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Wingecarribee Shire Council

Integrated Water Cycle Management Options Review Paper

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WINGECARRIBEE SHIRE COUNCIL

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Executive Summary

This paper provides a review of the options for addressing the Integrated Water Cycle Management (IWCM) Issues across Wingecarribee Shire and will be used to develop the IWCM Scenarios. This includes options for addressing the water supply and sewerage scheme issues across the Shire.

Sewerage Schemes

The three options evaluated to address issues with the sewerage schemes are:

- Upgrade individual plants with no NorBE compliance
- Upgrade individual plants with NorBE compliance
- Construct a common STP to treat sewage from Berrima, Bowral and Moss Vale, and upgrade Mittagong STP all with NorBE compliance

The cost estimates of these options are summarised in **Table S1**.

Table S1: Cost estimates of sewerage scheme options

Scenario	Bowral STP	Moss Vale STP[(1)]	Mittagong STP	NorBE Compliance	Present Value Capital Cost ($M)
1	Upgrade to 19,000 EP (upfront)	Stage 1 – Upgrade to 19,600 EP. Stage 2 – Upgrade to 32,000 EP in 2031.	Process optimisation upfront with capacity upgrade to 18,500 EP in 2022	Yes	99.4
2	Upgrade to 19,000 EP (upfront)	Stage 1 – Upgrade to 19,600 EP. Stage 2 – Upgrade to 32,000 EP in 2031.	Process optimisation upfront with capacity upgrade to 18,500 EP in 2022	No	84.3
3	Construct new common STP for Berrima, Bowral and Moss Vale Stage 1 – 34,000 EP Stage 2 – 51,000 EP in 2031		Process optimisation upfront with capacity upgrade to 18,500 EP in 2022	Yes	136.2

Water Supply Schemes

The three options evaluated to address issues with the water supply schemes are:

- Maintain current supply zones with all WTPs operating
- Decommission Medway WTP and supply Medway zone from Wingecarribee WTP
- Decommission Medway WTP, supply Medway zone from Wingecarribee WTP, and supply part of Moss Vale zone from Bundanoon WTP

The water supply options and their cost estimates are provided in **Table S2**.

Table S2: Cost estimates of water supply scheme options

Scenario	Moss Vale Supply from Bundanoon (ML/d)[1]	Medway Supply from Wingecarribee WTP	Wingecarribee WTP augmentation	Bundanoon WTP augmentation	Present Values Cost ($M)[(1)]
1	0	No	2041	No	6.94
2	0	Yes	2031	No	3.44
3	2 to 3	Yes	No	2020 – 2030	4.01

Note1: Present value cost includes O&M and avoided costs (@7%).

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1 Introduction

1.1 Background

The main urban centres within Wingecarribee Shire are Bowral, Moss Vale, Mittagong and Bundanoon. As well, there are smaller villages including Hill Top, Yerrinbool, Colo Vale, Robertson, Berrima, New Berrima, Exeter, Burrawang, Penrose, Willow Vale, Alpine, Balaclava, Renwick, Wingello, Sutton Forest, Avoca, Fitzroy Falls and Balmoral Village.

This technical paper forms part of the wider Wingecarribee Integrated Water Cycle management (IWCM) Strategy. The objectives of this paper are to:

- Review the feasibility of the individual local, urban and regional level water and sewerage Options to address the Issues identified in the Issues paper.
- Using the Triple Bottom Line (TBL) criteria, evaluate and shortlist the individual options for subsequent bundling in to scenarios.

IWCM Issues

The major issues associated with the water and sewerage system requiring infrastructure upgrades are outlined in the table below.

