hunterh2O

# West Yamba Urban Release Area

## Water Supply and Sewer Servicing Strategy

## Yamba Residential Subdivision Pty Ltd

JULY 2019

ABN 16 602 201 552

## Report Details

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|---|---|
| **Report Title** | West Yamba Urban Release Area: Water Supply and Sewer Servicing Strategy |
| **Project No.** | 5166 |
| **Status** | Revised Final |
| **File Location** | P:\Clarence Valley Council\5166 West Yamba Servicing Strategy\2. Tasks\4. Revised Report\West Yamba Servicing Strategy (Revised Final v2).docx |
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## Document History and Status

| Revision | Report Status | Prepared by | Reviewed by | Approved by | Issue Date |
|---|---|---|---|---|---|
| A | Draft for Client Review | Angela Dwyer/ Daniel Alexander | Daniel Turnbull | Jeremy Smith | 30/10/2015 |
| B | Final Draft for Council Review | Angela Dwyer/ Daniel Alexander | Daniel Turnbull | Jeremy Smith | 18/12/2015 |
| C | Revised Draft for Client Review | Angela Dwyer/ Daniel Alexander | Geoff Long | Geoff Long | 04/06/2018 |
| D | Revised Final Draft for Council Review | Angela Dwyer/ Daniel Alexander | Geoff Long | Geoff Long | 03/08/2018 |
| E | Final | Angela Dwyer | Daniel Alexander | Geoff Long | 23/11/2018 |
| F | Revised Final | Angela Dwyer | Daniel Alexander | Geoff Long | 07/02/2019 |
| G | Revised Final Version 2 | Angela Dwyer | Daniel Alexander | Geoff Long | 01/07/2019 |

# Executive Summary

This report details the water supply and sewerage servicing strategy for the West Yamba Urban Release Area (WYURA). The development is expected to consist of around 1,380 residential lots and development is projected to occur over the next 25 – 30 years.

There is sufficient capacity in Clarence Valley Council's existing water supply infrastructure to supply the proposed development. The recommended strategy for water supply is to provide dual points of connection to the initial lots, via connections to the existing 375 mm diameter watermain in Harold Tony Drive to the north and the existing 150 mm diameter watermain in Carrs Drive to the east. For future stages, it is recommended that a 250 mm diameter ring-main is constructed through the development area that ultimately connects to the existing 375 mm diameter watermain in Yamba Road.

The sewerage reticulation scheme for the WYURA is conditioned by the Consent to be a pressure system. The Yamba Sewage Treatment Plant (STP) was recently upgraded and has sufficient capacity to treat the sewage from the WYURA. There is, however, limited spare capacity in the existing sewerage network. Connection of the WYURA development requires construction of a large diameter pressure sewer main between the WYURA and the STP. The WYURA would connect directly to the STP via a number of smaller pressure sewerage sub-systems that discharge into the large diameter main.

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# 1 Introduction

This report details the water supply and sewer servicing strategy for the West Yamba Urban Release Area (WYURA). It has been prepared on behalf of Yamba Residential Subdivision Pty Ltd by Hunter H2O to satisfy Clarence Valley Council's requirements. It develops strategies for the provision of water supply and sewerage infrastructure to the proposed development area.

Hunter H2O was originally engaged in 2015 to prepare a servicing strategy for the WYURA. Hunter H2O submitted a draft report to Council in late 2015. The proposed development was delayed and the report was not finalised at that time. The staging and lot yield of the WYURA changed between 2015 and 2018, and an updated report was prepared in 2018.

The strategy was discussed at Clarence Valley Council's Ordinary Council Meeting on 26th February 2019. Prior to this meeting, WYURA landowners had raised concerns that the proposed sewer trunk mains did not provide sufficient capacity for possible lot yields. The strategy was granted "in principle" approval to allow the connection of the first stage of the development (approximately 56 lots to connect to SPS Y4 via temporary infrastructure). The development lot yield and timing has changed since 2018 and this version of the strategy incorporates the revised lot yield information that was provided by WYURA landowners in April 2019. Stage 1 now includes a larger number of lots and the Stage 1 temporary connection to SPS Y4 will not be proceeding. Instead, the infrastructure between the WYURA and the STP will be constructed during Stage 1.

This version of the report addresses Council's comments on the draft report and incorporates the revised staging and lot yield for the development.

## 1.1 Background

The proposed development site is situated to the south of the town of Yamba and is zoned R1 General Residential in the Clarence Valley Local Environmental Plan (LEP) 2011. The site has a total area of approximately 100 hectares and is bounded by existing residential development in Yamba to the north and east and undeveloped land to the south and west.

The proposed development will consist of residential lots. The initial phase, referred to in this report as the Carrs Drive development area, consists of 161 lots that are expected to be developed in 3 stages over the next 3 - 5 years. The initial stage has been expanded and now includes the land to the south of Miles Street which will consist of approximately 200 manufactured home sites. The anticipated lot yield from the remainder of the development area is 1,016 lots, with an anticipated release rate of approximately 50 lots per year.

Clarence Valley Council required that the strategy considered servicing of the land zoned R5 Large Lot Residential to the south of the WYURA. The anticipated lot yield for this area is approximately 104 lots but the development timing is unknown at this stage. Council determined at its meeting on 27 June 2017 (Resolution 15.102/17) to exclude all R5 Large Lot Residential land at West Yamba from Development Servicing Plans for sewer. As a result, these additional lots will only be considered in the water supply strategy.

An overview of the development area is provided in Figure 1-1.

