe size diameter was obtained for each demand flow.

To meet the average current demand (from section 2.1) the values are as follows:

Table 2:3 Average demand pipe sizing

Average Demand per second	0.4 L/s
Pipe size diameter	40 mm

To meet the theoretical peak value (from section 2.2) the values are as follows:

Table 2:4 Peak demand pipe sizing

Theoretical Peak Demand per second	0.8 L/s
Pipe size	50 mm

The customer surveys indicated that there will be no significant increase in future water use. The reasons for this include no expected changes to land zoning and no planned changes to agricultural practices. The current average and peak demand can therefore be used for future demand.

The pipe on the west side of Emigrant Creek could be 50mm considering Council has never provided fire hydrants in that section of the pipe, however, it is recommended to construct a 100mm pipe if a new pipe is to be laid as it meets all the above demands and provides allowance for future demand. Design guidelines such as the Water Services Association of Australia (WSAA) recommend 100mm diameter pipe as the minimum pipe diameter for water supply.

On the east side of Emigrant Creek the pipe should be sized for fire hydrant use in an industrial area which would be 150mm in diameter according to the WSAA standards. See extract from WSAA Water Supply code in figure 2.2.

ZONING/DEVELOPMENT	MINIMUM PIPE SIZE (DN)	
	Cast iron outside diameter series	ISO series
Low and medium density residential	100 (1)	125 (1)
High density residential (≥ 4 storeys)	150	180
Multiple developments of high density residential (≥ 8 storeys)	200 or 225 (2)	250 or 280 (2)
Industrial and commercial	150	180

NOTES:

1 *The Water Agency may authorise smaller pipe sizes to address issues such as water quality, provided that requirements for fire fighting supply are otherwise met.*

2 *The Water Agency to nominate the preferred size.*

Figure 2:2 Minimum Pipe Sizes for Particular Developments (Table 3.1 in WSAA, 2002)

2.4 Survey results (Confidential)

Surveys were conducted with 11 customers connected to the Smith Drive Water main. Full surveys are found in Appendix B. The findings of the surveys are summarised following.

Land use

- approximately 27% of properties quote that the property is residential use only
- approximately 27% have residential use combined with agricultural use
- approximately 46% have other uses such as church use, residential with golf driving range and agricultural use only

Outdoor water use

- approximately 64% of properties use water from the main as the sole source of water for indoor and outdoor use.
- approximately 36% of properties have alternative water supply apart from the main for outdoor use. This includes rainwater, dam, bore water and grey water use.

Indoor water use

- all properties have less than 3 buildings onsite, including larger sheds
- all respondents believe they are water conscience and conservative with their water use. Most claimed they had dual flush toilets and low pressure showerheads installed
- all properties were happy with the water quality and pressure. Only negative comments on water quality were "*there is a smell of the fluoride*[2] *in the water in the morning*" and another comment noted that "*before the break the water was cloudy but now it is very good*".
- only one property had water alternatives connected to the house. This was a rainwater tank

Future Water Use

- most properties do not anticipate having an increase in water use in the future

Opinions on Water Supply Alternatives

- Rainwater tanks: resistance to using rainwater as an alternative for reasons such as:
    - cost of installation, operation and maintenance including the cost of electricity for the pump
    - space available
    - insecticide and herbicide in the air entering the tank and causing health issues
    - capacity/reliability
    - removing potable connection would decrease property value.

[2] Council does not currently fluoridate water, suspect the customer may refer to Chlorine, which is above the Australian Drinking Water Guideline limit for odour generation (the limit is 0.6 mg/L).

    - backward step from having a town potable water supply
    - rainwater tanks on the property would ruin the aesthetics of the residential home
- Onsite water storage: concerns that arose regarding this option were
    - initial cost
    - cost of electricity for pumps
    - space available
    - insecticide and herbicide in the air entering the tank and causing health issues
    - it was a backward step
    - two customers said they would rather not but may consider and discuss it.
- Greywater use: one property already had this in place. Two property owners said they were not against this alternative. One property owner said they would have installed this system in their house but he was not allowed to by Council. Another concern was about the facilities that would have to fit in their property to allow for this.
- Bore water and river water: the water in this region is brackish/salty and not suitable to use

Other comments from customers included:

- “Maintain the system we have. It’s adequate”
- “Meter location is inconvenient and is difficult to maintain line when it does not fall within property boundary”
- “Main water vital to employment in region”
- “Home has always been connected to the main since it was built. Residents will be strongly opposed to being cut off the potable supply.”
- “Improvements are welcome especially since they have to maintain the connection from the bridge to the house”
- “Not interested in going offline- devalues property. Infrastructure still there anyway”
- “Main is ok. Don’t need to look into it”
- “Happy with the way things are but will cooperate”

Major users

Three major users were surveyed. Key points are mentioned here:

1. NSW Department of Agriculture: no alternative water supply. Workers not sure why this is the case
2. Westbridge: large agriculture and residential property that relies solely on mains water.
3. Property with 2 houses on Uralba Rd: has a nursery also, relies solely on water from the main. Says that the water from the main is vital for employment in the region

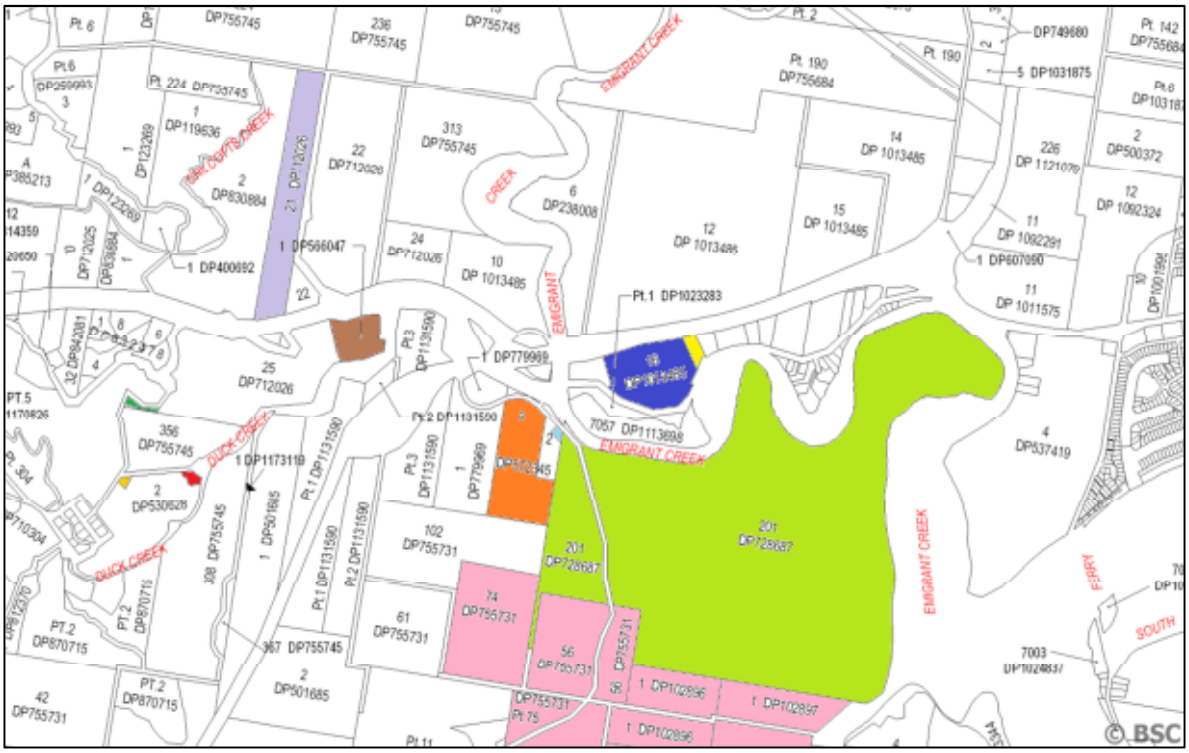

Figure 2:3 Property Boundaries of 11 Surveyed Properties in Colours

2.5 Demand management

To reduce demand or limit it, it may be useful to address the 4 properties that use the most water. All these properties have some level of business occurring as part of their property and a residential house. Rous Water is currently offering rebates to residential homes, businesses and community groups to implement water saving initiatives. The business rebates fall under the Rous Water's Blue and Green Business Program. Although rebates are given towards the cost of purchase and installation cost, many property owners expressed concern about ongoing electricity cost if pumps where required.

Apart from the major users, all the users mentioned that they are conservative and water use conscious. They cited cost and rural upbringing as the cause of their water saving attitude. However, using the data that Council provided regarding water consumption, water use was not found to be lower than average.

3 Description of Options for Section 1

Section 1 of the pipe is the section of pipe from the industrial estate on Smith Drive to Emigrant Creek. See Figure A. This section of the report provides a description of each option. It also lists the main advantages and disadvantages of the option. Each option will be assessed against the criteria listed in Section 6 of this report. Detailed assessments are provided in Appendix H.

3.1 Option 1 – new pipeline above ground

A new above ground 1.5km long pipeline could be laid beside the existing pipeline to Emigrant Creek. The pipeline would need to be 900m long to service Smith Drive customers only, including the golf driving range. This pipeline would be 150 mm in diameter to allow for future water demand in the industrial area and allow adequate supply to meet fire requirements in the industrial estate. The material of this pipeline would be DICL (ductile iron cement lined) with rubber ring joints and above ground thrust blocks or fully welded mild steel on concrete supports. The existing pipe would be removed after the new pipe is commissioned.

3.1.1 Advantages

- Avoids disturbance of ground conditions
- New pipeline reduces operational and maintenance costs
- Above ground placement minimises safety, environmental and regulatory concerns during constructions
- Less interaction with government authorities.

3.1.2 Disadvantages

- Pipe is still exposed to environmental conditions that will cause increased corrosion
- Pipe material needs to be vandal proof. DICL or mild steel is more expensive than polyethylene (PE) pipe
- Construction costs
- On-going maintenance associated with pipe spraying and inspection of above ground asset
- Potential for damage of house service lines connected to the above ground pipe.

3.2 Option 2 – new pipeline below ground using directional drilling

A new below ground 1.5km long pipeline could be laid beside the existing pipeline to Emigrant Creek. The pipeline would need to be 900m long to service Smith Drive customers only, including the golf driving range. This pipeline would be 150 mm in diameter to allow for future water demand in the industrial area and allow adequate supply to meet fire requirements in the industrial estate. This pipeline would be laid using

directional drilling. The material for pipeline would be PE. The existing pipe would be removed after the new pipe is commissioned.

3.2.1 Advantages

- PE pipe will provide good chemical resistance to acid sulphate soils and saline ground conditions
- Construction methodology will cause minimum disruption to environment and community
- Easy to avoid other buried services by drilling below
- Reduced construction impact compared with trenching or a second above ground pipe
- Can be constructed under the existing pipe while keeping the existing pipe operating
- Few on-going maintenance costs
- Buried pipe is less prone to damage from impact from falling branches or cars than an above ground pipe
- Less interaction with government authorities
- Short interruption of water supply to residents.

3.2.2 Disadvantages

- Cost
- Environmental issues associated with management of drilling fluid

3.3 Option 3 – new pipeline below ground using trenching

A new below ground 1.5 km long pipeline could be laid alongside the existing pipeline. This pipeline could be laid using trenching techniques. This pipeline would be 150 mm in diameter. The material of this pipeline could be PE which is more cost effective than DICL. PE is also recommended over polyvinyl chloride as it is generally more cost effective at the required diameter. The pipe would be constructed with the existing pipeline operational. The existing pipe would be removed after the new pipe is commissioned.

3.3.1 Advantages

- PE pipe will withstand acid sulphate soils and saline ground conditions
- Minimal on-going maintenance costs
- Buried pipe is less prone to damage from impact from falling branches or cars than an above ground pipe

3.3.2 Disadvantages

- Environmental impacts of disturbing soils
- Approvals for trenching near water bodies
- Disruption to community during construction

3.4 Option 4 – existing pipeline as a conduit for PE pipeline

The existing pipe can be used as a conduit for a new smaller PE pipe. A 150mm PE pipe could be dragged through the existing 200mm pipe. The 150mm pipe will allow adequate capacity for the industrial area and potential new development in this area. This PE can be transported onsite in coils. The existing pipe would need to be inspected with CCTV before the PE pipe is installed to be sure there are no blockages and the PE pipe will pass through. The existing pipe would need to be offline during the installation of the PE pipe. Installation could be staged, starting at the west end of the pipe, near the golf course.

3.4.1 Advantages

- Low cost
- Reduced construction environmental impact compared with trenching or directional drilling
- Short construction period

3.4.2 Disadvantages

- This option cannot be constructed while keeping the existing pipeline operational. The water supply would be interrupted for a long period – a couple of weeks for the first connections
- The PE pipe will need to be pressure derated to allow for temperature extremes of exposed above ground pipe
- Pipe is still exposed and prone to damage by vandals and accidental impact
- There are no design standards for this application of the PE pipe
- The design will need to allow movement of the PE pipe inside the cast iron pipe due to different thermal expansion coefficients. This will need to allow movement at house service line connections
- Pipeline will still require spraying to allow pipeline inspection

4 Description of Options for Section 2

This section of the report describes options to provide water supply to customers west of Emigrant Creek. See figure A.

4.1 Option 1 – reduce pipe size by onsite storages

4.1.1 Description

This option includes installing onsite storages to meet daily peak demand and providing a smaller diameter pipe to each property that supplies average demand. Each house west from Emigrant Creek will require a storage tank. This tank would be approximately 1000L and would be continuously topped up from the potable town supply. One storage tank will be constructed on each property. This option will require 2.5 km of 50mm PE pipe, nine 1000L PE tank and nine pumps installed.

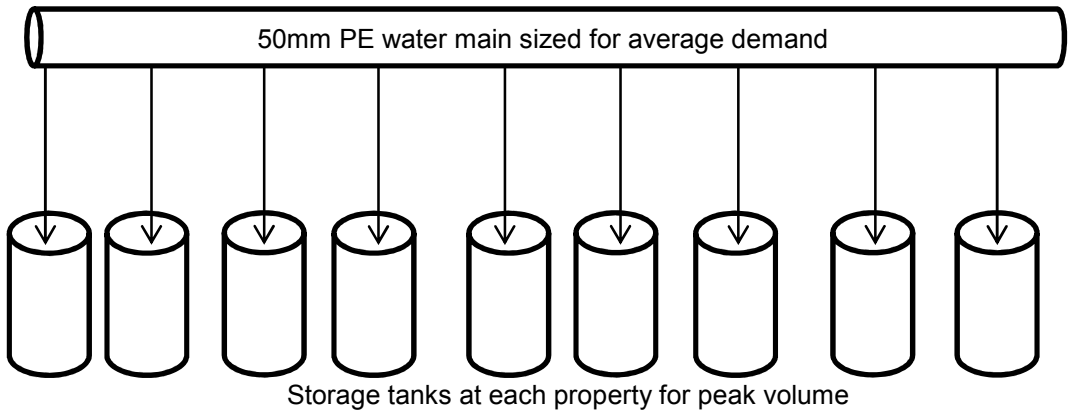

Figure 4:1 Schematic of Option 1 with onsite storages and pipe sized for average demand

4.1.2 Advantages

- Might encourage more conscious water use

4.1.3 Disadvantages

- Overall high cost option. Cost of option includes new tanks and pumps for each property plus constructing a pipeline to each property
- There is infrastructure on private property in addition to the Council owned pipe
- Environmental impacts of laying a pipe will be the same
- On-going pumping costs for residents
- On-going maintenance of tanks and pumps for residents including cost and inconvenience
- Opposition by residents due to operating costs, need to allocate space for tanks and perceived reduced reliability.

4.2 Option 2 – existing pipe as conduit for smaller pipe

4.2.1 Description

This option uses the existing pipe as a conduit for a new smaller pipe. This option was only feasible if smaller pipe was hydraulically suitable for the required flow, which is shown to be the case in section 2 of this report. The pipe line would be 2.5 km and would require 9 connections for the 9 properties. This pipe would be PE as it is a continuous pipe and can be pulled through the existing pipe unlike polyvinyl chloride which is jointed and could not be drawn. The pipe can be sized at 40 mm for average supply and 50mm for peak flows. A booster pump will not be required. A 100mm pipe is recommended considering the small incremental cost of the larger pipe compared with the benefits of a larger pipe being able to meet peak demand for main water users and could provide enough supply for fire fighting requirements.

4.2.2 Advantages

- Low cost
- Reduced construction environmental impact compared with trenching or directional drilling
- Short construction period
- 100mm PE pipe could be laid to meet future increased demand

4.2.3 Disadvantages

- PE pipe could become hot near the cane farm area during cane burning
- Pipeline will still require spraying to allow pipeline inspection
- This option cannot be constructed while keeping the existing pipeline operational. The water supply would be interrupted for a long period – a couple of weeks for the first connections
- The PE pipe will need to be pressure derated to allow for temperature extremes of exposed above ground pipe
- Pipe is still exposed and prone to damage by vandals and accidental impact
- There are no design standards for this application of the PE pipe
- The design will need to allow movement of the PE pipe inside the cast iron pipe due to different thermal expansion coefficients. This will need to allow movement at house service line connections.