Table 1.1: Water Service System Issues at Wingecarribee Shire

Element	Issue	Issue Type
Security of Supply	Under the existing WTP supply area zoning, the Wingecarribee supply area PDD is predicted to exceed the WTP capacity by around 2031.	Capacity
	Under the proposed revised supply area zoning, the Bundanoon WTP capacity is already exceeded by the Bundanoon supply area peak day demand.	
Berrima Sewerage Scheme	A sewage detention time of about 10 hours at ADWF was calculated for pumping station BE1 which has the potential for septicity and odour generation.	Performance
Sewerage pumping stations	Pumping station BE5 at Berrima, BW11 and Lift PS at Bowral, Hill Top at Mittagong and MV8 at Moss Vale all have an emergency storage volume of less than 2 hours under ADWF	Performance
Bowral STP	Regular exceedance of the 50th percentile limit of total nitrogen and some exceedances of the 90th percentile for total phosphorus. The plant is currently operating past its capacity for total nitrogen.	Regulatory
	The plant has a hydraulic design capacity of 14,600 EP based on a loading of 240 L/EP/d. The current estimated EP of about 15,000 exceeds the design capacity.	Capacity
	The plant is currently operating past its capacity for biological loading.	Capacity
Mittagong STP	Exceeded 50th percentile concentration limit for total nitrogen. The plant is currently operating past its capacity for total nitrogen and total phosphorus.	Regulatory
	The plant has a hydraulic design capacity of 14,000 EP based on a loading of 230 L/EP/d. The current estimated EP of about 16,500 exceeds the design capacity.	Capacity

Element	Issue	Issue Type
Moss Vale STP	Exceedance of total load limits for nitrogen due to extra flows at the STP. Exceedance of total daily volume limit due to inflow infiltration	Regulatory
	The current estimated EP of 8,988 treated by the plant means that the plant is operating at its current design capacity of 9,000 EP. However if the MVEC has progressed as expected, then the current estimated EP is 11,212 which exceeds the design capacity of the plant.	Capacity
	The biological/nutrient loading rates measured in the 2009 Influent Sewage Monitoring Report were lower than the STP design loading rates hence the biological / nutrient capacity of the plant is not expected to be exceeded until around 2018.	Regulatory
NorBE	For each STP upgrade the GHD report concluded that even when options were considered where the effluent concentration limits were more stringent than expected for other catchment based plants, NorBE was not assured.	Regulatory
Unserviced areas	Council has an on-site sewage management strategy but experience shortage of resources to undertake number of inspections required.	Best Practice Management

1.2 Previous Studies

Sewerage Schemes

As part of Council's commitment to develop strategies for the longer term operation of Council's sewage treatment plants, Council commissioned GHD to undertake investigations for the STPs at Bowral, Mittagong and Moss Vale. The investigations covered:

- Raw sewage characterisation
- Plant capacity assessment
- Neutral or Beneficial Effect (NorBE) assessment.

PWA has been commissioned by Council to undertake an independent review of the findings and recommendations provided in the GHD investigations. This review will be used to inform the preparation of Council's IWCM Strategy.

As part of the investigation, GHD prepared and supervised a raw sewage sampling program. The test results for composite sampling for Bowral, Moss Vale and Mittagong presented in the GHD report did not appear to be an accurate representation of the dry weather raw sewage strength to these plants. The BOD, COD and SS levels were unusually low for dry weather flow sewage.

A new program of composite 72-hour sampling and analysis of the raw sewage was recommended to confirm the suitability of the design parameters. The program was completed and test results provided to Public Works Advisory (PWA) in February 2017.

Common STP

Wingecarribee Shire Council (WSC) engaged Public Works Advisory (PWA) to evaluate the option of constructing a common STP to treat sewage from Berrima, Bowral and Moss Vale with a view to including this option in Council's IWCM Scenarios.

Water Supply Scheme

GHD was engaged by Wingecarribee Shire Council to assess options for the future of Medway WTP. GHD considered three options for the future supply to Medway. This included review of relevant information, and completion of a corporate level risk assessment.

Council also prepared a Water Supply System Master Plan. The Master Plan provided a review of some items of the WTP Source Management situation. In the study Council has identified the following considerations for management of its fleet of treatment plants:

- Relative cost of water supplied by each WTP
- Requirements for capital upgrades / renewals at WTP.
- Transfer capacity between the WTP systems

This analysis provides a review of some items of the WTP Source Management situation.

2 Sewerage Schemes

2.1 Overview

Following the receipt and review of results from testing of the 72-hour composite samples, PWA reviewed the GHD investigation report for Bowral, Moss Vale and Mittagong STPs. While the earlier sampling results appeared to be indicative of a very low strength raw sewage, the repeat sampling program yielded results that were closer to expected raw sewage quality. The outcomes of this review are provided below.