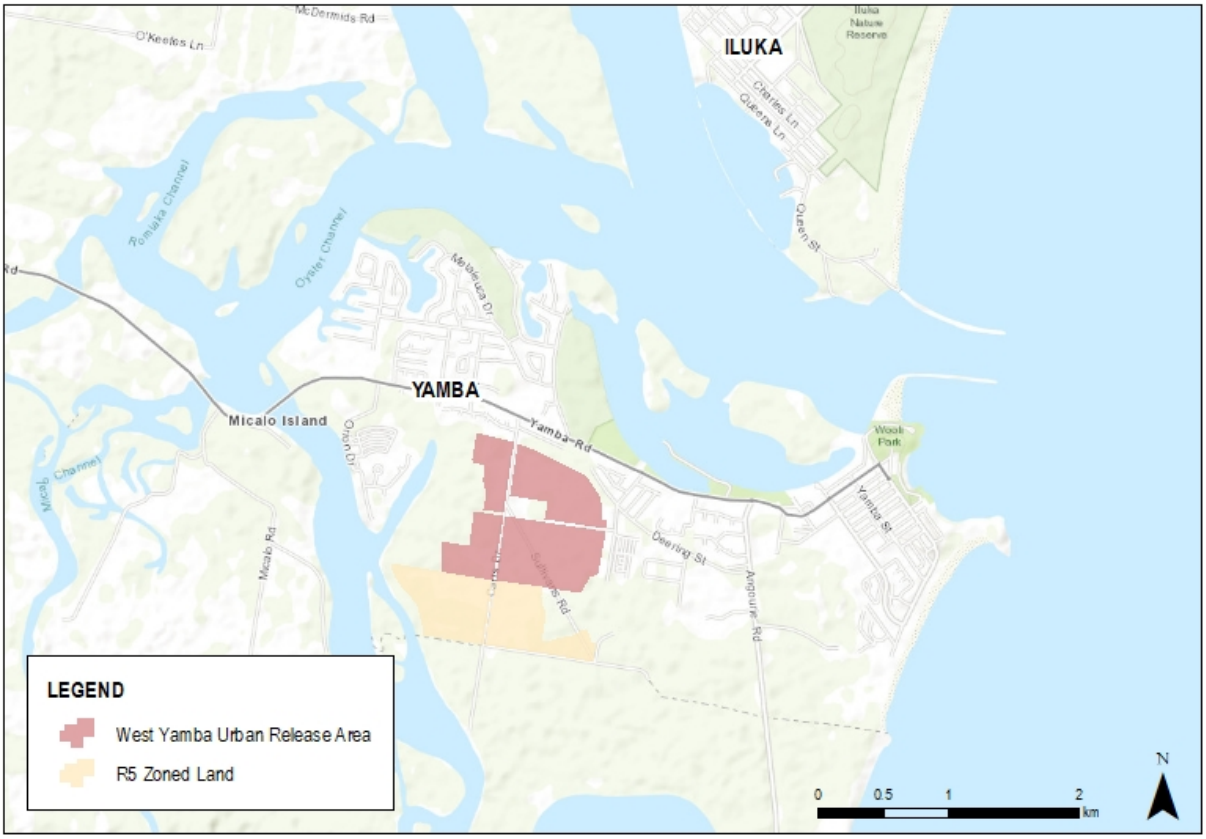


*Figure 1-1 Overview Map of the West Yamba Urban Release Area and R5 Zoned land*

## 1.2 Water Supply System

An overview of the existing water supply system is provided in **Exhibit 1.** Water supply for the Yamba area is sourced from Maclean Reservoir. A branch main off the trunkmain to Yamba supplies Iluka and other towns north of the Clarence River. The Yamba supply is boosted during peak demand periods via a pumping station located at Palmers Island.

The western section of Yamba is supplied directly from the trunkmain. The trunkmain connects to the Yamba reservoirs which provide back-up storage. The Yamba Reservoirs are located off Clarence Street and consist of two discrete storages, with a small high level storage (0.54 ML capacity, Top Water Level 51.6 m AHD) constructed atop the larger low level reservoir (9.5 ML capacity, Top Water Level 46.4 m AHD). At present, all incoming flow enters the upper (high level) reservoir, with direct supply via a bottom outlet to the properties connected to the high level zone. A small diameter "trickle feed" inlet is always open to maintain the water level in the high reservoir. Inflows in excess of high level zone demands overflow to the lower reservoir. A larger diameter inlet to the high level reservoir is opened during low demand periods (overnight) to assist with refilling of the lower reservoir, again via overflows from the high reservoir. A bottom outlet from the low level reservoir supplies back into the low pressure zone.

An elevated reservoir at Angourie, approximately 5 km south of Yamba, provides backup storage for low lying properties within Angourie. Council has since installed a variable speed booster pump to augment supply to higher properties at Angourie during high demand periods.

Clarence Valley Council has recently completed construction of a H2OMAP computer model of the Yamba water supply system. This model will be used to determine system capacity for the proposed development.

## 1.3 Existing Sewerage System

An overview of the existing sewerage system is provided in **Exhibit 2.** The WYURA is located to the south of the existing Yamba sewerage transportation system. The existing Yamba sewerage transportation system includes over thirty pump stations which convey flows to the Yamba STP.

The Yamba STP is located off Angourie Road, approximately 3 km east of the WYURA. The STP was upgraded in 2016 and has sufficient capacity to treat sewage from the proposed WYURA. However, there is currently no sewerage infrastructure to convey flows from the WYURA to the STP.

Clarence Valley Council has advised that there is limited spare capacity in the existing sewerage system and that new sewerage infrastructure will be required to convey flows from the WYURA to the STP.

# 2 Water Demands and Wastewater Loadings

The section provides a summary of the proposed water demands and wastewater loadings that were adopted for this study.

## 2.1 WYURA Lot Yield

The proposed development staging at West Yamba is detailed in Table 2-1.

*Table 2-1 Proposed West Yamba Development Staging*

| Stage | Net Area (ha)[1] | Lot Yield | Water ET | Sewer ET |
|---|---|---|---|---|
| Carrs Drive - Stage 1 | 3.2 | 57 | 57 | 57 |
| Carrs Drive - Stage 2 | 2.9 | 54 | 54 | 54 |
| Carrs Drive - Stage 3 | 2.8 | 50 | 50 | 50 |
| Land South of Miles Street[2] | 3.9 | 200 | 120 | 150 |
| **Carrs Drive Subtotal** | **12.8** | **361** | **281** | **311** |
| Future Stages | 40.9 | 1,016 | 1,016 | 1,016 |
| R5 Land[3] | 52.2 | 104 | 104 | - |
| **Total** | **105.9** | **1,481** | **1,401** | **1,327** |

1. Net development area excluding road reserves, as shown on Master Plan provided by Site Plus on 24/8/2015. R5 land net development area is 90% of the gross development area
2. Development will consist of manufactured housing estate of approximately 200 homes, as advised in email from Site Plus on 18/04/2018. As per Council resolution 15.008/18 from the 20 February 2018 Council meeting, Council has advised the development may adopt 0.6 ET per dwelling for water and 0.75 ET per dwelling for sewer for planning purposes. This rate is based on two bedroom dwellings. For reference, the rate for three bedroom dwellings is 0.8 ET per dwelling for water and 1 ET per dwelling for sewer.
3. Council determined at its meeting on 27 June 2017 (Resolution 15.102/17) to exclude all R5 Large Lot Residential land at West Yamba from Development Servicing Plans for sewer; these lots are excluded from the sewer strategy.

The total lot yield for the “Future Stages” has been provided by the landowners. The anticipated lot release rate is 50 lots per year. The total lot yield for the R5 land was estimated based on a density of 2 lots per hectare which is the maximum allowable under the current zoning.

## 2.2 Water Demands

Demands used as part of the system capacity analysis are predominantly based on metered flows for existing connections, and theoretical design flows for future customers.

### 2.2.1 Existing System Demands

The existing water supply area in Yamba consists of a mix of residential properties and associated non-residential services. There are no large users identified by Council that have a major impact on supply pressures.

Council provided bulk water meter flows recorded immediately downstream of the side-branch which feeds the northern side of the Clarence River. This meter therefore only measures the flow into Yamba. Flows were provided from late October 2013 to mid-September 2015.

An analysis of the provided flows was undertaken to determine average and peak metered flows into Yamba. The instantaneous flow readings were proportionally averaged across each day. Average and peak daily flows were then determined based on the daily flow record. The daily flows are shown in Figure 2-1.