4.3 Option 3: a, b and c – new pipeline alongside current pipeline

This option is broken down further into three options. A new pipeline can be placed alongside the current pipeline route in three different ways:

a) above ground

b) below ground using directional drilling

c) below ground using trenching

A 100mm pipe is recommended because the incremental cost of laying a 100mm pipe compared with a 50mm DICL or 63mm PE pipe is insignificant compared with the benefit of providing a 100mm pipe that could meet peak instantaneous agricultural demand and enough flow for fire fighting.

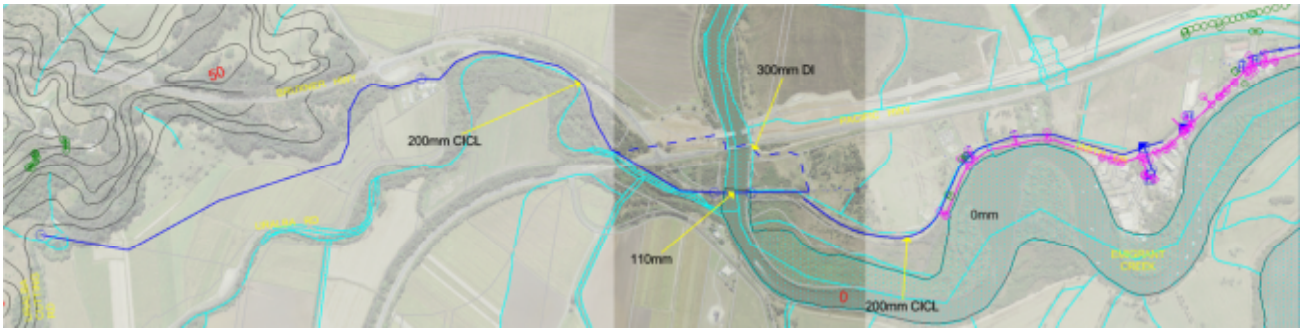

Figure 4:2 Route of Current Pipeline

4.3.1 Option3a, above ground

This option consists of laying a new 2.5 km pipeline alongside the current one above ground. This pipeline would be 100 mm in diameter and on concrete supports with thrust blocks and take offs also required. The material of this pipeline would be DICL (ductile iron cement lined) with rubber ring joints. The above ground components of the existing pipeline would be removed once the new pipe is operational.

4.3.2 Advantages

- Avoids disturbance of acid sulphate soils and wetlands
- New pipeline reduces operation and maintenance costs
- Above ground placement reduces safety concerns associated with trenching.
- Fewer environmental impacts than trenching
- New pipe can be constructed while keeping existing pipeline operational

4.3.3 Disadvantages

- Pipe is still exposed to environmental conditions that will cause increased corrosion
- Pipe material needs to be vandal proof. DICL or mild steel is more expensive than PE.
- Cost
- On-going maintenance associated with pipe spraying and inspection of above ground asset
- Potential for damage to pipe and house service lines

4.3.4 Option 3b, below ground using directional drilling

This option includes directional drilling a new 2.5 km pipeline alongside the existing pipeline. PE is the preferred material for this option considering corrosion resistance to acid sulphate soils and suitability for directional drilling. The above ground components of the existing pipeline would be removed once the new pipe is in place.

4.3.5 Advantages

- PE pipe will provide good chemical resistance to acid sulphate soils and saline ground conditions
- Construction methodology will cause minimum disruption to environment and community
- Easy to avoid other buried services by drilling below
- Reduced construction impact compared with trenching or a second above ground pipe
- Can be constructed under the existing pipe while keeping the existing pipe operating
- Few on-going maintenance costs
- Less interaction with government authorities
- Short interruption of water supply to residents

4.3.6 Disadvantages

- Cost
- Environmental issues associated with management of drilling fluid

4.3.7 Option 3c, below ground trenching

This option involves trenching a new 2.5 km pipeline alongside the current one. PE is the preferred material for this option considering its corrosion resistance to acid sulphate soils. The above ground components of the existing pipeline would be removed once new pipe is in place.

4.3.8 Advantages

- PE pipe will provide good chemical resistance to acid sulphate soils and saline ground conditions
- Minimal on-going maintenance costs
- Lower construction costs than directional drilling

4.3.9 Disadvantages

- Environmental impacts of disturbing acid sulfate soils and wetlands
- Approvals for trenching near water bodies
- Disruption to community during construction
- Easement required during construction to allow new pipe to be laid next to the existing pipe, while maintaining the existing pipe in operation

4.4 Option 4 – new pipeline route below ground

4.4.1 Description

This option follows the realignment suggested by the Ballina Bypass Alliance as shown in Appendix C. To service existing customers, the pipe would split into two paths. One path follows the exiting water main route. The other path follows Pimlico Rd. The Pimlico Rd residents will have shorter house service lines with the main adjoining their properties rather than accessing the main near Emigrant Creek.

This pipeline would be about 4.8 km long. 2.3 km along Pimlico Rd and 2.5 km along the existing pipe route. The pipeline would be 100mm diameter. A new pipeline route above ground was not considered as this limits the long term use of the site. Laying a pipe above ground would also make the pipeline more susceptible to breakages, degradation and vandalism, increasing the cost of future maintenance.

The section of pipe near Emigrant Creek is currently under review with the Ballina Bypass Alliance (BBA). The BBA has submitted designs for Council approval to relay the section of pipe from Emigrant Creek to Duck Creek. See appendix C for details. The relaying of this section of pipe as proposed by BBA would impact 4 house service connections. Discussion with BBA should request the pipe be re-laid in a way that does not halve the number of customers currently connected to the main west of Emigrant Creek. It is suggested the work by BBA be finalised before Council commits to any work on the main to the west of Emigrant Creek.

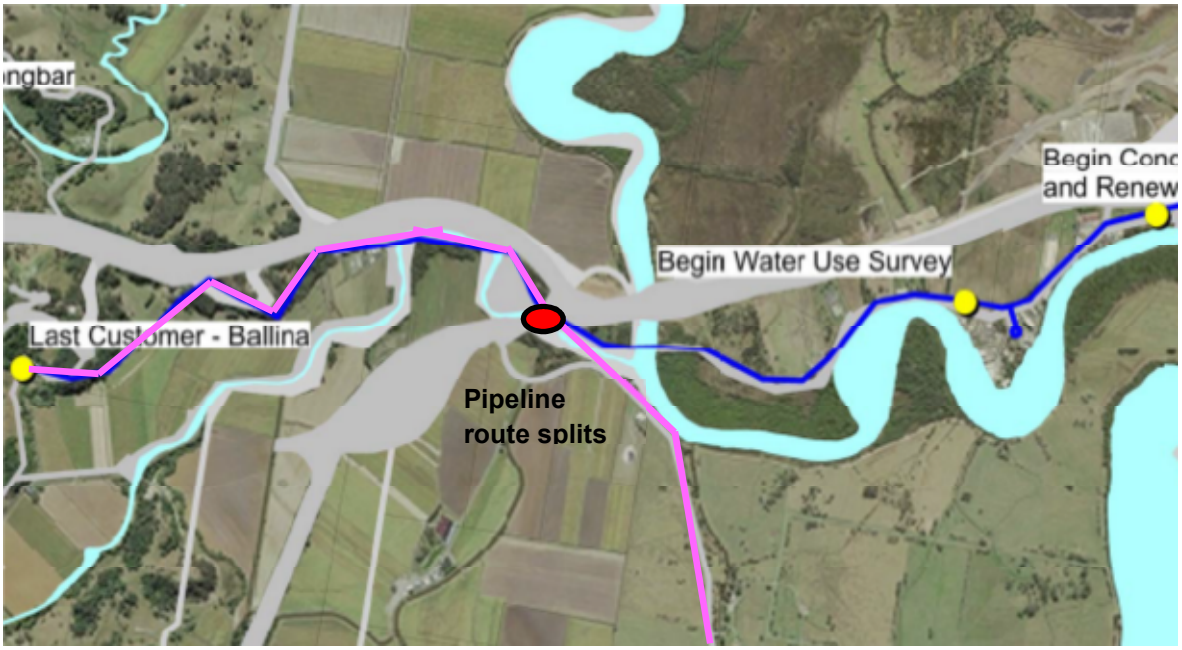

Figure 4:3 Suggested route in pink

4.4.2 Advantages

- Reduces length of house service lines
- Sections of the pipe will be built by Ballina Bypass Alliance reducing capital costs for Council
- Minimal on-going maintenance costs
- Will allow other residents in Pimlico Rd to connect to the main

4.4.3 Disadvantages

- The length of the pipe is long compared to other options which will increase cost and risk of encountering construction issues
- Environmental impacts of disturbing sensitive soils
- Approvals for trenching near water bodies
- Disruption to community during construction
- New easements required. However it is expected residents would generally see the benefit of this project and would work with Council

4.5 Option 5 – construct new reservoir

4.5.1 Description

This option involves the construction of a new reservoir with a reduced diameter pipeline and boosted system. The topography of this area does not suit gravity feed. The pipe would remain along Smith Drive under Emigrant Creek and Duck Creek. The location of this reservoir could be at Duck Creek near the Pacific Highway. A pumped system would then provide water for the last 5 residents. The size of this reservoir would be 1 day storage which is approximately 100kL. The reservoir is connected to a small pipe and is filled daily. The space required at the reservoir location would include the footprint of the reservoir itself, a booster pump station and access space for operators. This would require about 5m by 10m.

Figure 4:4 Suggested location of reservoir

4.5.2 Advantages

- Lower pipeline cost for Council when compared with laying a new larger diameter pipeline

4.5.3 Disadvantages

- High cost option. Cost includes reservoir, pumps, instruments, fencing and construction of the pipeline
- Operating costs associated with pump and reservoir
- Planning approval and land acquisition

4.6 Option 6 – terminating pipeline before Emigrant Creek combined with on-site storage

4.6.1 Description

Terminate the pipeline east of Emigrant Creek and install rainwater tanks for properties west of Emigrant Creek.

Figure 4:5. Option 6 - Rainwater tanks west of Emigrant Creek

4.6.2 Advantages

- Lower capital cost(assumes Council will install tanks)
- May reduce use of potable water in agriculture
- No on-going maintenance costs by Council
- Reduces social inequity of some customers being connected to the main while neighbouring properties are on rainwater tanks

4.6.3 Disadvantages

- Community has expressed concerns about losing an existing water supply
- Operating costs borne by community
- Potential health impacts associated with rainwater tank use
- Impact on the businesses in the area
- Perceived “backwards step” in taking away a water supply
- Reduction in property values
- Rainwater tanks not as reliable as a town water supply

4.7 Option 7 – providing water supply from another Council Water Main

4.7.1 Description

This option considers providing water supply from another nearby Council Water Main. This could be the Alstonville supply. To connect the current main to the end of the Alstonville main would require a new main of approximately of 1.9 km. In addition the Smith Drive Water Main would still need to be replaced/repaired.

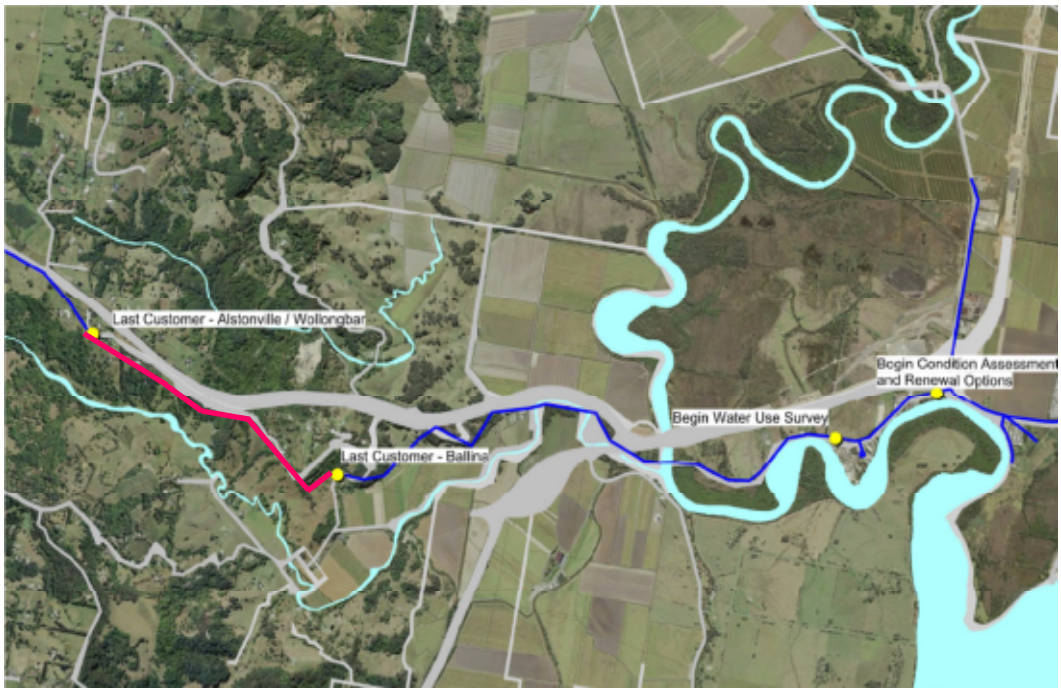

Figure 4:6: Option 7 - Connecting Alstonville Water Main with the Smith Drive Water Main

New line shown in red

4.7.2 Advantages

- Connecting West Ballina to an existing supply can integrate the water systems better than some other options and is a reliable source of water

4.7.3 Disadvantages

- High cost option because the cost of a new pipe from Alstonville would be added to the cost of the new pipe along the existing route to service the customers
- environmental impacts of pipe from Alstonville to Ballina would make this option less attractive than any option that utilises the existing pipe route

5 Description of Options for the entire length of the pipeline

5.1 Option 1 – permanent repairs along length of pipeline

5.1.1 Description

This option includes repairing the pipe to reduce the chance of future breaks and failures. This would include preventative maintenance to allow the maintenance team to be proactive rather than reactive. The condition assessment found the pipe joints need repair and the body of the pipe is failing in some locations. It would be difficult to assess which joint will start to leak next, meaning all the joints to the west of Emigrant Creek and about 1 in 5 joints on the pipe east of Emigrant Creek would need to be repaired as shown in the photos to the right. The failures in the body of the pipe would be difficult to identify until leaks start. These would require sleeves as shown.

Replacing long sections with PVC pipe and gibaults is not recommended considering the potential for the PVC pipe to be damaged and the costs of these joints.

5.1.2 Advantages

- The pipe can remain in operation during repairs
- Work is covered under maintenance so approvals and environmental impact assessment will not be required.

5.1.3 Disadvantages

- High cost. The repair joints are expensive and take time to install.
- These repairs only marginally increase the design life of the pipe considering there is evidence of corrosion of the body of the pipe. The asset is still 77 years old.
- These repairs only marginally increase the reliability of the asset

5.2 Option 2 – update existing reduced pressure zones

5.2.1 Description

Further reducing pressure zones might reduce the leaks along the pipeline. Considering a reduced pressure zone has already been implemented, the effect of further pressure reduction would be minimal. The condition assessment showed that the pipe leaks were due to poor condition of joints and pipe corrosion.

5.2.2 Advantages

- This option has already been implemented
- Water main would be offline for a short period of time

5.2.3 Disadvantages

- It is unclear that the pipe failures are due to high pressure. Implementing the reduced pressure zone may reduce some failures, but not all. Leaks appear to be because of joint failure and corrosion, not high pressure/

5.3 Option 3 – on going standard maintenance to pipeline

5.3.1 Description

This option consists of continued on-going standard maintenance to the pipeline. Currently Ballina Shire Council workers inspect the main on a regular basis (1 day a week to 1 day a fortnight) and attend to the most important leaks. This involves repairs such as replacing sections of pipe with PVC, lead joint repairs, fitting new joints and fitting stainless steel sleeves over the pipe.

Figure 7.1: Current condition of pipe

5.3.2 Advantages

- No capital cost
- Only standard maintenance environmental impact assessment and approvals required

5.3.3 Disadvantages

- High maintenance costs.

6 Criteria

The options described in section 3-5 of this report have been assessed against ten (10) criteria. The criteria all have equal weighting. The criteria consider the following and are not in any particular order:

1. Capital costs
2. Operating costs
3. Environmental impacts
4. Heritage issues
5. Safety in construction
6. Constructability
7. Regulatory approval
8. Land acquisition
9. Security of water supply- in construction and operation of the main
10. Future proofing/ flexibility for future augmentation

Each section in this chapter explains why each criterion is of importance and describes the method of rating options against the criteria for the purpose of comparing options. Each option will be assessed against each criterion with a rating given between 1 and 5. A higher rating is a favourable solution and a low rating is less favourable. All the ratings for each criteria are then added together to give an overall score. The option with the highest score will indicate the most favourable solution.