2.2 Bowral STP

2.2.1 Analysis of Sampling Results

The sampling results for Bowral STP, along with the results in the GHD report are presented in and are compared with the plant design parameters.

Table 2.1: Comparison of influent sewage quality with Bowral STP design data

Parameter	Units	GHD Strategy Study ("median")[1]	Average *(Jan. 2017 sampling)*	Bowral STP Design
ADWF	kL/day	3,194	2,715	3,504
Load	EP	13,308	15,051[2]	14,600
Hydraulic loading	L/EP/d	240	180	240
BOD	mg/L	73	209	250
BODf	mg/L	31	60	-
COD	mg/L	88	589	-
CODf	mg/L	66	167	-
TSS	mg/L	67	262	-
VSS content	mg/L	67	234	-
Reactive P	mg/L	4.7	6.1	-
TP	mg/L	6.0	10.7	8.3
Ammonia – N	mg/L	37	50.8	-
TN	mg/L	43	68	67
pH		7.8	8.3	-
Alkalinity	$mgCaCO_3/L$	232	349	-

1 *Table3.6 of GHD report.*
2 *2016 residential plus non-residential EP as calculated in the IWCM*

The information from the 72-hour sampling data provided in Table 2.1 indicates that:

- The strength (quality) of the raw sewage is closer to the design raw sewage quality compared to the sampling results presented in the GHD report.
- Influent BOD from repeat sampling is still less than the design BOD but should still likely provide sufficient carbon for denitrification.
- Repeat sampling influent TN is equivalent to design load.

- Repeat sampling influent TP is 30% greater than design TP. Therefore alum usage and sludge production will be greater than allowed for in design.

2.2.2 Population Projections

The equivalent population (EP) was calculated in the Issues Paper using the information provided in the Infoworks sewer model for each sewerage scheme. It is understood that these models were prepared in 2015 and therefore it is expected that the population and flow data would be from the 2013/14 period. The summary of the residential population, non-residential EP and total EP for the Bowral sewerage scheme are provided in **Table 2.2**.

Table 2.2: Serviced Equivalent Population projection – Bowral STP

EP	2011 Census + WSSMP Growth				Forecast extension		
	2016	**2021**	**2026**	**2031**	**2036**	**2041**	**2046**
Residential	12,480	13,425	14,003	14,463	15,003	15,564	16,146
Non-residential	2,577	2,610	2,642	2,676	2,709	2,743	2,778
Sub total	15,057	16,035	16,645	17,138	17,712	18,307	18,924

The recorded flow during the 72-hour sampling and the assessed total 2016 EP for Bowral resulted in a hydraulic loading of around 180 L/EP/day. If a hydraulic loading of around 200 L/EP/d were to be considered for design the current hydraulic capacity of the plant would be sufficient to cover growth until around 2035.

2.2.3 Review of GHD Findings and Recommendations

Bowral STP is a 14,600 EP capacity STP that utilizes one IDEA reactor (10,600 EP) and two Pasveer channels (2 x 2,000 EP) for secondary treatment and chemical phosphorus removal to treat sewage. The effluent is filtered and disinfected via a UV unit prior to discharge to Wingecarribee River. Some treated effluent from the STP is currently reused at the STP.

PWA has reviewed the findings and recommendations of the GHD investigation. A detail assessment of this review is provided in Appendix A. The aspects where PWA's recommendations differ from GHD's recommendations are summarised below:

- The IDEA reactor was designed for 20 day sludge age. The capacity of the reactor should be re-assessed based on a 25 day sludge age which allows for improved nitrification capability and provides more flexibility to vary the Mixed Liquor Suspended Solids (MLSS) for operational reasons. The capacity of the IDEA reactor would be reduced to approximately 10,000 EP (from 10,600EP) if the plant is operated at 25 days sludge age and 200L/EP/day.
- Decommission the Pasveer channels and provide a new reactor with a capacity (9,000 EP for 25 days sludge age) to cater for additional capacity at year 2046.
- Relocate caustic dosing point to dose directly into each IDEA reactor to provide flexibility to vary the dose into each reactor to respond to individual operational requirements. Install pH meters in each IDEA reactor to optimise caustic dosing and performance.
- An additional catch pond may not be necessary depending on the size of new reactor. The objective should be to reduce long hydraulic retention time which increases the risk of algal formation.
- Provide a suitable mechanical dewatering system to prevent excessive sludge build up. Modify the catch pond to suit the capacity of the dewatering system. It may be possible to share a portable dewatering system between Council's STPs.
- Upgrade the filtration system to be capable of achieving effluent TP limits for NorBE and for processing dry weather plant flows.