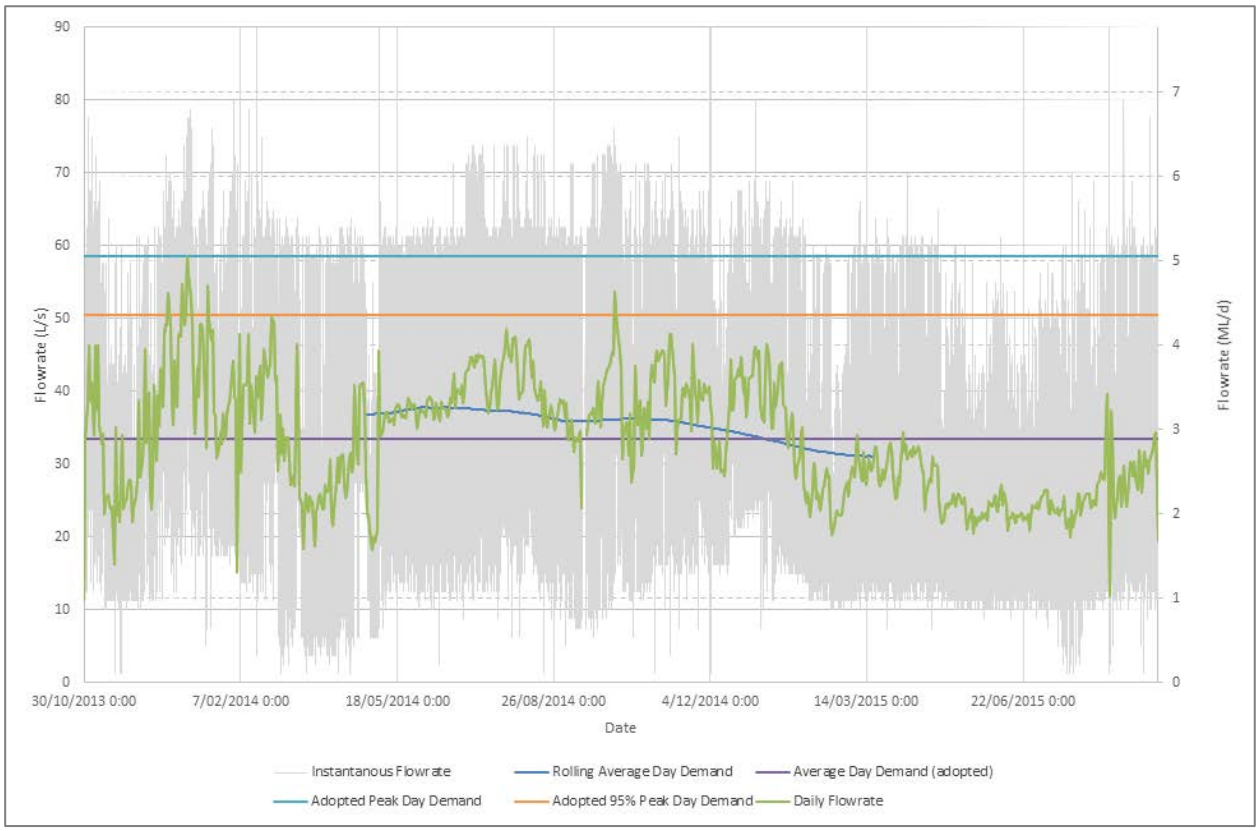


*Figure 2-1 Metered Flows to Yamba / Angourie*

The model supplied by Council contained demands based on customer meter readings. These metered customer demands were consistent with the bulk flow meter readings, hence no modification to the supplied average demands was made within the model. As there was less than two complete years' worth of bulk metered data, peak demands were determined as the maximum bulk metered flow during the recorded period. Peak day factors for the commercial demand component were set at 1.2 × average day demand which is a typical factor used by other water agencies including Hunter Water Corporation. The required residential peak day factor (to provide the remainder of the peak) was then determined and was found to correlate well with Water Services Association of Australia (WSAA) guidelines. A summary of the existing system demands are shown in Table 2-2.

*Table 2-2 Existing System Demands*

| | Residential | Commercial/ Light Industrial | Total |
|---|---|---|---|
| Average Day Demand (L/s) | 20.59 | 12.92 | 33.51 |
| (ML/d) | 1.78 | 1.12 | 2.90 |
| Peak Day Demand (L/s) | 43.11 | 15.50 | 58.62 |
| (ML/d) | 3.73 | 1.34 | 5.06 |
| Peak Day Factor | 2.09 | 1.20 | |
| 95% Peak Day Demand (L/s) | 35.81 | 14.73 | 50.54 |
| (ML/d) | 3.09 | 1.27 | 4.37 |
| 95% Peak Day Factor | 1.74 | 1.14 | |

A residential diurnal demand profile was supplied by Council. A Commercial diurnal pattern was adopted based on the Hunter Water Corporation commercial profile.

### 2.2.2 WYURA Demands

The theoretical future water demands for the WYURA were estimated using the *WSAA Water Code* (Water Services Association of Australia, 2002) and Clarence Valley Council's *Development Design Specification D11 Water Supply System* (AUS-SPEC Joint Venture, 2002) document.

The D11 Guidelines specify an instantaneous demand of 0.1 L/s per lot. By using the WSAA guideline recommendations for peaking factors, this instantaneous demand equates to a peak day demand of 0.02 L/s per lot and an average day demand of 0.01 L/s per lot. Comparison of this with the metered consumption within Yamba / Angourie and the total dwelling count (2011 census) of 3,866 households gives a metered average day demand of 0.0053 L/s per lot. The D11 flowrates therefore provide a conservative allowance, which is considered prudent as this study has not considered additional demands from potential (as-yet unidentified) non-residential development that may occur in conjunction with residential growth. It is recommended that Council monitors demands and short term flowrates as development progresses beyond the initial development stages to determine if the D11 requirements may be adjusted to suit local flow profiles.

The proposed development demands are shown in Table 2-3.

*Table 2-3 WYURA Theoretical Water Demands*

| | Per Lot | Carrs Drive | Future | R5 Land | Total |
|---|---|---|---|---|---|
| No. of ET | | 281 | 1016 | 104 | 1,401 |
| Average Day Demand (L/s) | 0.01 | 2.81 | 10.16 | 1.04 | 14.0 |
| Average Day Demand (ML/d) | 0.001 | 0.24 | 0.88 | 0.09 | 1.21 |
| Peak Day Factor | | 2 | | | |
| Peak Day Demand (L/s) | 0.02 | 5.6 | 20.3 | 2.1 | 28.0 |
| Peak Day Demand (ML/d) | 0.002 | 0.49 | 1.76 | 0.18 | 2.42 |
| 95% Peak Day Factor | | 1.74 | | | |
| 95% Peak Day Demand (L/s) | 0.02 | 5.3 | 19.3 | 2.0 | 26.6 |
| 95% Peak Day Demand (ML/d) | 0.002 | 0.46 | 1.67 | 0.17 | 2.30 |

## 2.3 Wastewater Loadings

The theoretical sewer design flows for the WYURA were estimated using the *WSAA Sewerage Code* (Water Services Association of Australia, 2002), Clarence Valley Council's *Development Design Specification D12 Sewerage System* (AUS-SPEC Joint Venture, 2002) document and information provided by Council.