6.1 Capital Cost

Capital cost includes the cost of any equipment/materials needed to implement the project. Capital cost will be rated from 1-5 as displayed in the table below with each number indicating a cost range. Capital costs are for comparison and not for budgeting purposes. It is desirable to have small capital cost. The costs assume Council will pay for infrastructure on private property such as rainwater tanks and grey water systems.

Rating	1	2	3	4	5
Cost range	Greater than $2M	$1M-$2M	$500k-$1M	$100k-$500k	$0-$100k

6.2 Operating cost

Operating cost describe the cost of operating the assets/system for a 1 year interval considering average use and degradation. This operating cost applies to the cost that Ballina Shire Council will cover. The cost to the residents is covered in the economic impacts included in the Environmental Impact Assessment. Operating cost will be rated from 1-5 as displayed in the table below with each number indicating a cost range. Operating costs are for comparison and not for budgeting purposes. It is desirable to have small operating cost. The costs assume Council will not pay for operating costs of infrastructure on residents' properties such as rainwater tanks and grey water systems.

Rating	1	2	3	4	5
Cost range (per annum)	$50,000-$100,000	$20,000-$50,000	$10,000-$15,000	$1000-$10,000	$0-$1000
Description	Unpredictable and likely very high operational costs	Unpredictable and likely high operational costs	Risk of unplanned failure e.g. Occasional blockages due to small pipe in addition to standard pipe maintenance	Operational costs to new pipeline + other equipment that needs to be operated	Standard operating costs associated with a new pipeline

6.3 Environmental impacts

Council seeks to minimise the environmental impact of its operations. Environmental impact will be considered in the terms described in the table below:

Air pollution	This include impacts on the air quality such as dust or emissions for construction or operations
Water pollution	This considers pollution to water bodies such as creeks, rivers, groundwater etc…
Soil pollution and disturbance to acid sulphate soils	Several areas in the Ballina Shire Council region require development consent due to acid sulphate soils. These areas are identified as part of Ballina Shire LEP 1987 and 2012. This also considers local Contaminated Land Maps.
Noise pollution	This considers the noise of construction and operation
Ecological	This considers any impacts to fauna including endangered species. This also considers any impacts to flora including endangered species. Using maps of sensitive areas identified by National Parks and Wildlife Service (NPWS) and National Parks and Wildlife Service (NPWS) Wetlands, Vegetation, Riparian areas, SEPP areas, Estuary Habitats, Biodiversity Constraints
Community impacts	This take into account local community opposition or preference
Community resources	This considers how the option enhances or reduces community resources which can include recreational areas and community services
Natural resources	This considers the natural resources required for construction and operation
Social Impacts	This considers how the option encourages social equality
Economic impacts	This considers the extent to which economic equity is encouraged by the option e.g. ability to subdivided and irrigate and covering costs of tanks. This focuses on the community rather than Council costs which are covered in construction and operation costs criteria.
Aesthetic	This considers how the option looks within its selected location and surrounding environment
Land use impacts	This considers if the option complies with the land use zone or whether this option limits future zoning possibilities
Activity as a whole	This is an opportunity to include any other issues

The environmental impact of an option will be assessed as LOW, MEDIUM or HIGH.

LOW- means the potential impact (considering the extent, level of adverse impact and nature of the impact) of the option is insignificant.

MEDIUM- means the potential impact (considering the extent, level of adverse impact and nature of the impact) of the option is medium.

HIGH- means the potential impact (considering the extent, level of adverse impact and nature of the impact) of the option is high.

A combination of LOW, MEDIUM or HIGH score will lead to a rating from 1-5. The detailed assessment is provided in Appendix D.

6.4 Heritage issues

This considers any heritage impacts both aboriginal and non-aboriginal. This register is kept on the Ballina Shire Local Environmental Plan (LEP), the State Heritage Inventory and the Aboriginal Heritage Information Management System (AHIMS). The LEP lists various items of heritage value but none lie in the proximity of the current pipeline or the proposed pipeline. The State Heritage Inventory search also did not list any items in the current or suggested route. AHIMS search found no Aboriginal Heritage in any of the locations under investigation including the areas where the pipe from Alstonville would be laid. The results from the State Heritage Inventory and the AHIMS search can be found in Appendix E. All these searches indicated that there are no items of heritage value in the vicinity of this project. All options rate equally (all received rating of 5) for this criterion, so this criterion is not discussed further.

Rating	1	2	3	4	5
Heritage	Likely to impact				Unlikely to impact

6.5 Safety in construction and operation

This considers safety aspects of the option. A differentiating factor of safety is the level of trenching involved hence the criterion has been based on this. An alternative to trenching is directional drilling which does not have the safety concerns of trenching. Access to the pipeline is also a safety consideration to a lesser degree.

Rating	1	2	3	4	5
Safety in construction and operation	Trenching+ difficult to access maintenance route (likely to be frequent)	Trenching+ difficult to access maintenance route (not likely to be frequent) Potential safety impacts during operation	Trenching + maintenance route easy to access	No trenching but route difficult to access	Safe- no trenching needed and easy access for maintenance

6.6 Constructability

The constructability criteria assess if the option is physically viable and practically possible. Constructability will be rated from 1-5 as displayed in the table below with each number indicating the constructability of each option. Options with easy access and little interaction with the public will

rate higher. Options that require access to difficult terrain, managing of the public to keep them out of construction zones and potential traffic management will score lower. This also includes Dial before You Dig information (Appendix F) and if services would need to be realigned or considered in the option implementation.

Rating	1	2	3	4	5
Constructability	Impact on service lines and onsite property access	Impact on service lines and minimal onsite property access	Minimal and unlikely impact on service lines	No impact on service lines but more onsite property access	No impact on service lines and minimal onsite property access

6.7 Regulatory approval

Seeking regulatory approvals can cause delays and increase costs. For such reasons, it would be preferred to choose an option with minimal approvals needed. The risk of regulatory approvals will be assessed as rating 1 to 5.

Rating	1	2	3	4	5
Approvals	Three or more regulatory issues identified and likely to be an issue	Two regulatory issues identified and likely to be an issue	One regulatory issue identified and likely to need approval	Council only approval	No regulatory approval issues are anticipated to be required for the option

Issues potentially needing regulation have been identified using the suggested factors in the Environmental Planning and Assessment Regulation 2000 Schedule 228, State Environment Planning Policy for SEPP14, North Coast Regional Environmental Plan and the Ballina Shire Council Local Environmental Management Plan. Reports used for the Ballina Bypass were also used to ensure key environmental issues relevant to that area have been included. Regulatory approvals may be required for:

- Soil contamination- Acid Sulfate soil
- Threated species, populations or ecological communities. Fauna/flora - SEPP 14
- Air, noise or water pollution- not really big issue
- Impact on health of neighbourhood
- Hazard- Contaminated land, Waste
- Heritage
- Easements
- DIP sites
- Zoning
- Property (can property owners tap into service rightfully)

A more detailed explanation of the more significant of these issues and their regulation process overview can be view in Appendix G.

6.8 Land acquisition/easements

Land acquisitions can be costly and create discontent in the community. Therefore options with no land acquisition will be preferred. The risk/likelihood of land acquisition will be assessed as a rating from 1-5.

Rating	1	2	3	4	5
Land acquisition	Land acquisition would be required from residential properties	Land acquisitions would be required from industrial properties	New easement would be required		No land acquisitions or easement changes required

6.9 Security of water supply

Security of the water supply option includes assessing the reliability of the option during the construction and operational phases (transition).

Rating	1	2	3	4	5
Security of water supply	Less secure in long term. Longer (week or more) interruptions during transition	Less secure in long term. Minimal(less than a week but more than a day) interruptions during transition		More secure in long term. Some (1 day) interruptions during transition.	More secure in long term. Minimal (a few hours) interruptions during transition.

6.10 Future proofing/ flexibility for future augmentation

An option with the ability to meet a larger demand with less cost is preferred. The majority of the residential land is either not zoned for subdivisions or has a subdivision minimum lot size of 40ha. This limits the extent to which potable water for residential purposes would need to increase in the future. Additional zone No 1 (b) Rural-Secondary Agricultural Land prohibits the development of large scale tourist targeted development which would also indicate the need for potable water should not increase dramatically. However, in the future, water demand in residential dwellings could increase and allowance should be made for a small increase.

There is potential for development in the industrial area.

The ratings for this criterion are as follows:

Rating	1	2	3	4	5
Future proofing	Does not meet current maximum demand	Limits future increase in demand and is not adaptable	Adaptable to future needs but will require additional facilities and major cost	Adaptable to future needs but will require minor costs	Supplies current and anticipated future needs

7 Summary of Findings

This section provides the summary tables and ultimate scoring of each option described in sections 3-5 against the criteria described in section 6. The detailed assessment of each option is provided in appendix H.

7.1 Section 1, Along Smith Drive, East of Emigrant Creek

The following table summarises the assessment for each criterion for section 1.

	Capital costs	Operational costs	Environmental Impacts	Safety in construction	Constructability	Regulatory approvals	Land acquisitions	Security of water supply	Future proofing	Description of Option	Overall Score
Option 1	4	5	5	5	4	4	5	5	5	Above ground same route	**42**
Option 2	3	5	5	5	4	4	5	5	5	Below ground same route- directional drilling	**41**
Option 3	4	5	4	3	2	3	5	5	5	Below ground same route- trenching	**36**
Option 4	5	4	5	5	3	5	5	1	4	Small pipe in current pipe	**37**

The most advantageous option is laying an above ground pipe alongside the existing pipeline (Option 1). This option is preferred considering the lower capital costs compared with directional drilling. The trenching option scored lower considering environmental and approvals concerns with trenching near Emigrant Creek. Option 4, drawing a smaller diameter pipe inside the existing pipe scored lower considering the higher operational costs of maintaining the old pipe as the conduit, the longer interruption to supplies during construction and concerns regarding reliability of the system in the future.

7.2 Section 2, West of Emigrant Creek to Uralba

The following table summarises the assessment for each criterion for section 2.

	Capital costs	Operational costs	Environmental Impacts	Safety in construction	Constructability	Regulatory approvals	Land acquisitions	Security of water supply	Future proofing	Description of Option	Overall Score
Option 1	4	3	3	4	4	4	5	4	1	Onsite storage & small pipeline	**32**
Option 2	4	4	5	4	3	5	5	1	2	PE pipe in current pipe	**33**
Option 3a	4	5	5	4	3	2	5	5	5	Above ground same route	**38**
Option 3b	4	5	4	4	3	1	5	5	5	Below ground same route- directional drilling	**36**
Option 3c	4	5	1	2	3	1	5	5	5	Below same route- trenching	**31**
Option 4	2	5	2	3	2	1	3	5	5	New route	**28**
Option 5	3	4	2	3	4	1	1	5	5	New reservoir	**28**
Option 6	4	5	1	5	4	5	5	1	1	Terminate at PH and tanks after	**31**
Option 7	1	5	4	2	4	3	3	4	2	Alstonville+ replace all pipeline	**28**

The most advantageous option is to lay a new above ground DICL pipe next to the existing pipe (Option 3a). This option provides a secure water supply for the future with ease of constructability and safety in construction. The below ground options were less favourable considering the environmental and approval concerns. The options with storages scored lower due to costs and community concerns over tanks on properties.

7.3 Options for the entire length of the pipeline

The following table summarises the weighting for each criterion.

	Capital costs	Operational costs	Environmental Impacts	Safety in construction	Constructability	Regulatory approvals	Land acquisitions	Security of water supply	Future proofing	Description of Option	Overall Score
Option 1	2	2	5	4	5	5	5	2	2	Permanent repairs	**32**
Option 2	5	1	5	5	5	5	5	2	1	Reduced pressure	**34**
Option 3	5	1	5	4	5	5	5	1	1	Standard maintenance	**32**

These options are not recommended because they do not meet the service levels of Council in providing reliable water supply to residents. All of these options do not satisfactorily address the leakage in the pipeline and hence water loss would continue.

8 Conclusion

For Section 1 of the pipeline, two options had similar high scores. These were:

- Option 1 – above ground, same route (score 42)
- Option 2 – below ground – directional drilling (score 41)

For Section 2 of the pipeline, two options had similar high scores. These were:

- Option 3a – above ground, same route (score 38)
- Option 3b – below ground, same route, directional drilling (36)

The preferred solution is to construct an above ground pipeline alongside the existing pipeline for section 1 and section 2. This option improves water security for the existing customers with minimum interruption to supply and lowest environmental impact.

The below ground same route directional drilling option is less favourable in both sections due to a combination of factors including cost, environmental impacts, constructability and potential approvals. This option is therefore not as advantageous as an above ground pipeline adjacent to the existing route.

The pipe realignment work by BBA needs to be approved by Council, considering the impact on existing users, with the recommendation that BBA lay the pipe in such a way current house service lines can be maintained. The alignment provided to date in appendix C, does not do this.

9 Cost estimate of preferred option

This cost estimate is to provide indicative expected costs of laying a new pipeline along Smith Drive in Ballina to Cutting Edge Rd, Uralba. The pipeline will generally be above ground with directionally drilled sections at Emigrant Creek, Duck Creek, and Pimlico Rd.

The costs in this estimate are prepared based on previous contractual experience of Beca in regional Australia. Council should review these estimates considering local conditions at Ballina that may impact these costs.

Item	Description	Unit	Qty	Rate	Amount
1.0	**Site Investigation:**				**8,000**
1.01	Survey, includes services locations	sum	1	8,000	8,000
2.0	**Site Preparation:**				**10,000**
2.01	Site establishment	item	1	10,000	10,000
3.0	**Civil works**				**558,000**
3.01	Above ground 150mm DICL pipe with supports, thrust blocks, air valves, hydrants and scours Smith Drive	m	1,300	130	169,000
3.02	Above ground 150mm DICL pipe with supports, thrust blocks in water charged area on Smith Drive	m	100	220	22,000
3.03	Above ground 150mm DICL pipe with supports, thrust blocks, air valves, hydrants and scours West of Emigrant Creek	m	2,400	130	312,000
3.04	11 House Service line connections	ea	11	2,000	22,000
3.05	Directional Drill under Emigrant Creek	ea	1	6,400	6,400
3.06	directional Drill under Duck Creek	ea	1	4,400	4,400
3.07	Directional Drill under Pimlico Rd	ea	1	2,200	2,200
3.08	traffic management	item	1	5,000	5,000
3.09	restoration	item	1	5,000	5,000
3.10	temporary works	item	1	10,000	10,000
	SUBTOTAL Works				576,000
4.0	**Indirect Costs:**				**203,560**
4.01	Project Management	item	1	10%	57,600
4.02	Design	item	1	6%	34,560
4.03	Consents, permits	item	1	5%	28,350
4.04	Environmental Assessment	item	1	10%	57,600
4.05	Spares	item	1		15,000
4.06	community consultation	item	1		10,000
	SUBTOTAL including indirect				**779,560**

Item	Description	Unit	Qty	Rate	Amount
5.0	**Contingency @30% of capital cost**				**167,400**
6	**TOTAL ESTIMATED COST**				**947,000**

The following assumptions have been made during the preparation of this estimate:

1. The estimate of indicative cost identified in this report have been prepared as part of the options assessment for upgrading the Smith Drive Watermain. Considering the level of certainty with the project, a contingency of 30% is recommended.
2. These estimates have been prepared on the basis that a Principal Contractor will be appointed to construct the complete project following a competitive D&C tendering process. The Principal Contractor will have full responsibility for all Health and Safety matters and will attend upon the sub-contractors.
3. The rates and prices used in these estimates have been based on average present day EBA's and normal productivities. No allowance has been provided for any specific site agreement rates or special industrial relations agreements which would be additional to the base rates.
4. All utilities are adequate and easily accessible for tie in of new works.
5. An independent project manager will be appointed.

The following are excluded from this estimate:

1. No allowance has been made for disturbing acid sulphate soils.
2. No allowance for extensive site preparation or removal and treatment of any contaminated materials should they be encountered on the site
3. Escalation and FOREX provisions. These estimates are based on present day (July 2013) rates and allowances and no allowance has been for future escalation and changes in exchange rates
4. No allowance for import duties or tariffs
5. Council project costs (inc. finance, legal and insurances), land costs, operational costs
6. GST
7. Unforseen site industrial charges

10 Recommendation

Council should progress a new above ground DICL pipeline adjacent to the existing main for the entire length of the Smith Drive Water Main. Council should further investigate this option and seek to implement in the immediate future to avoid the major water loss occurring and reduce on-going maintenance costs to repair failures.