- Consider replacement of the UV system with a chlorination/dechloriantion system to facilitate disinfection and additionally enhanced TN removal to achieve NorBE compliance. Provide a chlorine contact tank with upstream chlorine and downstream dechlorination dosing systems prior to discharge.

2.3 Mittagong STP

2.3.1 Analysis of Sampling Results

The sampling results for Mittagong STP, along with the corresponding results from the GHD report are presented in Table 2.3 and are compared with the plant design parameters.

Table 2.3: Comparison of influent sewage quality with Mittagong STP design data

Parameter	Units	GHD Strategy Study ("median")[1]	Average (Jan. 2017 sampling)	Mittagong STP Design
ADWF	kL/day	2,184	1,829	3,360
Load	EP	9,100	16,472[2]	14,000
Hydraulic loading	L/EP/day	240	110	240
BOD	mg/L	66	152	267
BODf	mg/L	21	21	-
COD	mg/L	233	455	-
CODf	mg/L	80	108	-
TSS	mg/L	73	237	-
VSS content	mg/L	70	181	-
Reactive P	mg/L	4.9	5.1	-
TP	mg/L	6.5	10.3	10
Ammonia – N	mg/L	45	47.4	-
TN	mg/L	56	69.6	67
pH		7.8		-
Alkalinity	$mgCaCO_3/L$	290	311	-

1 Table3.6 of GHD report.
2 2016 residential plus non-residential EP as calculated in the IWCM

The information from the 72-hour sampling data provided in Table 2.3 indicates that:

- The strength (quality) of the raw sewage is closer to the design raw sewage quality compared to the sampling results presented in the GHD report.
- Influent BOD from repeat sampling is still less than the design BOD but should still likely provide sufficient carbon for denitrification.
- Repeat sampling influent TN and TP is equivalent to design load.
- Repeat sampling influent BOD is approximately 60% of the plant's design raw sewage concentration. Further testing should be undertaken to confirm this given that TN and TP are equivalent to their respective design values.

2.3.2 Population Projections

The equivalent population (EP) was calculated in the Issues Paper using the information provided in the Infoworks sewer model for each sewerage scheme. It is understood that these models were prepared in 2015 and therefore it is expected that the population and flow data would be from the 2013/14 period. The summary of the residential population, non-residential EP and total EP for the Mittagong sewerage scheme are provided in Table 2.4.

Table 2.4: Serviced Equivalent Population projection – Mittagong STP

EP	2011 Census + WSSMP Growth				Forecast extension		
	2016	2021	2026	2031	2036	2041	2046
Residential	13,045	13,772	14,220	14,857	15,417	15,997	16,599
Non-residential	3,200	3,240	3,281	3,322	3,364	3,406	3,449
Sub total	16,245	17,013	17,501	18,179	18,780	19,403	20,048

The recorded flow during the 72-hour sampling and the assessed total 2016 EP for Mittagong resulted in a hydraulic loading of around 110 L/EP/day. This is considered to be too low for design purposes. If a hydraulic loading of around 200 L/EP/d (as estimated for Bowral) were to be considered for design, the current hydraulic capacity of the plant would be sufficient to cater for growth up to 2021.

2.3.3 Review of GHD Findings and Recommendations

The Mittagong STP currently has a design capacity of 14,000 EP and utilizes two IDAL reactors for secondary treatment, chemical phosphorus removal and UV disinfection to treat sewage.