The WSAA Code describes the Design Flow as comprising of three components:

1. Peak Dry Weather Flow **(PDWF)** representing the peak sewage discharge from connected properties and is a function of the average dry weather sewage flow from connected properties;
2. Groundwater Infiltration **(GWI)** representing the long term non-rainfall dependent infiltration into the sewerage network from groundwater;
3. Peak (rainfall dependent) inflow and infiltration **(IIF)** representing the peak (rainfall dependent) inflow and infiltration into the sewerage network;

The Design Flow is therefore defined by the following equation:

**Design Flow (DF) = PDWF + GWI + IIF**

The Design Flows determined from this equation use a wet weather sewage containment (or overflow frequency) factor of 1.0. This factor equates to an average wet weather recurrence interval of 2 years.

Theoretical sewer loadings are defined in terms of Equivalent Persons (EP) where 1 EP is the equivalent sewage loading from an average person. Council's D12 document stipulates that the equivalent sewer loading from an average person during average dry weather flow (ADWF) is 240 L/day and that the average residential lot is equivalent to 3.2 EP. Council advised that a lower value of 210 L/EP/day was adopted for

the hydraulic design at Iluka. A lower value is considered acceptable for the WYURA, as new dwellings will have water efficient fixtures and appliances. The reduction in water usage will result in reduced discharge to the sewerage system. An ADWF of ***210 L/EP/day*** (equivalent to 0.0024 L/s/EP) was therefore adopted for the WYURA.

Hence,

Average Dry Weather Flow, **ADWF = 0.0024 L/s/EP**

Peak Dry Weather Flow, **PDWF = d x ADWF**

The ratio of average to peak dry weather flow, d, is the dry weather peaking factor and is the function of the gross development area, A. The WSAA code defines:

$$d = 0.01(\log A)^4 - 0.19(\log A)^3 + 1.4(\log A)^2 - 4.66(\log A) + 7.57$$

Further information on how to calculate the GWI and IIF component of the Design Flow can be found in the WSAA Sewerage Code[4]. Because the WYURA will be serviced by a pressure sewerage system, the allowance for infiltration and inflow into the sewer system during wet weather is expected to be lower than for a gravity system. The allowance was taken as 20% of the value calculated using the WSAA methodology. This allowance is consistent with the value used in the Illuka Sewerage Scheme Concept Design (GHD, 2006), which was also serviced by a pressure sewerage system.

A summary of the calculated sewer loadings for the WYURA is provided in Table 2-4.

*Table 2-4 WYURA Theoretical Sewer Loadings*

| Stage | Lot Yield | ET | EP | ADWF (L/s) | PDWF (L/s) | Design flow: 1-in-6 month (L/s) | Design flow: 1-in-2 year (L/s) |
|---|---|---|---|---|---|---|---|
| Carrs Drive[1] | 361 | 311 | 995 | 2.4 | 8.2 | 11.4 | 11.9 |
| Future Stages | 1,016 | 1,016 | 3,251 | 7.9 | 26.8 | 42.7 | 38.7 |
| **Total** | **1,377** | **1,327** | **4,246** | **10.3** | **35.0** | **54.1** | **50.6** |

1. Includes development to south of Miles Street (200 manufactured homes, 0.75 ET per home).

The peak discharge rate from a pressure sewerage system is dependent on the number of pumps in the system and the numbers of pumps that are expected to operate simultaneously. Further details are provided in Section 4.2.

# 3 Water Supply Servicing Strategy

The existing system has been analysed using Council's H2OMAP water model of the Yamba / Angourie system to determine the required infrastructure for Carrs Drive and for the remainder of the WYURA. The required augmentations are identified in the following sections.

## 3.1 Design Criteria

Water supply system design criteria shall be in accordance WSA 03 – Water Supply Code of Australia, Part 1, unless directed otherwise by Clarence Valley Council's *Development Design Specification D11 Water Supply* document.

The major criteria set out by the documents above include the following:

- Peak instantaneous demand is 0.15 L/s/connection except when supplying more than 1,000 connections, when in this case a peak instantaneous demand of 0.1 L/s/connection shall be used.
- A minimum pressure of 20 m (200 kPa) must be maintained during peak instantaneous demand conditions for all reticulation systems.
- The desirable maximum pressure should be 80 m (780 kPa).
- Fire fighting pressure shall be maintained at 15 m (150 kPa) for peak hour flow and provide 10 L/s on the 95$^{th}$ percentile peak day for residential buildings at the location of the fire flow. A pressure of 3 m should be maintained for the peak hour flow at all locations other than the location of the fire flow. These requirements are based on AS2419.1 Fire Hydrant Installations and the Water Directorate's Fire Flow Design Guidelines published in June 2011.
- Useable reservoir capacity should be equal to a minimum of 8-24 hours consumption at peak day demand.

All cost estimates provided are based on the NSW Reference Rates Manual for Valuation of Water Supply, Sewerage and Stormwater Assets[7], unless explicitly stated otherwise. Details of costs are shown in **Appendix A.**

## 3.2 Impact of WYURA Demands on Existing System Performance

Council's existing H2OMAP model of the existing water supply system was analysed to determine the available pressure to the WYURA development, and the impact of the WYURA on the existing water supply system.

There are currently no areas in Yamba experiencing low pressure (<20 m) under peak day demand conditions. The additional demands for the future stages of the WYURA were added to the model and the impact on the existing system was assessed. The Palmers Island pumping station would be required to operate more frequently to supplement the supply to Yamba as a result of the additional development. Pressures are assisted within the existing system when Yamba low level reservoir pays out back into the system to supplement the inflow from Maclean / Palmers Island pumping station. Under this configuration the minimum pressures within Yamba do not fall below the minimum recommendation of 20 m.

Based on current demands, Yamba has approximately 45 hours' supply capacity under peak day demand conditions. This is in excess of WSAA's recommended range of 8 to 24 hours' peak supply. The additional demands from WYURA mean that the storage duration reduces to 32 hours under peak day conditions. This is still in excess of the WSAA recommended range. A summary of the available storage capacity in the existing system is shown in Table 3-1.

*Table 3-1 Peak Day Reservoir Storage Capacity in Yamba*

| Stage | PDD (ML/day) | Storage Capacity (hrs) |
|---|---|---|
| Existing System | 5.06 | 45 |
| Existing System + Carrs Drive | 5.55 | 42 |
| Existing System + Future stages | 7.09 | 33 |
| Existing System + Future stages + R5 Land | 7.30 | 32 |

The WSAA guidelines are part of a risk based approach to providing adequate levels of service. Council should undertake a risk analysis which considers response time to failures, condition of critical components of the water supply network, and likelihood of failure events to determine if 32 hours will provide sufficient reserve capacity for Yamba's system.

## 3.3 Servicing Strategy for the WYURA

The water supply servicing strategy has been developed in two stages. The first stage addresses servicing of the Carrs Drive development area, and the second stage addresses servicing of the future stages of the WYURA.

### 3.3.1 Initial Stages (Carrs Drive)

Under existing system demands, the undeveloped WYURA receives pressures as shown in Table 3-2.

*Table 3-2 Existing System Pressures*

| Stage | ADD Pressure (m) | | PDD Pressure (m) |
|---|---|---|---|
| | Minimum | Maximum | Minimum |
| Existing System | 55.7 | 65 | 45 |

Following development of the WYURA, the resulting pressures within the existing system are shown in Table 3-3.