11 References

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Appendices

Appendix A - PE Pipe Headloss Graph

Appenidx B - Customer Surveys

Appendix C - Realignment Proposed by Ballina Bypass Alliance

Appendix D - Environmental Impact of Options

Appendix E - Heritage Searches

Appendix F - Services information

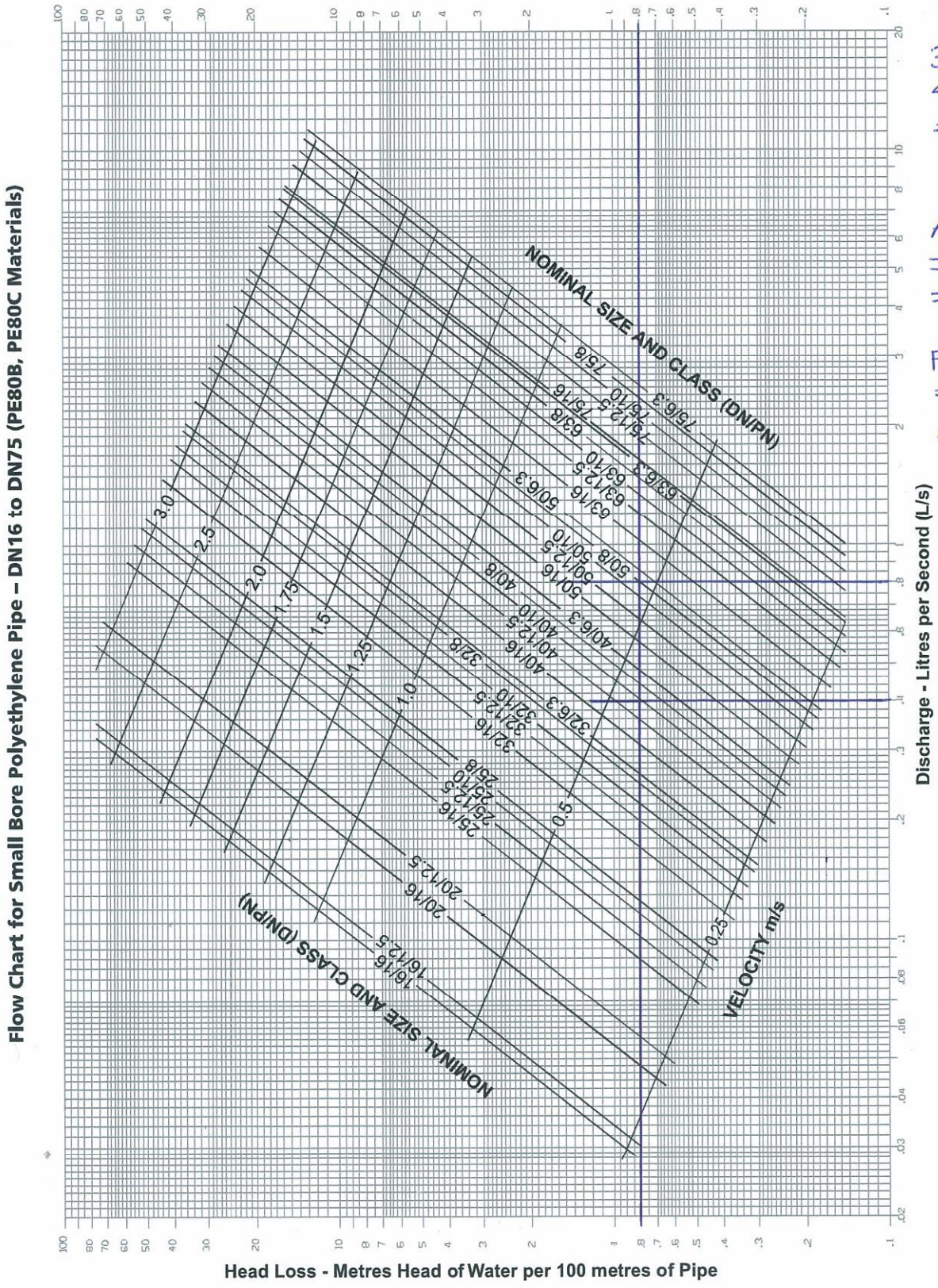
Appendix G - Regulatory Approvals

Appendix H – Individual Assessment of Options

Appendix A

Headloss Graph

Flow Chart for Small Bore Polyethylene Pipe – DN16 to DN75 (PE80B, PE80C Materials)



Headloss

35m over 4.5 km
= 0.8m/100m

Avg flow
= 33.8 kL/d
= 0.4 L/s

Peak flow
= 67.5 kL/d
= 0.8 L/s

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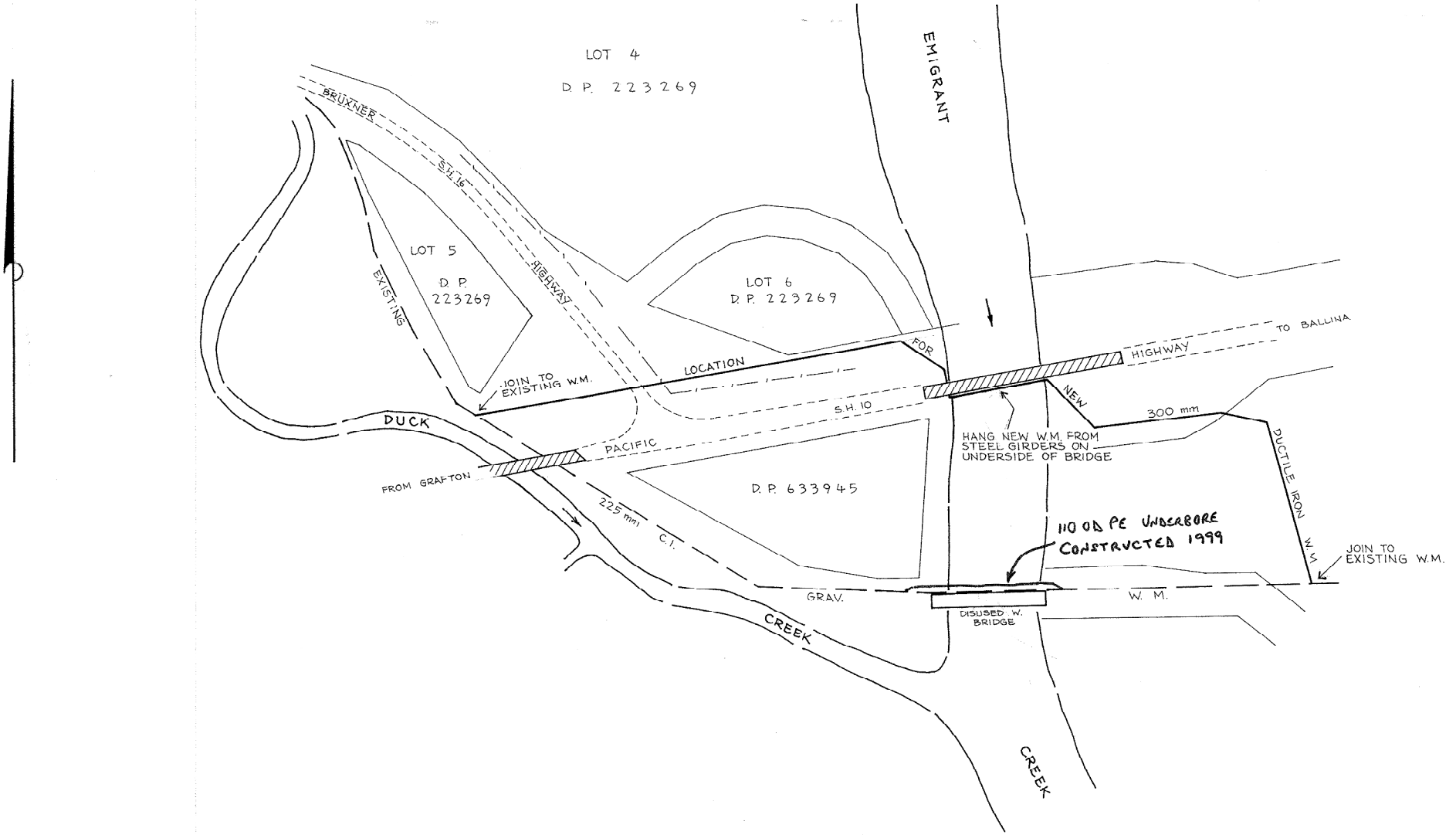
Appendix B

Customer Surveys

Appendix C

Realignment Proposed



NOTE - PROPOSED DIVERSION HAS NOT BEEN CONSTRUCTED

SHIRE OF BALLINA

LOCATION FOR PROPOSED DIVERSION OF WATER MAIN

DUCK CREEK WATER SUPPLY

Scale

Plan No

Appendix D

Environmental impact assessment

Section 1

Option		Air pollution	Water pollution	Soil pollution	Noise pollution	Ecological	Community resources	Natural resources	Social Impacts	Economic impacts	Aesthetics	Land use impacts	Activity as a whole	Rating
1	New pipe-alongside +above	L	L	L	L	L	L	L	L	L	L	L	L	**5**
2	New pipe-alongside +below(directional drilling)	L	L	L	L	L	L	L	L	L	L	L	L	**5**
3	New pipe-alongside +below (trenching)	L	M	M	L	L	L	L	L	L	L	L	L	**4**
4	Existing pipe as conduit	L	L	L	L	L	L	L	L	L	L	L	L	**5**

Rating	Definition
1	two or more H
2	one H
3	three or more M
4	one or two M
5	only L

*low, medium, high definitions are described in Section 6.3 of this report

Section 2

Option		Air pollution	Water pollution	Soil pollution	Noise pollution	Ecological	Community resources	Natural resources	Social Impacts	Economic impacts	Aesthetics	Land use impacts	Activity as a whole	Rating
1	Average + onsite storage	L	L	L	L	L	M	L	M	M	L	L	L	**3**
2	Existing pipe as conduit	L	L	L	L	L	L	L	L	L	L	L	L	**5**
3a	New pipe-alongside +above	L	L	L	L	L	L	L	L	L	L	L	L	**5**
3b	New pipe-alongside +below(directional drilling)	L	M	M	L	L	L	L	L	L	L	L	L	**4**
3c	New pipe-alongside +below (trenching)	M	L	H	L	H	L	L	L	L	L	L	L	**1**
4	New pipe-new route + below	L	M	M	L	H	L	L	L	L	L	M	L	**2**
5	New reservoir	M	M	M	L	H	L	L	L	L	M	M	L	**2**
6	Terminate pipe + onsite storage	L	L	L	L	L	L	L	H	H	L	L	L	**1**
7	Connect to Alstonville main	L	L	M	L	M	L	L	L	L	L	L	L	**4**

Rating	Definition
1	two or more H
2	one H
3	three or more M
4	one or two M
5	only L

*low, medium, high definitions are described in Section 6.3 of this report

Entire length of the pipeline

Option		Air pollution	Water pollution	Soil pollution	Noise pollution	Ecological	Community resources	Natural resources	Social Impacts	Economic impacts	Aesthetics	Land use impacts	Activity as a whole	Rating
1	Permanent repairs	L	L	L	L	L	L	L	L	L	L	L	L	**5**
2	Reduce pressure	L	L	L	L	L	L	L	L	L	L	L	L	**5**
3	Standard maintenance	L	L	L	L	L	L	L	L	L	L	L	L	**5**

Rating	Definition
1	two or more H
2	one H
3	three or more M
4	one or two M
5	only L

*low, medium, high definitions are described in Section 6.3 of this report

Appendix E

Heritage Searches

AHIMS Web Services (AWS)
Search Result

Your Ref Number : Smith Drive 1

Client Service ID : 101025

Beca Pty Ltd

Date: 17 May 2013

44 Market St

Sydney New South Wales 2000

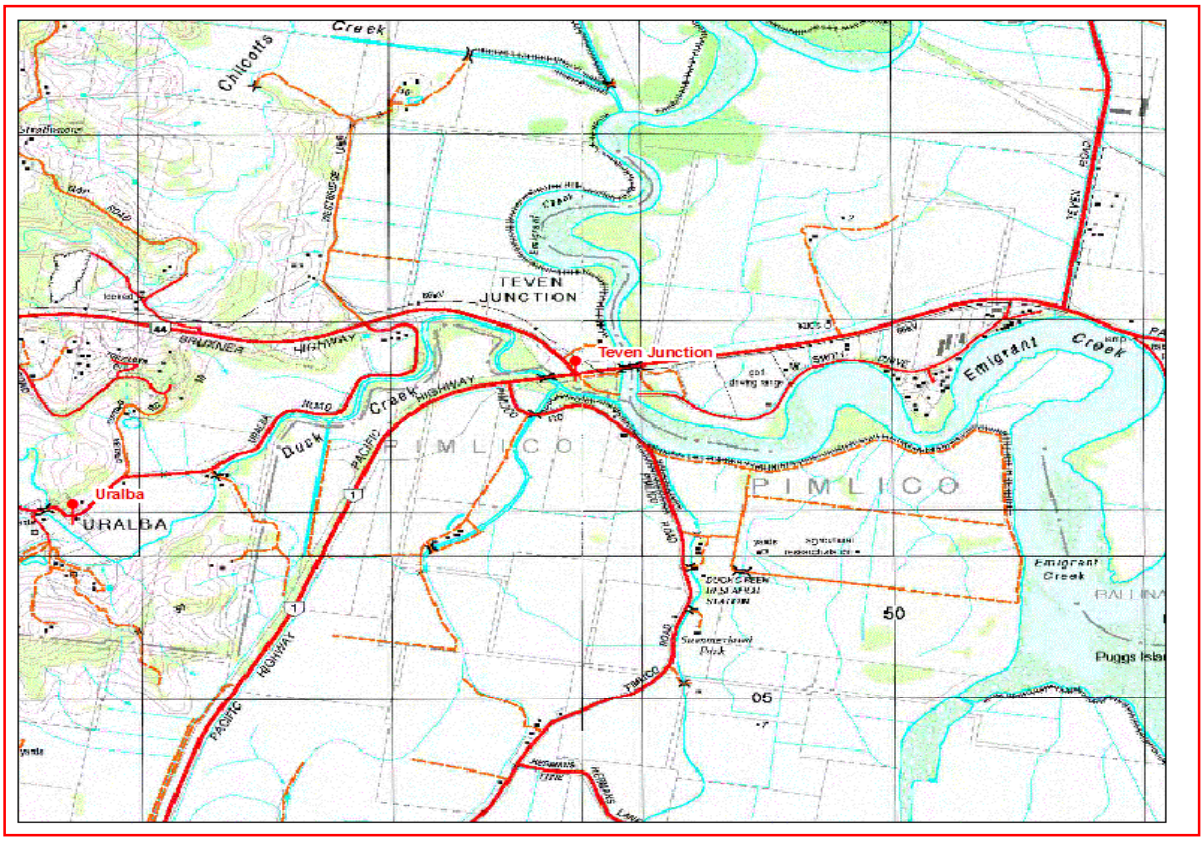
Attention: Susana Simon

Email: susana.simonmendoza@beca.com

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lat, Long From : -28.883, 153.4775 - Lat, Long To : -28.8541, 153.5233 with a Buffer of 50 meters, conducted by Susana Simon on 17 May 2013.

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



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

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

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

PO BOX 1967 Hurstville NSW 2220
43 Bridge Street HURSTVILLE NSW 2220
Tel: (02)9585 6345 (02)9585 6471 Fax: (02)9585 6094

ABN 30 841 387 271
Email: ahims@environment.nsw.gov.au
Web: www.environment.nsw.gov.au

AHIMS Web Services (AWS)
Search Result

Your Ref Number : Smith Drive 3

Client Service ID : 101030

Beca Pty Ltd

Date: 17 May 2013

44 Market St

Sydney New South Wales 2000

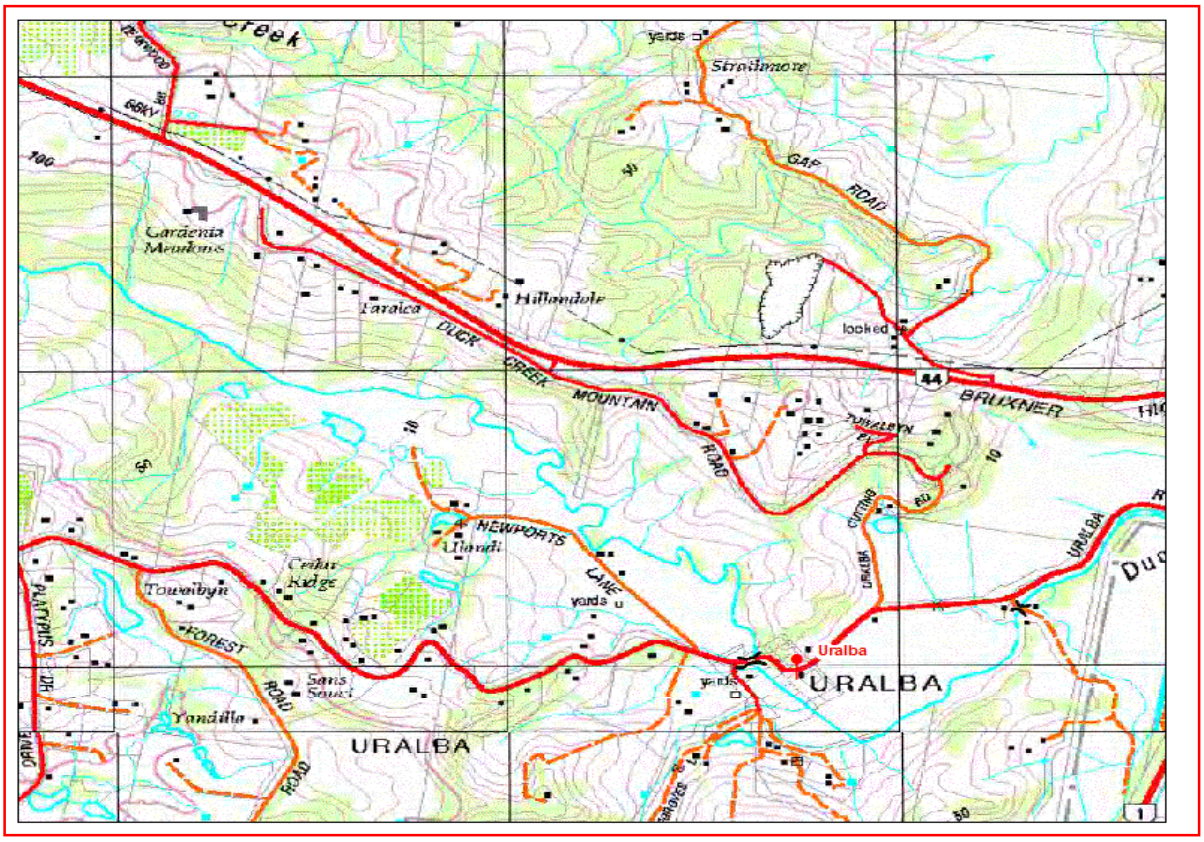
Attention: Susana Simon

Email: susana.simonmendoza@beca.com

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lat, Long From : -28.8746, 153.4594 - Lat, Long To : -28.8563, 153.4884 with a Buffer of 50 meters, conducted by Susana Simon on 17 May 2013.