PWA has reviewed the findings and recommendations of the GHD investigation. A detail assessment of this review is provided in Appendix A. The aspects where PWA's recommendations differ from GHD's recommendations, are summarised below:

- The original IDEA reactor was designed for 20 day sludge age. The capacity of the reactor should be re-assessed based on 25 day sludge age which allows for improved nitrification capability and provides more flexibility to vary the MLSS for operational reasons. The capacity of the IDEA reactors would be reduced to approximately 13,500 EP (from 14,000EP) if the plant is operated at 25 days sludge age and 200L/EP/day.
- A new 6,500 EP reactor would provide the additional capacity forecast for 2046 if the plant is operated at 25 days sludge age. The new reactor to include DO control to prevent over aeration and maximise denitrification. An inlet anoxic selector compartment may be required due to relatively low BOD (compared with Bowral and Moss Vale STPs)
- pH correction may be required with increased TN and TP (greater alum dosage) requirements for NorBE compliance. Install caustic storage and dosing facility. Dose caustic directly into each IDEA reactor to provide flexibility to vary the dose into each reactor to respond to individual operational requirements. Install pH meters in each IDEA reactor to optimise caustic dosing and performance.
- An additional catch pond may not be necessary depending on the size of new reactor. The objective should be to reduce long hydraulic retention time which increases the risk of algal formation. Confirm balancing requirements which will be subject to downstream filtration and disinfection capacities.
- Provide a suitable mechanical dewatering system to prevent excessive sludge build up. Modify the catch pond to suit the sizing and the capacity of the dewatering system. It may be possible to share a portable dewatering system between Council's STPs.

- Upgrade the filtration system to be capable of achieving effluent TP limits for NorBE and for processing non-wet weather inflows. Provide a flocculation system with alum dosing upstream of the filters to achieve TP limits for NorBE compliance.
- Consider replacement of UV system with a chlorination/dechloriantion system to facilitate disinfection and enhanced TN removal to achieve NorBE compliance. Provide chlorine contact tank with upstream chlorine dosing and downstream dechlorination system prior to discharge.
- Confirm if additional sludge lagoon storage capacity is required due to potential additional sludge production for greater removal of TP associated with NorBE compliance.

2.4 Moss Vale STP

2.4.1 Analysis of Sampling Results

The sampling results for Moss Vale STP, along with the results in the GHD report are presented in Table 2.5 and are compared with the plant design parameters.

Table 2.5: Comparison of influent sewage quality with Moss Vale STP design data

Parameter	**Units**	**GHD Strategy Study ("median")**[1]	**Average *(Jan. 2017 sampling)***	**Design**
ADWF	kL/day	2,151	1,780	2,160
Load	EP		8,988[2]	9,000
Hydraulic loading	L/EP/day		200	240
BOD	mg/L	110	245	292
BODf	mg/L	58	65	-
COD	mg/L	314	711	-
CODf	mg/L	111	191	-
TSS	mg/L	80	378	-
VSS content	mg/L	80	347	-
Reactive P	mg/L	6.0	5.9	-
TP	mg/L	7.7	10.1	13
Ammonia – N	mg/L	41	48.3	-
TN	mg/L	47	65.2	67
pH		7.3	7.6	-
Alkalinity	mg$CaCO_3$/L	243	316	-

1 Table3.6 of GHD report.
2 2016 residential plus non-residential EP as calculated in the IWCM

The information from the 72-hour sampling data provided in Table 2.5 indicates that:

- The strength (quality) of the raw sewage is closer to the design raw sewage quality compared to the sampling results presented in the GHD report.
- Influent BOD from repeat sampling is still less than the design BOD but should still likely provide sufficient carbon for denitrification.
- Repeat sampling influent TN is equivalent to design load.

- Repeat sampling influent TP is approximately 75% of design load. Therefore alum usage and sludge production will be less than design usage and sludge production.

2.4.2 Population Projections

The equivalent population (EP) was calculated in the Issues Paper using the information provided in the Infoworks sewer model for each sewerage scheme. It is understood that these models were prepared in 2015 and therefore it is expected that the population and flow data would be from the 2013/14 period. The summary of the residential population, non-residential EP and total EP for the Moss Vale sewerage scheme are provided in **Table 2.6**.