*Table 3-3 Stages 1-3 Pressures*

| Stage | Minimum PDD Pressure (m) |
|---|---|
| Existing System + Carrs Drive Demand | 44 |
| Existing System + Future Stages Demand | 35 |

To comply with WSAA guidelines and firefighting standards, it is proposed that the Carrs Drive development connect directly to the existing DN150 main in Carrs Drive. A new DN150 loop main should be provided within the development to provide sufficient firefighting capacity and redundancy in the event of a watermain failure within the development.

It is noted that the Carrs Drive development is vulnerable to loss of supply in the event of a failure of the existing DN150 between O'Grady's Lane and the development area. Three options were considered with regards to this risk as follows:

1. Accept the failure risk and repair if failure occurs. This is a relatively short length of single supply main and the projected growth of future stages mean that a duplicate main will be constructed to service additional development within the next 2-3 years. Council may not consider this to be an acceptable solution, in which case either Option 2 or Option 3 would need to be considered.
2. Construct a section of duplicate DN150 main along Carrs Drive from the DN375 main in Harold Tory Drive (approximate length 450 m). This main would provide sufficient supply security for the

Carrs Drive development however would be rendered redundant once future stages (and the resulting larger trunkmains) are developed.

3. Construct a section of DN250 main along Carrs Drive from the DN375 main in Harold Tory Drive (approximate length 450 m). This DN250 main would have sufficient capacity for future stages of the WYURA once developed. This DN250 can be constructed in stages as development progresses. The first required length for Stage 1 is approximately 190 m long. This pipe would be constructed by the Carrs Drive developers with future developers reimbursing the Carrs Drive developer at the time of development of future stages.

Council has indicated that Option 3 is preferred.

The required infrastructure for the Carrs Drive development is summarised below. The Carrs Drive developer indicated that the DN250 main should be extended along Carrs Drive to the intersection with Miles Street to allow the manufactured housing estate to connect.

Carrs Drive - Stage 1:

- 609 m of DN100
- 176 m of DN150
- 188 m of DN250

Carrs Drive - Stage 2:

- 407 m of DN100
- 340 m of DN150
- 486 m of DN250

Carrs Drive - Stage 3 (including initial development land south of Miles Street):

- 521 m of DN100
- 222 m of DN150

A preliminary layout of the proposed watermains is provided in **Exhibit 3.** A reticulation layout has not been developed or costed for the manufactured housing estate south of Miles Street

Cost estimates for the infrastructure were prepared using the guidelines in the NSW Reference Rates Manual (Deparment of Primary Industries Office of Water, 2014) with costs indexed to June 2017. The estimates include both overheads (survey, investigation, design and project management) and contingencies. The contingencies allow for risk or uncertainty in the estimate, and include both inherent risk (uncertainty in the scope of work) and contingent risk (uncertainty due to additional costs which are beyond the control of the designer or constructer) (Deparment of Primary Industries Office of Water, 2014).

The estimated cost of this infrastructure is approximately $640,000. Details of the cost estimates are provided in **Appendix A**. The cost breakdown between trunk mains and reticulation mains is provided below:

- Reticulation mains for Carrs Drive development: $410,000
- DN250 Trunk main from Harold Tory Drive to Miles Street: $230,000

A new DN150 loop main should be provided within the initial development land south of Miles Street. Staging of smaller mains within the development should be undertaken once lot layouts are determined. Cost estimates have not been prepared for reticulation mains within the initial development land south of Miles Street.

### 3.3.2 Future Stages

To adequately service all identified stages of the WYURA, a DN250 ring-main is recommended (approximate length 1,360 m). This main would connect from Carrs Drive to the existing DN375 watermain in Yamba Road near the intersection with Golding Street. Staging of this main as well as other smaller mains within the development should be undertaken once lot layouts are determined. The estimated cost for the DN250 ring-main is $450,000. Cost estimates are provided in **Appendix A**. Cost estimates have not been prepared for the reticulation mains to service future stages. A preliminary layout of the regional water supply infrastructure for future stages is provided in **Exhibit 4.**

Additional reservoir storage is not required for future stages, subject to a risk assessment of failure preparedness to be undertaken by Council.

## 3.4 Summary of Water Strategy

A summary of the estimated capital costs to provide water reticulation to the WYURA is presented in Table 3-4. The reticulation sewer costs are for the Carrs Drive development only. Costs for the provision of reticulation mains to future stages have not been included.

*Table 3-4 Summary of Capital Costs (Water)*

| Item | Capital Cost |
|---|---|
| Reticulation mains – Carrs Drive | $410,000 |
| DN250 trunk watermain for initial stages | $230,000 |
| DN250 trunk watermain for future stages | $450,000 |
| **TOTAL** | **$1,090,000** |

# 4 Sewer Servicing Strategy

The sewerage reticulation scheme for the WYURA is conditioned by the Consent to be a pressure system. A pressure sewerage system consists of a network of interconnected pressure pipes which deliver sewage flows to the downstream sewerage system. Further details of pressure sewerage systems are provided in Section 4.2.

The following sections provide an analysis of the existing sewerage system capacity and a staged approach for providing sewerage services to the WYURA. There is limited spare capacity in the existing Yamba sewerage network for additional connections and the WYURA will be required to connect directly to the Yamba STP.

## 4.1 Pressure Sewerage System Overview

A pressure sewerage system consists of a network of interconnected pressure pipes which deliver sewage flows to the downstream sewerage system. A small storage vessel is installed on each individual property which collects sewage from the dwelling. The storage vessel is fitted with a grinder/ macerator pumping unit which discharges the sewage through the pipe network. The small diameter pressure pipes are laid in narrow trenches at relatively shallow and constant depths, which can be laid to follow the topography.

There are several manufacturers and suppliers of pressure sewerage systems, such as Environment One Corporation (E-One) and Aquatec Pumping Systems. The pumps generally have a near vertical H-Q curve and can operate over a range of head conditions. For example, the E-One Extreme series pumps deliver between 0.75 L/s at 0 m and 0.4 L/s at 56 m. The systems can incorporate a remote terminal unit (RTU) to control the operation of pumps in the system via time-based control rules or via integration with SCADA. This can be used to modulate flows in the system leading to a reduction in peak flows, or it can be used to create periodic flushing waves or reduce detention times.

Environment One Corporation (E-One) has developed the simultaneous operations method for determining peak discharge rates for pressure sewerage systems. This methodology was used and a static network analysis was undertaken in order to determine preliminary pressure main sizes. The network was sized to ensure that the total dynamic head in the system would not exceed approximately 56 m.

The developer of the manufactured home site has recently advised that the development will be on a leasehold basis which allows for multiple house connections to a single pressure sewer unit. The preliminary sewer reticulation plan indicates that the development will be serviced by a combination of units with duplex pumps (servicing three to five lots) and triplex pumps (servicing six to ten lots). As there are fewer units, there is a higher probability that more units will be in operation simultaneously. The peak outflows from the system are difficult to quantify without detailed computer modelling that takes into account the pumping capacity of the duplex and triplex units and the maximum number of units expected to operate simultaneously. The analysis was based on a single pressure sewer unit per property in order to determine preliminary pipe sizing. The analysis should be refined during the concept design stage.

The analysis was undertaken to determine indicative pipe lengths and diameters for the initial development stages and the trunk mains for later development stages. No design work was undertaken for the pressure sewerage system. It is recommended that computer modelling of the system is undertaken at the concept design stage to optimise the system and pipe sizes. A control strategy could also be developed at the concept design stage to optimise the system.