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



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

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

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

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ABN 30 841 387 271
Email: ahims@environment.nsw.gov.au
Web: www.environment.nsw.gov.au

Appendix F

Dial Before You Dig

Job No 6358576

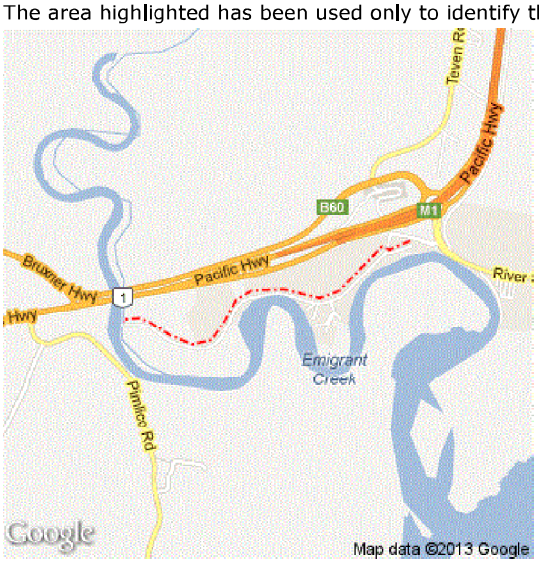
Phone: 1100
www.1100.com.au

Caller Details

Contact:	Miss Susana Simon Mendoza	**Caller Id:**	1200501	**Phone:**	0282164511
Company:	Not Supplied	**Mobile:**	Not Supplied	**Fax:**	Not Supplied
Address:	44 Market St SYDNEY NSW 2000	**Email:**	susana.simonmendoza@beca.com		

Dig Site and Enquiry Details

WARNING: The map below only displays the location of the proposed dig site and does not display any asset owners' pipe or cables. The area highlighted has been used only to identify the participating asset owners, who will send information to you directly.



User Reference: SmithDrive1
Working on Behalf of:
Private

Enquiry Date:	Start Date:	End Date:
17/05/2013	21/05/2013	31/05/2013

Address:
Smith Dr
West Ballina NSW 2478

Job Purpose: Design
Onsite Activity: Planning & Design
Location of Workplace: Both
Location in Road: CarriageWay,Footpath,Nature Strip

- Check that the location of the dig site is correct. If not you must submit a new enquiry.
- Should the scope of works change, or plan validity dates expire, you must submit a new enquiry.
- Do NOT dig without plans. Safe excavation is your responsibility. If you do not understand the plans or how to proceed safely, please contact the relevant asset owners.

Notes/Description of Works:
replacing water main

Your Responsibilities and Duty of Care

- If plans are not received within 2 working days, contact the asset owners directly & quote their Sequence No.
- ALWAYS perform an onsite inspection for the presence of assets. Should you require an onsite location, contact the asset owners directly. Please remember, plans do not detail the exact location of assets.
- Pothole to establish the exact location of all underground assets using a hand shovel, before using heavy machinery.
- Ensure you adhere to any State legislative requirements regarding Duty of Care and safe digging requirements.
- If you damage an underground asset you MUST advise the asset owner immediately.
- By using this service, you agree to Privacy Policy and the terms and disclaimers set out at **www.1100.com.au**
- **For more information on safe excavation practices, visit www.1100.com.au**

Asset Owner Details

The assets owners listed below have been requested to contact you with information about their asset locations within 2 working days. Additional time should be allowed for information issued by post. It is **your responsibility** to identify the presence of any underground assets in and around your proposed dig site. Please be aware, that not all asset owners are registered with the Dial Before You Dig service, so it is **your responsibility** to identify and contact any asset owners not listed here directly.
** Asset owners highlighted by asterisks ** require that you visit their offices to collect plans.
# Asset owners highlighted with a hash require that you call them to discuss your enquiry or to obtain plans.

Seq. No.	Authority Name	Phone	Status
29087428	Essential Energy (formerly Country Energy)	132391	NOTIFIED
29087427	Roads and Maritime Services	0288370285	NOTIFIED
29087429	Telstra NSW, North	1800653935	NOTIFIED

END OF UTILITIES LIST

CABLE/PIPE LOCATION

Assets were found in the search area

COMPANY NAME:	Not Supplied
ATTENTION:	Miss Susana Simon Mendoza
EMAIL:	susana.simonmendoza@beca.com
SEARCH LOCATION:	Smith Dr West Ballina NSW 2478
SEQUENCE NO:	29087428
DATE:	Friday, 17 May 2013

Provision of Plans:
Please find enclosed plans depicting approximate locations of **Essential Energy** assets in the search location***. The excavator must not assume that there may not be assets owned by other network operators in the search location.***

Underground assets searched for	Underground assets found
Essential Energy Electrical	☑
Essential Energy Water & Sewerage	☐

Plans are updated from time to time to record changes to underground assets. In the event that excavation does not commence within 28 days of receipt of a plan, a new plan should be obtained.

The excavator must retain the plans on site for the duration of the works.

The excavator shall report all damage made to Essential Energy assets immediately. Note that damage includes gouges, dents, holes and gas escapes.

IN CASE OF EMERGENCY OR TO REPORT DAMAGE:
PHONE 13 20 80

DISCLAIMER

Please be aware that plans may **not** reflect alterations to surface levels or the position of roads, buildings, fences etc. **Cable and pipe locations are approximate** and the plans are **not** suitable for scaling purposes. *Essential Energy does not retain plans for underground electrical or water & sewerage assets located on private property. Underground electrical assets located on private property are the responsibility of the owner*.

The plans have been prepared for Essential Energy's own use. **Essential Energy cannot and does not warrant the accuracy or completeness of the plans**. Essential Energy supplies them at no cost with the object of reducing the serious risk of unintentional damage being caused to its cables and pipes. **Essential Energy does not accept any liability for inaccuracies or any lack of information on the plans.**

Continued on page 2

www.essentialenergy.com.au
ABN 37 428 185 226
PO Box 718 Queanbeyan NSW 2620
Telephone: 13 23 91 Facsimile: 1800 354 636

Location of Assets on Site:
The plans indicate only that cables and pipes may exist in the general vicinity – they do not pinpoint the exact location of the cables and pipes. .

All individuals have a duty of care they must observe when working in the vicinity of underground cables and pipes. It is the **excavator's responsibility to visually expose the underground cables and pipes manually**, **ie. by using hand-held tools and non-destructive pot-holing techniques**. The excavator will be held responsible for all damage caused to the Essential Energy network or cables and pipes, and for the costs associated with the repair of any such damage. The excavator will also be held responsible for all damage caused to any persons.

When digging in the vicinity of underground assets, persons should observe the requirements of the **Work Near Underground Assets Guideline** published by the Work Cover Authority. (This is available at: http://www.workcover.nsw.gov.au/formspublications/publications/pages/WC01419_WorkNearUndergroundAssets.aspx or you may request a copy by calling Essential Energy on 13 23 91).

In addition:

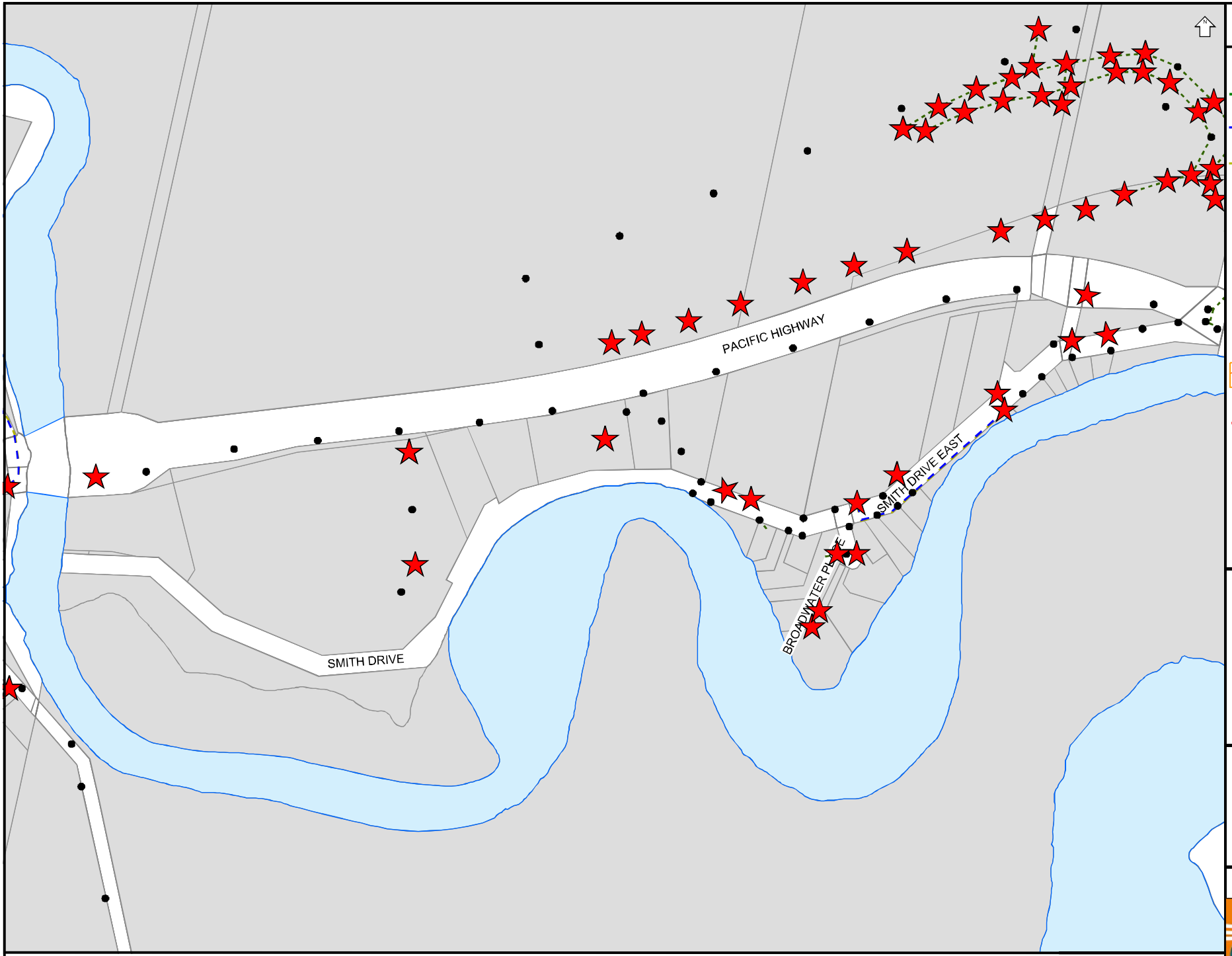
When digging in the vicinity of **electrical assets** persons should observe the requirements of the **Electricity Supply Act 1995.**
Persons excavating near live underground electrical reticulation and/or earthing cables **must exercise extreme caution at all times and adhere to the requirements of Essential Energy's Electrical Safety Rules**. (These are available on our website: http://www.essentialenergy.com.au/contestableworks). In some situations these procedures call for work to be performed by authorised staff.
Should there be any doubt as to the exact location of any underground electrical assets, and the potential for conflict with live underground cables caused by excavation at your work site is possible, you should contact **13 23 91** to arrange for an on-site location**.** No construction or excavation work is to commence prior to this on-site location and approval being obtained.

When digging in the vicinity of **water or sewer assets** persons should observe the requirements of the **Water Management Act 2000.**
Should there be any doubt as to the exact location of any underground water and sewer assets, and the potential for conflict with underground water and sewer pipes caused by excavation at your work site is possible, you should contact **13 23 91** to arrange for an on-site location**.** No construction or excavation work is to commence prior to this on-site location and approval being obtained.

Prior Notification:
Please note that you should allow for a **minimum of five (5) working days advance notice** in your construction program to permit Essential Energy time to allocate the necessary field resources to carry out the inspection at the site if required. This service may incur a fee and this can be negotiated with the local Area Coordinator at the time of making the appointment. Failure to give reasonable notice to the local Area Coordinator may result in disruption to Essential Energy's planned works program in the district and could incur an extra charge over and above the normal rate for this service.

For further information please call 13 23 91.

www.essentialenergy.com.au
ABN 37 428 185 226
PO Box 718 Queanbeyan NSW 2620
Telephone: 13 23 91 Facsimile: 1800 354 636



Overhead wires not shown LOOK UP & LIVE!

LEGEND

- LV Underground Cable
- HV Underground Cable
- Underground Pipe
- Underground Earth or Wires
- Ground Substation
- Pole
- Cubicle
- Pit
- Proposed Construction
- Critical* Underground Cable
- Critical* Zone Substation

* Critical Assets: Contact Essential Energy on 13 23 91

THE INFORMATION ON THIS MAP MAY NOT BE ACCURATE.
If details are incorrect, please notify Essential Energy on 13 23 91 (or fax 1800 354 636)

ISSUE DATE: 17/05/2013

You must resubmit your request if you have not started work within 4 weeks of the 'Issue Date' above

A4 | SCALE: 1:7449

Job Number: 6358576 Sequence number: 29087428 Job location: Smith Dr, West Ballina Map Centre: 153° 30' 38.2", -28° 51' 56.7"

essential energy

Susana Simon Mendoza

From:	Plan Management Centre <PlanManagementCentre@rms.nsw.gov.au>
Sent:	Friday, 17 May 2013 9:34 AM
To:	Susana Simon Mendoza
Subject:	Re: DBYD JOB:6358576 SEQ:29087427 - Smith Dr West Ballina NSW 2478
Attachments:	6358576.GIF

DIAL BEFORE YOU DIG

1100.com.au

response from

Roads and Maritime Services

There are no Roads and Maritime Services traffic signal cable drawings that are available for this Dial Before You Dig request.

Here is a list of all the attachments:

File name	Asset Type	Asset No	Asset Name	Plan Type	Size KB
6358576.GIF	Dig location	GIF	-	DBYD diagram	50

If you are working on a Motorway, Bus Transitway, near a Variable Message Sign or a Closed Circuit Television Camera, there might be other types of Roads and Maritime Services underground facilities of which you need to be aware. Please **forward** this email to PlanManagementCentre@rms.nsw.gov.au and ask for more information.

If you damage a cable you must notify Roads and Maritime Services immediately by phoning 131 700.