Table 2.6: Serviced Equivalent Population projection – Moss Vale STP

EP	2011 Census + WSSMP Growth				Forecast extension		
	2016	**2021**	**2026**	**2031**	**2036**	**2041**	**2046**
Residential	7,711	8,888	9,662	10,427	10,799	11,186	11,586
Non-residential	846	856	867	878	889	900	912
MVEC	4,372	8,952	13,574	18,195	18,192	18,189	18,185
Sub total	**12,928**	**18,696**	**24,103**	**29,500**	**29,880**	**30,275**	**30,683**

The recorded flow during the 72-hour sampling and the assessed total 2016 EP for Moss Vale resulted in a hydraulic loading of around 200 L/EP/day. If a hydraulic loading of around 200 L/EP/d were to be considered for design, the current hydraulic capacity of the plant would be sufficient to cover growth until around 2031, without considering the development of the Moss Vale Enterprise Corridor (MVEC).

2.4.3 Review of GHD Findings and Recommendations

Moss Vale STP has a design capacity of 9,000 EP and utilizes two IDEA reactors for secondary treatment, chemical phosphorus removal and UV disinfection to treat sewage. Treated effluent is discharged to Whites Creek.

PWA has reviewed the findings and recommendations of the GHD investigation. A detail assessment of this review is provided in Appendix A. The aspects where PWA's recommendations differ from GHD's recommendations, are summarised below:

- The original IDEA reactor was designed for 20 day sludge age. The capacity of the reactor should be re-assessed based on a 25 day sludge age which allows for improved nitrification capability and provides more flexibility to vary the MLSS for operational reasons. The capacity of the IDEA reactors would be approximately 7,200 EP (from 9,000EP) if the plant is operated at 25 days sludge age and 240L/EP/day
- The capacity upgrade would be provided in two stages. In Stage 1 constructing a new 12,400 EP reactor would provide a total capacity of 19,600 EP which would cater for the loads up to 2023. In Stage 2, providing an additional 12,400 EP reactor would provide a total capacity of 32,000 EP which would cater for the loads up to 2046. The new reactors are to include DO control to prevent over aeration and maximise denitrification.
- pH correction maybe required with increased TN and TP (greater alum dosage) requirements for NorBE compliance. Install caustic storage and dosing facility. Dose caustic directly into each IDEA reactor to provide flexibility to vary the dose into each reactor to respond to individual operational requirements. Install pH meters in each IDEA reactor to optimise caustic dosing and performance.
- An additional catch pond may not be necessary depending on the size of new reactor. The objective should be to reduce long hydraulic retention time which increases the risk of algal

formation. Confirm balancing requirements which will be subject to downstream filtration and disinfection capacities.

- Provide a suitable mechanical dewatering system to prevent excessive sludge build up. Modify the catch pond to suit the capacity of the dewatering system. It may be possible to share a portable dewatering system between Council's STPs.
- Upgrade the filtration system to be capable of achieving effluent TP limits for NorBE and for processing dry weather plant flows. Provide a flocculation system with alum dosing upstream of the filters to achieve TP limits for NorBE compliance.
- Consider replacement of UV system with a chlorination/dechloriantion system to facilitate disinfection and enhanced TN removal to achieve NorBE compliance. Provide chlorine contact tank with upstream chlorine dosing and downstream dechlorination system prior to discharge.
- Additional sludge lagoon storage capacity will be required due to potential additional sludge production for greater removal of TP associated with NorBE compliance.

2.5 Common STP

Public Works Advisory (PWA) evaluated the option of constructing a common STP to treat sewage from Berrima, Bowral and Moss Vale with a view to including this option in Council's IWCM Scenarios.

The plant would be constructed in two stages. In Stage 1 a 34,000 EP plant would be constructed with an average dry weather flow (ADWF) of 8,000 kL/day. In Stage 2 the plant capacity would be augmented to 51,000 EP for a total ADWF of 12,000 kL/day. This upgrade could be in 2020 if the Moss Vale Enterprise Corridor (MVEC) develops as nominated in the IWCM, or as late as 2025 or later if developed at half or lower than the nominated rate.

As the common STP would be a new construction replacing three plants which produce different effluent qualities, it is not clear how the effluent requirements would be evaluated with respect to the NorBE requirements. This aspect would need to be investigated further during detail studies.

<u>Site Options</u>

The MVEC, and the current Berrima and Moss Vale STP sites were evaluated as locations for the common STP. The proposed plant would require an area of approximately 10 Ha with possibility to fit on a 9 Ha lot if site issues allow for close placement of processes. Council does not own any land at the MVEC.