## 4.2 Sewer Servicing Strategy for WYURA

The sewerage strategy has been developed in two stages, as outlined below:

Stage 1. Carrs Drive development areas (161 lots total) and development south of Miles Street (200 manufactured home sites)

Stage 2. Future stages of the WYURA

The long-term strategy for the WYURA is based on several pressure sewerage sub-systems that discharge directly to the STP via a single large diameter pressure main. This larger diameter main would need to operate over a range of conditions as development proceeds.

A preliminary cost estimate was prepared based on either the NSW Reference Rates Manual (Deparment of Primary Industries Office of Water, 2014) (refer Section 3.3) or costs obtained from suppliers. The cost estimate includes the reticulation pipes for Stages 1 and 2 only. The cost of the property works (tank, grinder pumping units, boundary kits and electrical connections) was excluded. A cost estimate for these items was obtained from suppliers and is estimated at around $10,300 per property for a standard connection ($5,300 for the tank, pump and boundary kit and $5,000 for supply and installation in non-rock ground conditions). The cost for the small diameter pipes between the tank and pressure sewer mains would also be an additional cost.

### 4.2.1 Initial Stages

Stage 1 involves providing reticulation pipework for the Carrs Drive and manufactured home development and the construction of the pressure sewer main to the Yamba STP. This main would also service all future development in the WYURA and would need to be sized accordingly. The proposed route is shown in **Exhibit 5** and follows Miles Street, Golding Lane, Deering Street and Angourie Road and then follows the access road to the STP.

A spreadsheet analysis was undertaken to size the system and limit the system design pressure to 56 m or less. The analysis indicated that once all stages of the Carrs Drive development area are connected (361 lots), the total dynamic head in the system under normal operations is expected to be about 36 m so the system could connect directly to the STP without the need for a regional pumping station. Minimum velocity requirements would not be satisfied at Stage 2 and periodic flushing of the main would be required by programming a higher number of pumps to operate simultaneously.

A summary of the infrastructure requirements for Stage 1 is provided below:

- Pressure sewer mains:
    - 770 m of DN50 PE pipe
    - 1,100 m of DN63 PE pipe
    - 380m of DN 76 PE pipe
    - 270 m of DN90 PE pipe
    - 130 m of DN110 PE pipe
    - 380 m of DN120 PE pipe
    - 3,170 m of DN200 PE pipe

The DN120 sections of main along Carrs Drive have been increased in diameter to allow for the future connection of other development (refer Section 4.2.2).

The preliminary cost estimate for Stage 1 is $1,620,000. The approximate breakdown for the cost is $510,000 for the reticulation sewers and DN120 mains in Carrs Drive and $1,110,000 for the DN200 sewer main to the STP. The DN120 pressure sewer mains along Carrs Drive and the DN200 main from the intersection of Carrs Drive and Miles Street to the STP are likely to become “regional” infrastructure. A cost sharing arrangement would need to be negotiated between the Carrs Drive developers and future developers in the WYURA.

### 4.2.2 Future Stages

An overview of the ultimate sewer servicing strategy is provided in **Exhibit 6.** At ultimate development, it is expected that a number of pressure sewerage sub-systems will discharge directly to the STP via the DN120 and DN200 mains constructed for Stage 1. The actual boundaries and number of properties connected to each sub-system will be dependent on development staging and timing, and each sub-system would need to be designed to limit the system design pressure to approximately 56 m. Once future lot layouts and staging is known, computer modelling should be undertaken to determine the optimum layout and sizing for the sub-systems. Periodic flushing of the systems would be required during interim stages to achieve minimum velocity requirements in the pressure mains.

For the purposes of this analysis it was assumed that four additional pressure sewerage sub-systems would discharge to the STP via the DN 120 and DN200 pressure main constructed for Stage 1. The sub-systems are summarised in Table 4-2.

*Table 4-1 Pressure Sewerage Sub-systems – Future Stages*

| Sub-system | Number of lots | Maximum number of pumps operating simultaneously | Expected Peak outflow (L/s) |
|---|---|---|---|
| 1 - NW (Carrs Drive) | 361 | 16 | 11 |
| 2 - NE 1 | 170 | 10 | 7 |
| 3 – NE 2 | 256 | 13 | 9 |
| 4 - SE | 480 | 20 | 14 |
| 5 - SW | 110 | 8 | 5 |
| **Total** | **1,377** | **67** | **46** |

The anticipated connection point for the subsystems is summarised below:

- NE 1 Subsystem – connect to the DN120 pressure sewer main in Carrs Drive north of Miles Street. The 140 m section of main along Carrs Drive has been increased in diameter from DN110 to DN120 to cater for the additional flows from the NE 1 subsystem. The incremental cost to upsize this section of main is approximately $4,000.
- NE 2 Subsystem – connect to the DN200 pressure sewer main in Miles Street adjacent to the southern boundary of the development area
- SE Subsystem – connect to the DN200 pressure sewer main in Miles Street adjacent to the northern boundary of the development area
- SW Subsystem - connect to the DN120 pressure sewer main in Carrs Drive south of Miles Street. The 240 m section of main along Carrs Drive has been increased in diameter from DN90 to DN120 to cater for the additional flows from the SW subsystem. The incremental cost to upsize this section of main is approximately $16,000.

Cost estimates have not been prepared for the reticulation sewers for future stages.

## 4.3 Summary of Sewer Strategy

A summary of the estimated capital costs to provide sewer reticulation to the WYURA is presented in Table 4-3. The costs for the tanks/pump units and property sewers is excluded. The reticulation sewer costs are for the Carrs Drive and manufactured housing estate south of Miles Street only. Costs for future stages have not been included.

*Table 4-2 Summary of Capital Costs (sewer)*

| Item | Capital Cost |
|---|---|
| Stage 1 Reticulation Sewer | $510,000 |
| DN200 from WYURA to STP | $1,110,000 |
| **TOTAL** | **$1,620,000** |

# 5 Conclusions

A servicing strategy has been developed for the WYURA. A staged approach is recommended to allow connection of the first stages of the development prior to construction of regional assets.

## 5.1 Water Supply Strategy

There is sufficient capacity in the existing water supply system to allow for connection of the Carrs Drive development. The nominated connection point is the existing DN150 watermain in Carrs Drive. The first part of the DN250 ring-main is to be constructed as part of the Carrs Drive development to provide supply security.

A DN250 ring-main would need to be constructed through the development area prior to the connection of future stages. Opportunities for staging construction of this main should be investigated as development progresses.

No additional reservoir storage is required as a result of the proposed development included in this strategy.

## 5.2 Sewer Strategy

There is limited spare capacity in the existing sewerage system and the strategy requires that the WYURA discharges directly to the STP. The Carrs Drive and Miles Street (Stage 1) develops will connect via a proposed large diameter pressure main between the development area and the Yamba STP.

The long-term strategy consists of several pressure sewerage sub-systems that discharge to the large diameter pressure mains constructed for Stage 1. Once future lot layout and staging has been determined, the boundaries and number of lots serviced by each pressure sewerage system should be refined.