Before printing, please consider the environment

Automation version: 5.5

Location Details

Address	Smith Dr
Suburb	West Ballina
State	NSW
Postcode	2478
Activity description	Planning & Design
Private/Road/Both	B

Location in road	CarriageWay,Footpath,Nature Strip
Message	replacing water main

Caller Details

Customer id	1200501
Contact name	Miss Susana Simon Mendoza
Address	44 Market St
Suburb	Sydney
State	NSW
Postcode	2000
Telephone	0282164511
Fax	
Email	susana.simonmendoza@beca.com

Referral Details

Sequence no	29087427
Job number	6358576
Enquiry medium	Web
Utility id	30203
Utility company	Roads and Maritime Services
Enquiry time	17/05/2013 09:32
Commencement date	21/05/2013
Completion date	31/05/2013
Planning	Yes
User ref	SmithDrive1
Working for authority	Private
Authority name	Private

Roads and Maritime Services Dial Before You Dig
Plan Management Centre
Strategic Resourcing (Road) **|** *Road Design Engineering*
www.rmservices.nsw.gov.au

Roads and Maritime Services
110 George Street Parramatta NSW 2150 **|** *PO Box 3035 Parramatta NSW 2124*

Before printing, please consider the environment

Job No 6358807

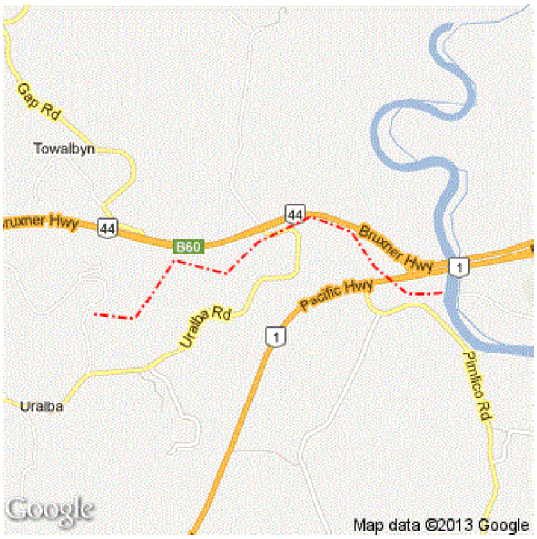
Phone: 1100
www.1100.com.au

Caller Details

Contact:	Miss Susana Simon Mendoza	**Caller Id:**	1200501	**Phone:**	0282164511
Company:	Not Supplied	**Mobile:**	Not Supplied	**Fax:**	Not Supplied
Address:	44 Market St SYDNEY NSW 2000	**Email:**	susana.simonmendoza@beca.com		

Dig Site and Enquiry Details

WARNING: The map below only displays the location of the proposed dig site and does not display any asset owners' pipe or cables. The area highlighted has been used only to identify the participating asset owners, who will send information to you directly.



Notes/Description of Works:
replacing water main

User Reference: SmithDrive2
Working on Behalf of:
Private

Enquiry Date:	Start Date:	End Date:
17/05/2013	21/05/2013	31/05/2013

Address:
Ballina Bypass Rd
Ballina NSW 2478

Job Purpose: Design
Onsite Activity: Planning & Design
Location of Workplace: Both
Location in Road: CarriageWay,Footpath,Nature Strip

- Check that the location of the dig site is correct. If not you must submit a new enquiry.
- Should the scope of works change, or plan validity dates expire, you must submit a new enquiry.
- Do NOT dig without plans. Safe excavation is your responsibility. If you do not understand the plans or how to proceed safely, please contact the relevant asset owners.

Your Responsibilities and Duty of Care

- If plans are not received within 2 working days, contact the asset owners directly & quote their Sequence No.
- ALWAYS perform an onsite inspection for the presence of assets. Should you require an onsite location, contact the asset owners directly. Please remember, plans do not detail the exact location of assets.
- Pothole to establish the exact location of all underground assets using a hand shovel, before using heavy machinery.
- Ensure you adhere to any State legislative requirements regarding Duty of Care and safe digging requirements.
- If you damage an underground asset you MUST advise the asset owner immediately.
- By using this service, you agree to Privacy Policy and the terms and disclaimers set out at **www.1100.com.au**
- **For more information on safe excavation practices, visit www.1100.com.au**

Asset Owner Details

The assets owners listed below have been requested to contact you with information about their asset locations within 2 working days. Additional time should be allowed for information issued by post. It is **your responsibility** to identify the presence of any underground assets in and around your proposed dig site. Please be aware, that not all asset owners are registered with the Dial Before You Dig service, so it is **your responsibility** to identify and contact any asset owners not listed here directly.
** Asset owners highlighted by asterisks ** require that you visit their offices to collect plans.
# Asset owners highlighted with a hash require that you call them to discuss your enquiry or to obtain plans.

Seq. No.	Authority Name	Phone	Status
29088462	Essential Energy (formerly Country Energy)	132391	NOTIFIED
29088463	Telstra NSW, North	1800653935	NOTIFIED

END OF UTILITIES LIST

CABLE/PIPE LOCATION

Assets were found in the search area

COMPANY NAME:	Not Supplied
ATTENTION:	Miss Susana Simon Mendoza
EMAIL:	susana.simonmendoza@beca.com
SEARCH LOCATION:	Ballina Bypass Rd Ballina NSW 2478
SEQUENCE NO:	29088462
DATE:	Friday, 17 May 2013

Provision of Plans:
Please find enclosed plans depicting approximate locations of **Essential Energy** assets in the search location***. The excavator must not assume that there may not be assets owned by other network operators in the search location.***

Underground assets searched for	Underground assets found
Essential Energy Electrical	☑
Essential Energy Water & Sewerage	☐

Plans are updated from time to time to record changes to underground assets. In the event that excavation does not commence within 28 days of receipt of a plan, a new plan should be obtained.

The excavator must retain the plans on site for the duration of the works.

The excavator shall report all damage made to Essential Energy assets immediately. Note that damage includes gouges, dents, holes and gas escapes.

IN CASE OF EMERGENCY OR TO REPORT DAMAGE:
PHONE 13 20 80

DISCLAIMER

Please be aware that plans may **not** reflect alterations to surface levels or the position of roads, buildings, fences etc. **Cable and pipe locations are approximate** and the plans are **not** suitable for scaling purposes. *Essential Energy does not retain plans for underground electrical or water & sewerage assets located on private property. Underground electrical assets located on private property are the responsibility of the owner*.

The plans have been prepared for Essential Energy's own use. **Essential Energy cannot and does not warrant the accuracy or completeness of the plans**. Essential Energy supplies them at no cost with the object of reducing the serious risk of unintentional damage being caused to its cables and pipes. **Essential Energy does not accept any liability for inaccuracies or any lack of information on the plans.**

Continued on page 2

www.essentialenergy.com.au
ABN 37 428 185 226
PO Box 718 Queanbeyan NSW 2620
Telephone: 13 23 91 Facsimile: 1800 354 636

Location of Assets on Site:
The plans indicate only that cables and pipes may exist in the general vicinity – they do not pinpoint the exact location of the cables and pipes. .

All individuals have a duty of care they must observe when working in the vicinity of underground cables and pipes. It is the **excavator's responsibility to visually expose the underground cables and pipes manually**, **ie. by using hand-held tools and non-destructive pot-holing techniques**. The excavator will be held responsible for all damage caused to the Essential Energy network or cables and pipes, and for the costs associated with the repair of any such damage. The excavator will also be held responsible for all damage caused to any persons.

When digging in the vicinity of underground assets, persons should observe the requirements of the **Work Near Underground Assets Guideline** published by the Work Cover Authority. (This is available at: http://www.workcover.nsw.gov.au/formspublications/publications/pages/WC01419_WorkNearUndergroundAssets.aspx or you may request a copy by calling Essential Energy on 13 23 91).

In addition:

When digging in the vicinity of **electrical assets** persons should observe the requirements of the **Electricity Supply Act 1995.**
Persons excavating near live underground electrical reticulation and/or earthing cables **must exercise extreme caution at all times and adhere to the requirements of Essential Energy's Electrical Safety Rules**. (These are available on our website: http://www.essentialenergy.com.au/contestableworks). In some situations these procedures call for work to be performed by authorised staff.
Should there be any doubt as to the exact location of any underground electrical assets, and the potential for conflict with live underground cables caused by excavation at your work site is possible, you should contact **13 23 91** to arrange for an on-site location**.** No construction or excavation work is to commence prior to this on-site location and approval being obtained.

When digging in the vicinity of **water or sewer assets** persons should observe the requirements of the **Water Management Act 2000.**
Should there be any doubt as to the exact location of any underground water and sewer assets, and the potential for conflict with underground water and sewer pipes caused by excavation at your work site is possible, you should contact **13 23 91** to arrange for an on-site location**.** No construction or excavation work is to commence prior to this on-site location and approval being obtained.

Prior Notification:
Please note that you should allow for a **minimum of five (5) working days advance notice** in your construction program to permit Essential Energy time to allocate the necessary field resources to carry out the inspection at the site if required. This service may incur a fee and this can be negotiated with the local Area Coordinator at the time of making the appointment. Failure to give reasonable notice to the local Area Coordinator may result in disruption to Essential Energy's planned works program in the district and could incur an extra charge over and above the normal rate for this service.

For further information please call 13 23 91.

www.essentialenergy.com.au
ABN 37 428 185 226
PO Box 718 Queanbeyan NSW 2620
Telephone: 13 23 91 Facsimile: 1800 354 636

Date: Friday, 17 May 2013

To: Miss Susana Simon Mendoza

Company: Not Supplied

Address: 44 Market St Sydney NSW 2000

Email: susana.simonmendoza@beca.com

Fax: Not Supplied

ELECTRICAL CABLE LOCATION

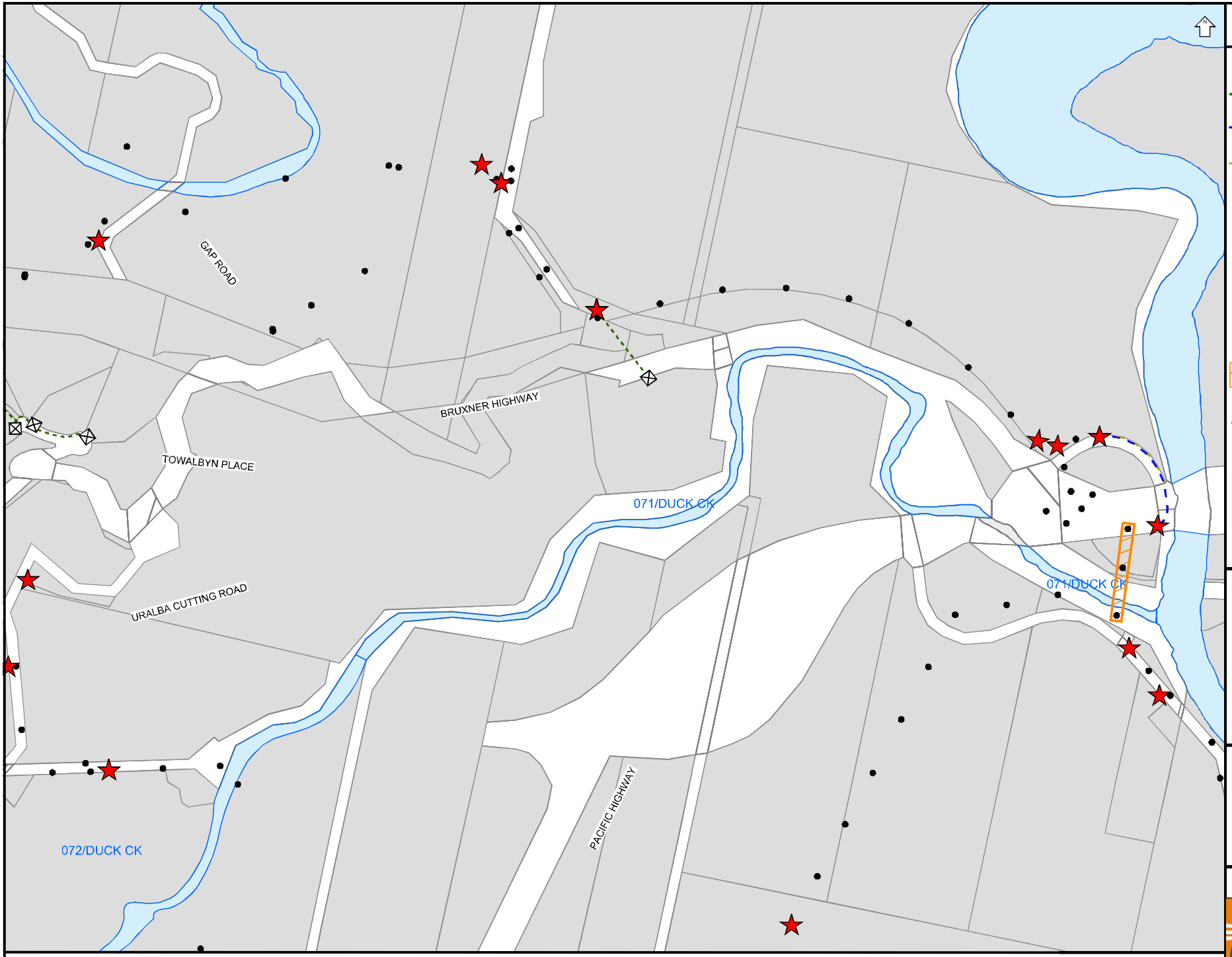
Dear Miss Susana Simon Mendoza

With reference to your enquiry:

- **Location:** Ballina Bypass Rd Ballina NSW 2478
- **Sequence No:** 29088462
- **Dial Before You Dig Job No:** 6358807
- **Dial Before You Dig Customer No:** 1200501

PLAN DOES NOT IDENTIFY ALL UNDERGROUND ASSETS IN THIS AREA. DO NOT COMMENCE EXCAVATION BEFORE CALLING TECHNICAL ENQUIRIES ON 13 23 91.

www.essentialenergy.com.au
ABN 37 428 185 226
PO Box 718 Queanbeyan NSW 2620
Telephone: 13 23 91 Facsimile: 1800 354 636



Overhead wires not shown LOOK UP & LIVE!

LEGEND

- LV Underground Cable
- HV Underground Cable
- Underground Pipe
- Underground Earth or Wires
- Ground Substation
- Pole
- Cubicle
- Pit
- Proposed Construction
- Critical* Underground Cable
- Critical* Zone Substation

* Critical Assets: Contact Essential Energy on 13 23 91

THE INFORMATION ON THIS MAP MAY NOT BE ACCURATE.
If details are incorrect, please notify Essential Energy on 13 23 91 (or fax 1800 354 636)

ISSUE DATE: 17/05/2013

You must resubmit your request if you have not started work within 4 weeks of the 'Issue Date' above

A4 | SCALE: 1:8857

essential energy

Job Number: 6358807 Sequence number: 29088462 Job location: Ballina Bypass Rd, Ballina Map Centre: 153° 29' 29.6", -28° 51' 57.7"

Appendix G

Regulatory Approvals

Soil Contamination

Acid sulphate soils

Acid sulphate sols have a content of sulphate which is usually stable under naturally occurring conditions. Excavating or lowering of the water table may result in exposure to atmospheric oxygen which would allow oxidation to produce Acid Sulphate Soils. Leachates from these soils can lower the pH of water ways resulting in mobilisation of metals, depletion of dissolved oxygen and reduction of photosynthesis all which have a deleterious effect on flora and fauna. Current groundwater pH is between 7.1 and 7.4 neutral and may be impacted by the oxidation.

Development consent is required for the carrying out of works on the land classified by the Acid Sulfate Soil Maps provided as part of the Ballina Local Environmental Plan 2012. The Acid Sulfate Soil Maps establish 5 classes of land based on the probability of acid sulphate being present. Class 1 has the highest risk for acid sulphate soils and this risk is least likely in Class 5. The current route of the main falls within Class 2 soils and may also pass over Class 3 and 5 soils.

Class of Land		Works
2		Works below the natural ground surface. Works by which the water table is likely to be lowered.
3		Works more than 1 metre below the natural ground surface. Works by which the water table is likely to be lowered more than 1 metre below the natural ground surface.
5		Works within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below 5 metres Australian Height Datum and by which the water table is likely to be lowered below 1 metre Australian Height Datum on adjacent Class 1, 2, 3 or 4 land.

Development consent must not be granted under this clause for the carrying out of works unless an acid sulfate soils management plan has been prepared for the proposed works in accordance with the Acid Sulfate Soils Manual and has been provided to the consent authority which is the Ballina Shire Council. However, despite the soil classing, developmental consent is not required if the work is undertaken by a public authority and is part of routine inspection or repairs which do not require the disturbance of more than 1 tonne of soil. Different options considered in this report may fall under different clauses of the Ballina Local Environmental Plan 2012 and thus the Plan should be considered for each option. Ballina Shire Council will be the regulatory authority for development consent in any circumstance.

Figure 1: Acid Sulfate Soil Classification (Ballina Shire Council LEP 2012 assessed via www.legislation.nsw.gov.au)

Threated species, populations or ecological communities

National Parks and Wildlife Service

Areas of Nation Park and Wildlife Services have identified several areas of importance in this area. These include areas such as wildfire, points of interest, walking tracks, RFS fire trails, shore birds roots, bitou bush, grey head flying fox, black flying fox, and corridors. Also key habitats, estate, bushlands, successional and wetlands. These areas are identified on figure. Development in these areas should be avoided.

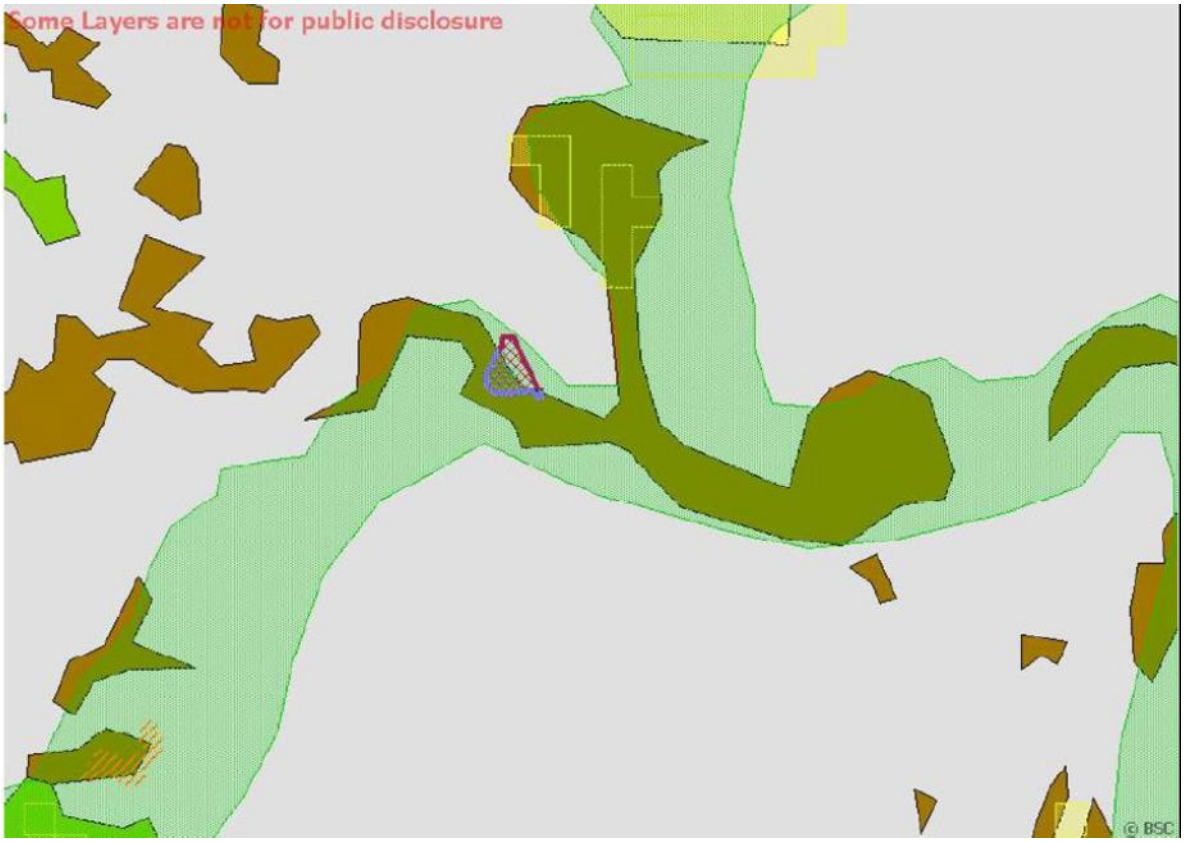


Figure 2: NPWS outlines (provided by Ballina Shire Council)

SEPP 14 and 26 Wetlands

Wetland areas located around the Emigrant Creek and near Smith Drive are listed as Wetland under the SEPP 14 Wetlands No 108 and No 95 (Figure). Ballina Shire Council is the consent authority for development consent. SEPP 14 also requires a copy of the application to be sent to Director of National Parks and Wildlife if the development consists of works as specified in clause 7(1). This is unlikely to be the case for any of the options. SEPP 26 Littorial Rainforests also exist in this area and consent from Council must be sought according to the regulation.

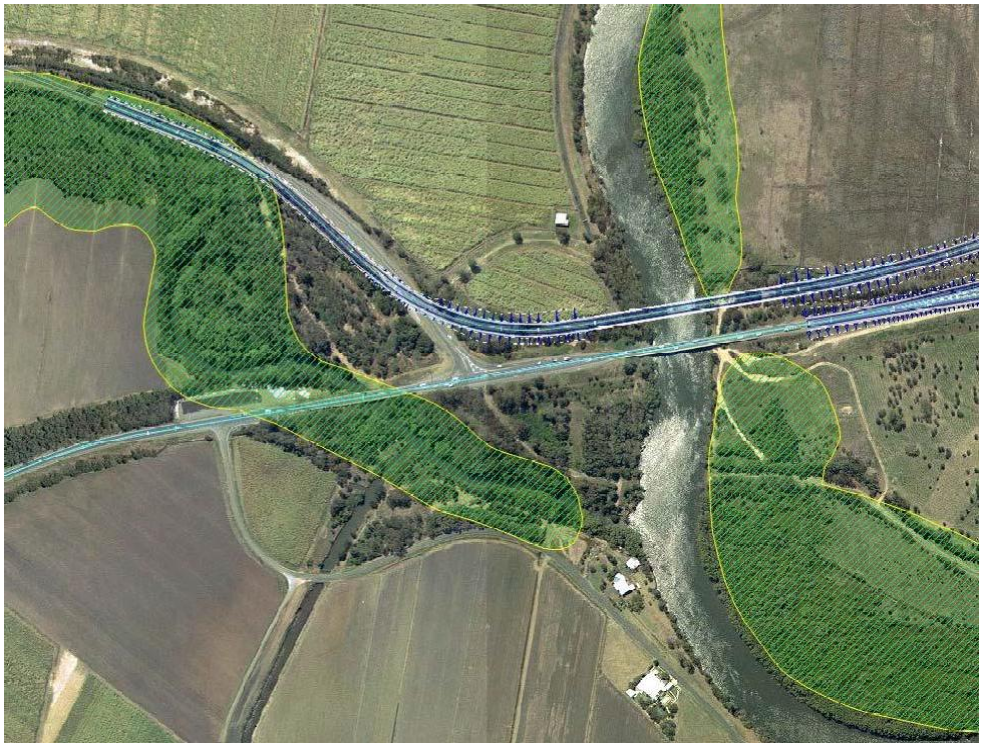


Figure 3: SEPP14 only (Wetland No 108 and No 95)

Figure 4: SEPP 14 and 26 areas combined (provided by Ballina Shire Council)

Air, noise or water pollution

Covered under other sections

Hazards- Contaminated land and Waste

Contaminated Land

There are contaminated lands (not for public disclosure) in the vicinity of the pipeline and houses affected. In particular, some lots of 165 Pimlico Rd, West Ballina and others have been identified.

Figure 5: Areas outlined in red are contaminated lands (provided by Ballina Shire Council and not for public disclosure)

Heritage

European Heritage

Development consent is required for works that affect heritage items. A State Heritage Inventory search was conducted and found that no heritage items were identified in this region. No

Ballina Courthouse and Post Office (Former)	22-24 River Street	Ballina	Ballina	SGOV
Ballina Fire Brigades	60 Crane Street	Ballina	Ballina	SGOV
Courthouse	River Street	Ballina	Ballina	GAZ
Fenwick House	Compton Drive	Ballina	Ballina	GAZ
Post Office	River Street	Ballina	Ballina	GAZ

Figure 6: State History Inventory Search Results for Ballina (http://www.environment.nsw.gov.au/heritageapp/heritagesearch.aspx)

Indigenous Heritage

The AHIMSS search for this region did not find any Aboriginal heritage items or objects of significance in this region. This is valid for option 1-9.

For option number 7, the region where the pipe to connect to the Alstonville pipeline would lie was also searched.

Refer to Appendix E for searches

Zoning

Zoning Development Consents

The current main lies in zone No **7 (a)**, zone No **1 (b)** and some unzoned patches according to Ballina Local Environment Plan 1987. Zone No. **7 (a)** is Environmental Protection (Wetland) Zone and has been zone with the primary objective of conserving and protecting significant wetland and to prohibit development that can destroy or damage wetland ecosystem. However public works and services are an exception to the objective where there is overriding public need and impact on wetland ecosystem is minimised. Additionally, development consent can be granted for utilities installation. A person shall not clear, drain, excavate or fill land to which this clause applies without the consent of the council. The council shall not consent to the carrying out of development on or adjacent to land within Zone No 7 unless it has taken into consideration:

(a) the likely effects of the development on the flora and fauna found in the wetlands,

(b) the likely effects of the development on the water table, and

(c) the effect of the wetlands of any proposed clearing, draining excavating or filling.

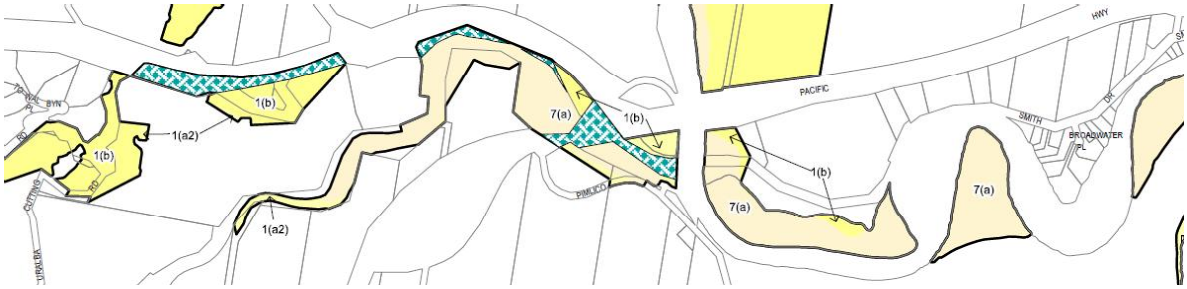


Figure 7: Land Zones (Ballina Shire Council LEP 1987 assessed via www.legislation.nsw.gov.au)

Zone No **1 (b)** Rural- Secondary Agricultural Land is zoned to regulate subdivision and encourage the rural character of the zone and hence prohibiting large residential developments and large scale commercial development. This zone is not to be subdivided. The development of land within the zone for public works and services is excluded from the objectives of the zone but development consent from council should be sought regardless.

Ballina Local Environment Plan 2012 is to be used in conjunction to version 1987. The other zones around the main are **RU1, RU2, IN1** and **W2**. For zones **RU1** (Primary Production), **RU2** (Rural Landscape), and **IN1** (General Industrial) the development of water supply systems are permitted with consent. However in zone **W2** (Recreational Waterways) the Ballina LEP 2012 does not give developmental consent for water supply systems.

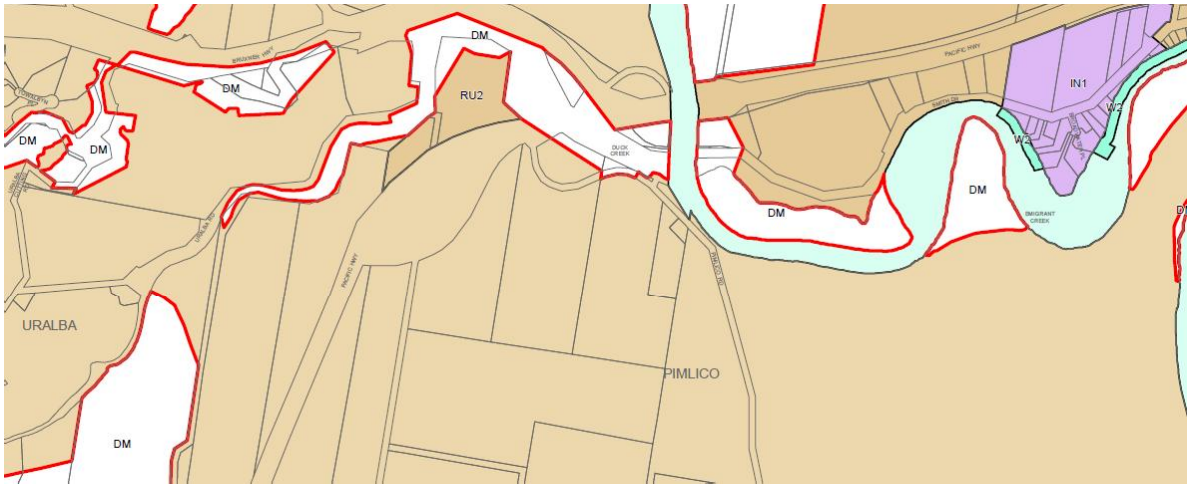


Figure 8: Land Zones (Ballina Shire Council LEP 2012 assessed via www.legislation.nsw.gov.au)

Appendix H

Individual Assessment of Options

ASSESSMENT OF OPTIONS FOR SECTION 1

The following table summarises the score for each criterion for section 1:

	Capital costs	Operational costs	Environmental Impacts	Safety in construction	Constructability	Regulatory approvals	Land acquisitions	Security of water supply	Future proofing	Description of Option	Overall Score
Option 1	4	5	5	5	4	4	5	5	5	Above same route	**42**
Option 2	3	5	5	5	4	4	5	5	5	Below same route- directional drilling	**41**
Option 3	4	5	4	3	2	3	5	5	5	Below same route- trenching	**36**
Option 4	5	4	5	5	3	5	5	1	4	Small pipe in current pipe	**37**

The most advantageous option is laying an above ground pipe alongside the existing pipeline (Option 2). This option is preferred mainly due to the cost and construction process which has less safety risks and is more commonly performed. Laying a below ground pipeline alongside the existing pipeline using directional drilling is almost equivalently as preferable as laying an above ground pipeline. The key differentiator is the capital costs for Council which would be higher for directional drilling.

Option 1- new pipeline above ground

Criteria	Rating	Comment
Capital cost	4	Costs associated with laying above ground DICL and removing existing pipe
Operating costs	5	Operational costs to new pipeline, some spraying required
Environmental impacts	5	See appendix D for detail
Safety in construction and operation	5	No trenching needed and easy access for maintenance
Constructability	4	Minimal or unlikely impact on service lines and minimal onsite property access
Regulatory approval	4	Council
Land acquisitions/easements	5	None anticipated
Security of water supply	5	More secure in long term. Minimal interruptions during transition

Criteria	Rating	Comment
Future proofing	5	Supplies current and anticipated future needs
Total score	**42**	

Advantages

- Avoids disturbance of ground conditions
- New pipeline reduces operational and maintenance costs
- Above ground placement minimises safety, environmental and regulatory concerns during constructions

Disadvantages

- Pipe is still exposed to environmental conditions that will cause increased corrosion.
- Pipe material needs to be vandal proof. DICL or mild steel is more expensive than polyethylene (PE) pipe
- Construction costs
- On-going maintenance associated with pipe spraying and inspection of above ground asset.
- Potential for damage of house service lines.

Option 2- new pipeline below ground using directional drilling

Criteria	Rating	Comment
Capital cost	3	Directional drilling is slightly more expensive than trenching, although costs of approvals and environmental assessment will be less.
Operating costs	5	Operational costs to new pipeline
Environmental impacts	5	See appendix D
Safety in construction and operation	5	No trenching needed (using directional drilling) and easy access for maintenance
Constructability	4	Minimal traffic management.
Regulatory approval	4	Council
Land acquisitions/easements	5	None anticipated
Security of water supply	5	More secure in long term. Minimal interruptions during transition
Future proofing	5	Supplies current and anticipated future needs
Total score	**41**	

Advantages

- PE pipe will provide good chemical resistance to acid sulphate soils and saline ground conditions.
- Construction methodology will cause minimum disruption to environment and community.
- Easy to avoid other buried services by drilling below.
- Reduced construction impact compared with trenching or a second above ground pipe
- Can be constructed under the existing pipe while keeping the existing pipe operating.
- Few on-going maintenance costs.
- Less interaction with government authorities.
- Short interruption of water supply to residents

Disadvantages

- Cost
- Environmental issues associated with management of drilling fluid
-

Option 3- new pipeline below ground using trenching

Criteria	Rating	Comment
Capital cost	4	Lower construction costs than directional drilling, but higher approval costs
Operating costs	5	Operational costs to new pipeline
Environmental impacts	4	Has potential to cause water and soil pollution in trenching process
Safety in construction and operation	3	Trenching + maintenance route easy to access
Constructability	2	Impact on traffic along Smith Drive, construction easement required.
Regulatory approval	3	One regulatory issue identified and likely to be an issue
Land acquisitions/easements	5	None anticipated
Security of water supply	5	More secure in long term. Minimal interruptions during transition
Future proofing	5	Supplied current and anticipated future needs
Total score	**36**	

Advantages

- PE pipe will withstand acid sulphate soils and saline ground conditions.
- Minimal on-going maintenance costs

Disadvantages

- Environmental impacts of disturbing soils
- Approvals for trenching near water bodies.
- Disruption to community during construction.
-

Option 4- existing pipeline as a conduit for PE pipeline

Criteria	Rating	Comment
Capital cost	5	No removal of existing pipeline costs. No new pipe supports.
Operating costs	4	Minor spraying and inspections
Environmental impacts	5	See appendix D
Safety in construction and operation	5	No trenching needed and easy access for maintenance.
Constructability	3	No impact on service lines and minimal onsite property access
Regulatory approval	5	
Land acquisitions/easements	5	None anticipated
Security of water supply	1	More secure in long term. Longer interruptions during transition
Future proofing	4	Adaptable to future needs but will some cost
Total score	**37**	

Advantages

- Low cost
- Reduced construction environmental impact compared with trenching or directional drilling
- Short construction period

Disadvantages

- This option cannot be constructed while keeping the existing pipeline operational. The water supply would be interrupted for a long period – a couple of weeks for the first connections.
- The PE pipe will need to be pressure derated to allow for temperature extremes of exposed above ground pipe.
- Pipe is still exposed and prone to damage by vandals and accidental impact.
- There are no design standards for this application of the PE pipe.
- The design will need to allow movement of the PE pipe inside the cast iron pipe due to different thermal expansion coefficients. This will need to allow movement at house service line connections.