# 6 References


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GeoLink. (2008). *Yamba Sewerage Concept Design.*

GHD. (2006). *Iluka Sewerage Scheme Concept Design Report Volume 1.*

Water Services Association of Australia. (2002). *Sewerage Code of Australia WSA 02-2002 Version 2.3.*

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Palmers Island Booster Pumping Station

YAMBA

Trunkmain from Maclean Reservoir

Yamba Reservoirs
High Level: 0.54 ML, TWL 51.6 m
Low Level: 9.5 ML, TWL 46.4 m

**LEGEND**

- Booster Pumping Station
- Reservoir
- Trunk Watermains
- Watermains
- WYURA
- R5 Land

hunterh2o

**WYURA Servicing Strategy**
**Overview of Existing Water Supply System**

| | | | |
|---|---|---|---|
| SCALE: 1:25,000 | | PROJECT No: 5166 | **EXHIBIT 1** A3 |
| DRN: AD | CHK: DA | DATE: OCTOBER 2018 | |
| File Name: Ex 1 - Existing Water Supply System | | | © COPYRIGHT INFORMATION |

YAMBA

Y11
Y13
Y21
Y8
Y6
Y7
Y5
Y15
Y26
Y18
Y16
Y10
Y19
Y17
Y20
Y4
Y23
Y22
YP2
Y2
YP36
Y1
Y3
Y27
Y28
Y12
YP1
Y30
Y33
Y32
Y25
YP4

Yamba Sewage Treatment Plant

**LEGEND**

- Sewage Treatment Plant
- Pump Station
- Private Pump Station
- Existing Rising Main
- Existing Sewer Gravity Main
- WYURA

hunterh2O

**WYURA Servicing Strategy**
**Overview of Existing Sewerage System**

| | | | |
|---|---|---|---|
| SCALE: 1:20,000 | | PROJECT No: 5166 | **EXHIBIT 2** A3 |
| DRN: AD | CHK: DA | DATE: OCTOBER 2018 | |
| File Name: Ex 2 - Existing Sewer System | | | © COPYRIGHT INFORMATION |

YAMBA

**LEGEND**

**Proposed Watermains**

**Stage, Diameter**

- 3, 250
- 3, 150
- 3, 100
- 2, 250
- 2, 150
- 2, 100
- 1, 250
- 1, 150
- 1, 100
- Existing Watermains
- WYURA
- R5 Land

Connect to existing DN375 watermain in Harold Tory Drive

Connect to existing DN150 watermain in Carrs Drive

DN250 watermain in Carrs Drive to allow for connection of inital lots south of Miles Street

hunterh2O

**WYURA Servicing Strategy**
**Water Supply - Initial Stages**

| | | | |
|---|---|---|---|
| SCALE: 1:10,000 | | PROJECT No: 5166 | **EXHIBIT 3** A3 |
| DRN: BG | CHK: DA | DATE: JUNE 2019 | |
| File Name: Ex 3 - Water Supply Servicing Strategy | | | © COPYRIGHT INFORMATION |

YAMBA

Complete DN250 ring-main

**LEGEND**

- Proposed Watermain
- Existing Watermains
- WYURA
- R5 Land

hunterh2O

**WYURA Servicing Strategy**
**Water Supply - Future Stages**

| | | | |
|---|---|---|---|
| SCALE: 1:10,000 | | PROJECT No: 5166 | **EXHIBIT 4** A3 |
| DRN:BG | CHK: DA | DATE: OCTOBER 2018 | |
| File Name: Ex 4 -Ultimate Water Supply Strategy | |  | |

Y16
Y10
Y19
Y17
Y20
Y23
Y4
Y22
YP2
YP36
Y1
Y27
YP1
Y28
Y12
Y33
Y32
Yamba STP
YP4

**LEGEND**

**Proposed Pressure Sewer Mains**

- DN 50
- DN 65
- DN 75
- DN 90
- DN 110
- DN 120
- DN 135
- DN 160
- DN 200
- Existing Sewer Pump Station
- Existing Rising Main
- Existing Sewer Gravity Main
- WYURA

hunterh2o

**WYURA Servicing Strategy**
**Sewer - Initial Stages**

| | | | |
|---|---|---|---|
| SCALE: 1:10,000 | | PROJECT No: 5166 | **EXHIBIT 5** A3 |
| DRN: AD | CHK: DA | DATE: JULY 2019 | |
| File Name: Ex 5 - Sewer Strategy | | | © COPYRIGHT INFORMATION |

Y16
Y10
Y19
Y17
Y20
Y22
Y4
Y23
YP2
Y1
NE 1 Subsystem
NE 2 Subsystem
YP36
NE 1 Subsystem to connect to DN120 in Carrs Drive
Y27
Y28
Y12
YP1
SE Subsystem
SW Subsystem
Y33
Y32
SW Subsystem to connect to DN120 in Carrs Drive
NE 2 and SE Subsystems to connect to DN200 along Miles Street
Yamba STP
YP4

## LEGEND

**Proposed Pressure Sewer Mains**

- DN 200 pressure sewer main
- DN 120 pressure sewer main
- Reticulation mains for earlier stages
- Existing Sewer Pump Station
- Existing Rising Main
- Existing Sewer Gravity Main
- Approximate pressure sewerage system boundaries
- WYURA

hunterh2o

**WYURA Servicing Strategy**
**Sewer - Future Stages**

| | | | |
|---|---|---|---|
| SCALE: 1:10,000 | | PROJECT No: 5166 | **EXHIBIT 6** A3 |
| DRN: AD | CHK: DA | DATE: JULY 2019 | |
| File Name: Ex 6 - Sewer - Future Stages | | © COPYRIGHT INFORMATION | |

# Appendix A: Cost Estimates

**WEST YAMBA URBAN RELEASE AREA SERVICING STRATEGY**

PRELIMINARY PROJECT ESTIMATE

PROJECT NO: 5166

Water Supply -Initial Stages (DN250 trunk main)

Date of Estimate: Jun-19

Note: Costs obtained from the NSW Office of Water Reference Rates Manual June 2014

*Estimated Contract Award Sum*

| ITEM | DEPTH | QUANTITY | UNIT | RATE | SUB-TOTAL (Inc. change in CPI) | TOTAL |
|---|---|---|---|---|---|---|
| **CHANGE IN CPI** | | | | | | |
| Jun-14 to Jun-17 | | 1.0700 | | 7.00% | | |
| **1. Pipes** | | | | | | |
| Water Trunkmain uPVC - DN250 | <1.5m | 680 | m | 182.00 | $ 132,423 | |
| | | | | | | $ 132,423 |
| **2. Establishment / Disestablishment** | | | | | | |
| Establishment / Disestablishment | | 1 | Item | 9,000.00 | $ 9,000 | |
| | | | | | | $ 9,000 |
| **Total Estimated Contract Award Sum** | | | | | | **$ 141,423** |

| | | | |
|---|---|---|---|
| | | | **A** |
| Design (includes Survey, Investigation, Design and Project Management) | 10% of A | $ 14,142 | |
| Inherent Risk | | | **B** |
| Feasibility Stage | 30% of A | $ 42,427 | |
| Contingency | | | **C** |
| Future Assets | 20% of A | $ 28,285 | |
| | | | **D** |
| **Total Preliminary Project Estimate** | **A + B + C + D** | **$ 230,000** | |

**WEST YAMBA URBAN RELEASE AREA SERVICING STRATEGY**

PRELIMINARY PROJECT ESTIMATE

PROJECT NO: 5166

Water Supply - Initial Stages (reticulation for Carrs Drive)

Date of Estimate: Jun-19

Note: Costs obtained from the NSW Office of Water Reference Rates Manual June 2014

*Estimated Contract Award Sum*

| ITEM | DEPTH | QUANTITY | UNIT | RATE | SUB-TOTAL (Inc. change in CPI) | TOTAL |
|---|---|---|---|---|---|---|
| **CHANGE IN CPI** | | | | | | |
| Jun-14 to Jun-17 | | 1.0700 | | 7.00% | | |
| **1. Pipes** | | | | | | |
| Water Reticulation uPVC - DN100 | <1.5m | 1,540 | m | 86.00 | $ 141,711 | |
| Water Reticulation uPVC - DN150 | <1.5m | 740 | m | 127.00 | $ 100,559 | |
| | | | | | | $ 242,269 |
| **2. Establishment / Disestablishment** | | | | | | |
| Establishment / Disestablishment | | 1 | Item | 12,000.00 | $ 12,000 | |
| | | | | | | $ 12,000 |
| **Total Estimated Contract Award Sum** | | | | | | **$ 254,269** **A** |
| Design (includes Survey, Investigation, Design and Project Management) | 10% of A | | | | | $ 25,427 **B** |
| Inherent Risk | | | | | | |
| Feasibility Stage | 30% of A | | | | | $ 76,281 **C** |
| Contingency | | | | | | |
| Future Assets | 20% of A | | | | | $ 50,854 **D** |
| **Total Preliminary Project Estimate** | A + B + C + D | | | | | **$ 410,000** |

**WEST YAMBA URBAN RELEASE AREA SERVICING STRATEGY**

PRELIMINARY PROJECT ESTIMATE

PROJECT NO: 5166

Water Supply - Future Stages Trunk Main

Date of Estimate: Jun-19

Note: Costs obtained from the NSW Office of Water Reference Rates Manual June 2014

*Estimated Contract Award Sum*

| ITEM | DEPTH | QUANTITY | UNIT | RATE | SUB-TOTAL (Inc. change in CPI) | TOTAL | |
|---|---|---|---|---|---|---|---|
| **CHANGE IN CPI** | | | | | | | |
| Jun-14 to Jun-17 | | 1.0700 | | 7.00% | | | |
| **1. Pipes** | | | | | | | |
| Water Trunkmain uPVC - DN250 | <1.5m | 1,358 | m | 182.00 | $ 264,457 | | |
| | | | | | | $ 264,457 | |
| **2. Establishment / Disestablishment** | | | | | | | |
| Establishment / Disestablishment | | 1 | Item | 12,000.00 | $ 12,000 | | |
| | | | | | | $ 12,000 | |
| **Total Estimated Contract Award Sum** | | | | | | **$ 276,457** | **A** |
| Design (includes Survey, Investigation, Design and Project Management) | 10% of A | | | | | $ 27,646 | **B** |
| Inherent Risk | | | | | | | |
| Feasibility Stage | 30% of A | | | | | $ 82,937 | **C** |
| Contingency | | | | | | | |
| Future Assets | 20% of A | | | | | $ 55,291 | **D** |
| **Total Preliminary Project Estimate** | A + B + C + D | | | | | **$ 450,000** | |

**WEST YAMBA URBAN RELEASE AREA SERVICING STRATEGY**

PRELIMINARY PROJECT ESTIMATE

PROJECT NO: 5166

Sewer Strategy - Initial Stages (Reticulation)

Date of Estimate: Jun-19

Note: Costs obtained from the NSW Office of Water Reference Rates Manual June 2014 (and June 2017 update)

*Estimated Contract Award Sum*

| ITEM | DEPTH | QUANTITY | UNIT | RATE | SUB-TOTAL (Inc. change in CPI) | TOTAL |
|---|---|---|---|---|---|---|
| **CHANGE IN CPI** | | | | | | |
| Jun-14 to Jun-17 | | 1.0700 | | 7.00% | | |
| **1. Low Pressue Mains** | | | | | | |
| DN 53.2 PE | <1.5m | 770 | m | 75.00 | $ 61,793 | |
| DN 63.6 PE | <1.5m | 1,100 | m | 85.00 | $ 100,045 | |
| DN 76.3 PE | <1.5m | 380 | m | 95.00 | $ 38,627 | |
| DN 93.2 PE | <1.5m | 270 | m | 108.00 | $ 31,201 | |
| DN 106 PE | <1.5m | 130 | m | 120.00 | $ 16,692 | |
| DN118 PE | <1.5m | 380 | m | 130.00 | $ 52,858 | |
| | | | | | | $ 301,216 |
| **2. Additional Items** | | | | | | |
| | | | | | | $ - |
| **3. Establishment / Disestablishment** | | | | | | |
| Establishment / Disestablishment | | 1 | Item | 15,000.00 | $ 15,000 | |
| | | | | | | $ 15,000 |

| | | | |
|---|---|---|---|
| **Total Estimated Contract Award Sum** | | **$ 316,216** | **A** |
| Design (includes Survey, Investigation, Design and Project Management) | 10% of A | $ 31,622 | **B** |
| Inherent Risk | | | |
| Feasibility Stage | 30% of A | $ 94,865 | **C** |
| Contingency | | | |
| Future Assets | 20% of A | $ 63,243 | **D** |
| **Total Preliminary Project Estimate** | A + B + C + D | **$ 510,000** | |

**WEST YAMBA URBAN RELEASE AREA SERVICING STRATEGY**

PRELIMINARY PROJECT ESTIMATE

PROJECT NO: 5166

Sewer Strategy - Initial Stages (DN200)

Date of Estimate: Jun-19

Note: Costs obtained from the NSW Office of Water Reference Rates Manual June 2014 (and June 2017 update)

*Estimated Contract Award Sum*

| ITEM | DEPTH | QUANTITY | UNIT | RATE | SUB-TOTAL (Inc. change in CPI) | TOTAL |
|---|---|---|---|---|---|---|
| **CHANGE IN CPI** | | | | | | |
| Jun-14 to Jun-17 | | 1.0700 | | 7.00% | | |
| **1. Low Pressue Mains** | | | | | | |
| DN200PE | <1.5m | 3,170 | m | 200.00 | $ 678,380 | $ 678,380 |
| **2. Additional Items** | | | | | | $ - |
| **3. Establishment / Disestablishment** | | | | | | |
| Establishment / Disestablishment | | 1 | Item | 15,000.00 | $ 15,000 | |
| | | | | | | $ 15,000 |
| **Total Estimated Contract Award Sum** | | | | | | **$ 693,380** **A** |
| Design (includes Survey, Investigation, Design and Project Management) | 10% of A | | | | | $ 69,338 **B** |
| Inherent Risk | | | | | | |
| Feasibility Stage | 30% of A | | | | | $ 208,014 **C** |
| Contingency | | | | | | |
| Future Assets | 20% of A | | | | | $ 138,676 **D** |
| **Total Preliminary Project Estimate** | A + B + C + D | | | | | **$ 1,110,000** |