- Pipeline will still require spraying to allow pipeline inspection.

ASSESSMENT OF OPTIONS FOR SECTION 2

The following table summarises the score for each criterion for section 2:

	Capital costs	Operational costs	Environmental Impacts	Safety in construction	Constructability	Regulatory approvals	Land acquisitions	Security of water supply	Future proofing	Description of Option	Overall Score
Option 1	4	3	3	4	4	4	5	4	1	Onsite storage & small pipeline	**32**
Option 2	4	4	5	4	3	5	5	1	2	PE pipe in current pipe	**33**
Option 3a	4	5	5	4	3	2	5	5	5	Above same route	**38**
Option 3b	4	5	4	4	3	1	5	5	5	Below same route- directional drilling	**36**
Option 3c	4	5	1	2	3	1	5	5	5	Below same route- trenching	**31**
Option 4	2	5	2	3	2	1	3	5	5	New route	**28**
Option 5	3	4	2	3	4	1	1	5	5	New reservoir	**28**
Option 6	4	5	1	5	4	5	5	1	1	Terminate at PH and tanks after	**31**
Option 7	1	5	4	2	4	3	3	4	2	Alstonville+ replace all pipeline	**28**

The most advantageous option is to lay a new above ground DICL pipe next to the existing pipe (Option 3a). This option provides a secure water supply for the future with ease of constructability and safety in construction.

Option one – reduce pipe size by onsite storages

Criteria	Rating	Comment
Capital cost	4	Cost of pipe is similar for average and peak demand. Water tanks and pumps would need to be provided by council.
Operating costs	3	Council will need to operate small diameter pipeline-blockages. Note: cost to residents factored in Environmental Impacts (Social and Economic Impacts)
Environmental impacts	3	Social and economic impacts of residents not having an average supply of water and having to cover electricity costs of pumps
Safety in construction and operation	4	No trenching but route difficult to access
Constructability	4	No impact on service lines but more onsite property access
Regulatory approval	4	Council
Land acquisitions/easements	5	None anticipated
Security of water supply	4	Slightly less than full size due to reliability of pump.
Future proofing	1	Limits future increase in demand and is not adaptable
Total score	**32**	

Advantages

- Can utilise existing infrastructure
- Might encourage more conscious water use.

Disadvantages

- Overall high cost option for Council when comparing with option 2 which also includes a smaller pipeline. Cost of option includes: new tanks and pumps for each property plus installing a pipeline
- There is infrastructure on private property in addition to the Council owned pipe
- All the environmental impacts of laying a pipe will be the same.
- On-going pumping costs for residents
- On-going maintenance of tanks and pumps for residents including cost and inconvenience
- Opposition to by residents due to costs

Recommendation

This option must be implemented together with another option.

Option two – existing pipe conduit for smaller pipe

Criteria	Rating	Comment
Capital cost	4	Cost of PE pipe
Operating costs	4	Some spraying of above ground pipe
Environmental impacts	5	None anticipated
Safety in construction and operation	4	No trenching are excavation equipment
Constructability	3	No impact on service lines and minimal onsite property access
Regulatory approval	5	No regulatory approval issues are anticipated to be required for the option
Land acquisitions/easements	5	None anticipated
Security of water supply	1	Significant interruptions during transition.
Future proofing	2	Limits future increase in demand
Total score	**33**	

Advantages

- Low capital cost for Council
- Reduced construction environmental impact compared with trenching or directional drilling
- Short construction period
- 100mm PE pipe could be laid to meet future increased demand.

Disadvantages

- PE pipe could become hot near the cane farm area during cane burning.
- Pipeline will still require spraying to allow pipeline inspection.
- This option cannot be constructed while keeping the existing pipeline operational. The water supply would be interrupted for a long period – a couple of weeks for the first connections.
- The PE pipe will need to be pressure derated to allow for temperature extremes of exposed above ground pipe.
- Pipe is still exposed and prone to damage by vandals and accidental impact.
- There are no design standards for this application of the PE pipe.
- The design will need to allow movement of the PE pipe inside the cast iron pipe due to different thermal expansion coefficients. This will need to allow movement at house service line connections.
-

Option three: a, b and c – new pipeline alongside current pipeline

a)Pipeline above ground

Criteria	Rating	Comment
Capital cost	4	The cost of the DICL (ductile iron cement lining) pipe with rubber joints or fully wielded mild steel
Operating costs	5	Operating costs will include regular maintenance to the new pipe
Environmental impacts	5	Has potential to cause water and soil pollution in construction processes. Can have medium level ecological effects due to having to enter SEPP14 land. See appendix D
Safety in construction and operation	4	No trenching but route difficult to access
Constructability	3	Impact on service lines and minimal onsite property access
Regulatory approval	2	Two regulatory issues identified and likely to be an issue
Land acquisitions/easements	5	None anticipated
Security of water supply	5	More secure in long term. Minimal interruptions during transition.
Future proofing	5	Supplies current and anticipated future needs
Total score	**38**	

Advantages

- Avoids disturbance of ground conditions
- New pipeline reduces operational and maintenance costs
- Above ground placement reduces safety concerns associated with trenching.
- Fewer environmental impacts than trenching
- New pipe can be constructed while keeping existing pipeline operational

Disadvantages

- Pipe is still exposed to environmental conditions that will cause increased corrosion.
- Pipe material needs to be vandal proof. DICL or mild steel is more expensive than PE.
- Cost
- On-going maintenance associated with pipe spraying and inspection of above ground asset.
- Potential for damage of house service lines.

b) Pipeline below ground using directional drilling

Criteria	Rating	Comment
Capital cost	4	The cost of the PE pipe
Operating costs	5	Operating costs will include regular maintenance to the new pipe.
Environmental impacts	4	Has potential to cause water and soil pollution in construction processes. Can have high level ecological effects due to having to enter SEPP14 land.
Safety in construction and operation	4	No trenching but route difficult to access
Constructability	3	Impact on service lines and minimal onsite property access
Regulatory approval	1	Three or more regulatory issues identified and likely to be an issue
Land acquisitions/easements	5	None anticipated
Security of water supply	5	More secure in long term. Minimal interruptions during transition.
Future proofing	5	Supplies current and anticipated future needs
Total score	**36**	

Advantages

- PE pipe will provide good chemical resistance to acid sulphate soils and saline ground conditions.
- Construction methodology will cause minimum disruption to environment and community.
- Easy to avoid other buried services by drilling below.
- Reduced construction impact compared with trenching or a second above ground pipe
- Can be constructed under the existing pipe while keeping the existing pipe operating.
- Few on-going maintenance costs.
- Less interaction with government authorities.
- Short interruption of water supply to residents.

Disadvantages

- Cost
- Environmental issues associated with management of drilling fluid

c) Pipeline below ground using trenching

Criteria	Rating	Comment
Capital cost	4	The cost of the PE pipe
Operating costs	5	Operating costs will include regular maintenance to the new pipe.
Environmental impacts	1	Has potential to cause water and soil pollution in construction processes. Can have high level ecological effects due to having to enter SEPP14 land and trench in it.
Safety in construction and operation	2	Trenching + difficult to access maintenance route(not likely to be frequent)
Constructability	3	Impact on service lines and minimal onsite property access
Regulatory approval	1	Three or more regulatory issues identified and likely to be an issue
Land acquisitions/easements	5	None anticipated
Security of water supply	5	More secure in long term. Minimal interruptions during transition.
Future proofing	5	Supplies current and anticipated future needs
Total score	**31**	

Advantages

- PE pipe will withstand acid sulphate soils and saline ground conditions.
- Minimal on-going maintenance costs
- Lower construction costs than directional drilling

Disadvantages

- Environmental impacts of disturbing soils
- Approvals for trenching near water bodies.
- Disruption to community during construction.
- Easement required during construction to allow new pipe to be laid next to the existing pipe, while maintaining the existing pipe in operation.
-

Option four – new pipeline route below ground

Criteria	Rating	Comment
Capital cost	2	The cost of the pipe and the capital installation cost of this option will vary with the technology
Operating costs	5	Operating costs will include regular maintenance to the new pipe

Criteria	Rating	Comment
Environmental impacts	2	Has potential to cause water and soil pollution in construction processes. Can have high level ecological effects due to having to enter SEPP14 land and trench in it. Plus future housing (or other) development will need to avoid building on this structure.
Safety in construction and operation	3	Trenching + maintenance route easy to access
Constructability	2	Impact on service lines and minimal onsite property access
Regulatory approval	1	Three or more regulatory issues identified and likely to be an issue
Land acquisitions/easements	3	New easement would be required
Security of water supply	5	More secure in long term. Minimal interruptions during transition.
Future proofing	5	Supplies current and anticipated future needs
Total score	**28**	

Advantages

- Reduces length of house service lines.
- Sections of the pipe will be built by Ballina Bypass Alliance leading to lower capital costs for Council
- Minimal on-going maintenance costs
- Will allow for other residents in Pimlico Rd to connect to the main

Disadvantages

- The length of the pipe is relatively long compared to other options which may lead to increased risk of encountering issues
- Environmental impacts of disturbing soils
- Approvals for trenching near water bodies.
- Disruption to community during construction.
- New easements required. However residents would generally see the mutual benefit of this project and would work with Council

Option five – construct new reservoir

Criteria	Rating	Comment
Capital cost	3	Construction of reservoir and any ancillary structure plus pipeline
Operating costs	4	Operating costs will include regular maintenance to the new

Criteria	Rating	Comment
		pipe and reservoir. Pump station power and maintenance
Environmental impacts	2	Has potential to cause air (dust) water and soil pollution in construction processes. Can have high level ecological effects due to having to enter SEPP14 land and trench in it. Plus it would not be aesthetically pleasing in the wetland and future housing (or other) development will need to avoid building on this structure.
Safety in construction and operation	3	Trenching + maintenance route easy to access
Constructability	4	No impact on service lines but more onsite property access
Regulatory approval	1	Three or more regulatory issues identified and likely to be an issue
Land acquisitions/easements	1	Land acquisition would be required from residential properties
Security of water supply	5	More secure in long term. Minimal interruptions during transition.
Future proofing	5	Supplies current and anticipated future needs
Total score	**28**	

Advantages

- Lower cost for Council when compared with laying a new large sized pipeline

Disadvantages

- Overall high cost option for Council when comparing with option 2 which also includes a smaller pipeline. Cost of option includes: reservoir and related infrastructure (e.g. pumps) plus installing a pipeline
- Operating costs associated with pump and reservoir
- Planning approval and land acquisition

Option six – terminating pipeline before Pacific Highway & on-site storage

Criteria	Rating	Comment
Capital cost	4	Rainwater tanks on 8 properties, with pumps, plumbing and community consultation
Operating costs	5	Operating costs will include regular maintenance to the new pipe
Environmental impacts	1	Social impacts for those that no longer have mains water provided to them. Plus the maintenance and operation costs that are carried by the customer.
Safety in construction and operation	5	Safe- no trenching needed and easy access for maintenance

Criteria	Rating	Comment
Constructability	4	No impact on service lines but more onsite property access
Regulatory approval	5	No regulatory approval issues are anticipated to be required for the option
Land acquisitions/easements	5	None anticipated
Security of water supply	1	Less secure in long term. Longer interruptions during transition
Future proofing	1	Limits future increase in demand and is not adaptable
Total score	**31**	

Advantages

- Lower capital cost(assumes Council will install tanks)
- May reduce use of potable water in agriculture
- No on-going maintenance costs by Council
- Reduces social inequity of some customers being connected to the main for asset legacy reasons while neighbouring properties are on rainwater tanks.

Disadvantages

- Community has expressed concerns about losing an existing water supply
- Operating costs borne by community
- Potential health impacts associated with rainwater
- Impact on the businesses in the area
- Perceived “backwards step” in taking away a water supply
- Reduction in property values
- Rainwater tanks not as reliable as a town water supply

Option seven – providing water supply from another Ballina Council Water Main

Criteria	Rating	Comment
Capital cost	1	Pipeline to connect the other main to Smith Drive Main
Operating costs	5	Operating costs will include regular maintenance to the new pipe
Environmental impacts	4	Soil pollution potentially from trenching in the pipe to connect the Alstonville main to the Smith Drive Water Main. Can have

Criteria	Rating	Comment
		high level ecological effects due to having to enter SEPP14 land and trench in it.
Safety in construction and operation	2	No trenching but route difficult to access
Constructability	4	No impact on service lines but more onsite property access
Regulatory approval	3	One regulatory issue identified and likely to be an issue
Land acquisitions/easements	3	New easement would be required
Security of water supply	4	More secure in long term. Longer interruptions during transition.
Future proofing	2	Adaptable to future needs but will require additional facilities and major cost
Total score	**28**	

Advantages

- Connecting West Ballina to an existing supply can integrate the water systems better than some other options and is a reliable source of water

Disadvantages

- Cost of a new pipe from Alstonville would be added to the cost of the new pipe along the existing route to service the customers
- The extra pipe with associated environmental impacts would make this option less attractive than any option that utilises the existing pipe route

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ASSESSMENT OF OPTIONS FOR THE ENTIRE LENGTH OF THE PIPELINE

The following table summarises the score for each criterion for the entire length of the pipeline:

	Capital costs	Operational costs	Environmental Impacts	Safety in construction	Constructability	Regulatory approvals	Land acquisitions	Security of water supply	Future proofing	Description of Option	Overall Score
Option 1	2	2	5	4	5	5	5	2	2	Permanent repairs	**35**
Option 2	5	1	5	5	5	5	5	2	1	Reduced pressure	**34**
Option 3	5	1	5	4	5	5	5	1	1	Standard maintenance	**35**

These options are not recommended because they do not meet the service levels of Council in providing reliable water supply to residents. All of these options do not satisfactorily address the leakage in the pipeline and hence water loss would continue.

Option One – permanent repairs along length of pipeline

Criteria	Rating	Comment
Capital cost	2	Cost of repairs
Operating costs	2	Unpredictable and likely high operational costs due to poor condition of pipe
Environmental impacts	5	None anticipated
Safety in construction and operation	4	No trenching but route difficult to access
Constructability	5	Same as existing maintenance
Regulatory approval	5	No regulatory approval issues are anticipated to be required for the option
Land acquisitions/easements	5	None anticipated
Security of water supply	2	Less secure in long term. Minimal interruptions during transition
Future proofing	2	Provides adequate supply
Total score	**32**	

Advantages

- The pipe can remain in operation during repairs
- Work is covered under maintenance so approvals and environmental impact assessment will not be required.

Disadvantages

- High cost. The repair joints are bought in $ per unit and installation would be about 6 hours.
- These repairs only marginally increase the design life of the pipe considering there is evidence of corrosion of the body of the pipe and the age of the asset.
- These repairs only marginally increase the reliability of the asset.

Option Two – creation of reduced pressure zone

Criteria	Rating	Comment
Capital cost	5	Cost of equipment e.g. pressure valve reducers
Operating costs	1	Unpredictable and likely very high operational costs due to poor condition of pipe
Environmental impacts	5	None anticipated
Safety in construction and operation	5	One item of work
Constructability	5	No impact on service lines and minimal onsite property access
Regulatory approval	5	No regulatory approval issues are anticipated to be required for the option
Land acquisitions/easements	5	None anticipated
Security of water supply	2	Less secure in long term. Minimal interruptions during transition
Future proofing	1	Limits future increase in demand and is not adaptable
Total score	**34**	

Advantages

- This option has already been implemented
- Water main would be offline for a short period of time.

Disadvantages

- It is unclear that the pipe failures are due to high pressure. 55m is not an exceptionally high mains pressure. The cast iron pipe should be able to withstand pressures higher than this. Implementing the reduced pressure zone may reduce some failures, but not all.

Recommendation

This option is not recommended as the benefit of introducing the reduced pressure zone is not clear.

Option Three – on-going standard maintenance to pipeline

Criteria	Rating	Comment
Capital cost	5	None
Operating costs	1	Unpredictable and likely very high operational costs due to poor condition of pipe
Environmental impacts	5	None anticipated
Safety in construction and operation	4	No trenching but route difficult to access
Constructability	5	No impact on service lines and minimal onsite property access
Regulatory approval	5	No regulatory approval issues are anticipated to be required for the option
Land acquisitions/easements	5	None anticipated
Security of water supply	1	Less secure in long term. Minimal interruptions during transition.
Future proofing	1	Limits future increase in demand and is not adaptable
Total score	**32**	

Advantages

- No capital cost
- Only standard maintenance environmental impact assessment and approvals required

Disadvantages

- This option does not rate particularly high and security of water supply in particular is rated low. The condition assessment option shows that this option would not provide a secure water supply as the asses is in poor state. The operating costs will eventually increase even higher and a larger problem will be created in the future as properties decide to connect to this main when it is in poor condition.

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