At the Berrima STP, the adjacent lot is owned by Boral Concrete and Council will proceed to acquire an area of this land. The back of the current Moss Vale plant was earmarked for expansion and therefore the process needs to be designed appropriately to minimise emissions. Also a lot of Moss Vale STP site has screenings and biosolids in the ground, and this will need to be moved which will be an added cost. Additional land would also need to be acquired at Moss Vale STP to accommodate the new STP.

<u>Sewage Transport System</u>

Sewage transport systems for all the site options were assessed. Raw sewage from each catchment would be pumped to the Common STP at a rate of 7 times the 2046 projected ADWF. Any flows from the catchment above 7 times ADWF would be balanced locally at the respective STP sites. The present value cost analysis showed that the lowest annual operating cost and present value cost for the sewage transport system is when the common STP is located at the Moss Vale STP site. This is mainly due to not having to pump the influent from Moss Vale which will contribute the largest load.

<u>Cost Estimates</u>

The STP was sized and costed based on the IDEA process. The capital, operating and maintenance and total present value costs are presented in Table S1. The costs do not include cost of land acquisition and are based on the Moss Vale STP site option, which is the preferred site options based on the present value cost analysis.

Table S1: Cost estimate for common sewage treatment scheme

Item	Cost ($K)
Transport System	
Capital cost	$16,137
Annual O&M Cost	$625
30-year Present Value O&M Cost@7%	$8,301
30-year Total Present Value Cost@7%	**$24,438**
Common STP	
Capital cost	$113,677
30-year Present Value Capital Cost@7%	$91,570
Annual O&M Cost	$2,461
30-year Present Value O&M Cost@7%	$29,152
30-year Total Present Value Cost@7%	**$120,722**
Total Cost – Transport plus STP	
30-year Present Value Capital Cost@7%	**$107,707**
30-year Total Present Value Cost@7%	**$145,160**

2.6 Effluent Quality and NorBE Assessment

2.6.1 Effluent License Limits

Effluent concentration limits for licensing are generally set based on the Accepted Modern Technology (AMT) criterion. The use of AMT concentration limits as 100 percentiles or an absolute limit means that any sample testing above the AMT concentration will potentially allow prosecution under the POEO Act.

Design limits/targets for STPs are rarely stated in absolute limits. This is due to a range of factors and recognises that a range of results is achieved in operation. Variation in performance can be attributed to a number of factors. The collection system is distributed through the community and potentially subject to variations in load from sources such as liquid trade waste, illegal discharges, inflow and infiltration. The consequence is that variation in performance of an STP is not unexpected and is due to activity in the catchment, seasonal variations and temperature. Consequently, AMT concentration limits are more appropriately applied as 90^{th} percentile limits for licencing.

The GHD report has assessed the following factors when reviewing the effluent quality discharge criteria:

- Current licence conditions;
- Benchmarking with comparable treatment plants in the same region;
- Limitation of treatment processes; and
- Potential recycled water applications.

The above discussion should be considered when negotiating effluent license limits with the EPA.

2.6.2 NorBE Assessment

The State Environmental Planning Policy (SEPP) Sydney Drinking Water Catchment requires that all proposed development in the Greater Sydney drinking water catchment to have a neutral or beneficial effect on water quality (NorBE) which requires much more stringent effluent quality requirements for Council's STPs. For example, if the plant flow volumes were to double (due to increased plant loads from new development) then the nutrient concentrations in the effluent would need to be halved from its current value in order to maintain (neutral) or reduce (beneficial) the current impact (evaluated in term of mass of nutrient) on the receiving waters.

Two strategies could be considered to progress towards achieving NorBE compliance for the STP augmentations. These are:

- Effluent reuse for irrigation thereby reducing the discharge volume and consequently the contaminant load
- Achieving the required higher quality effluent through process optimisation, and/or including additional treatment units.

These strategies are discussed further below.

Effluent Reuse by Irrigation

The capacity to utilise effluent for irrigation is limited by the relatively cool and wet climate in the Shire. A preliminary analysis was undertaken to estimate the area of land required to be irrigated to achieve 100 percent or 50 percent effluent reuse. Figure 2-1 provides a graph of the annual irrigation demand for the period analysed.

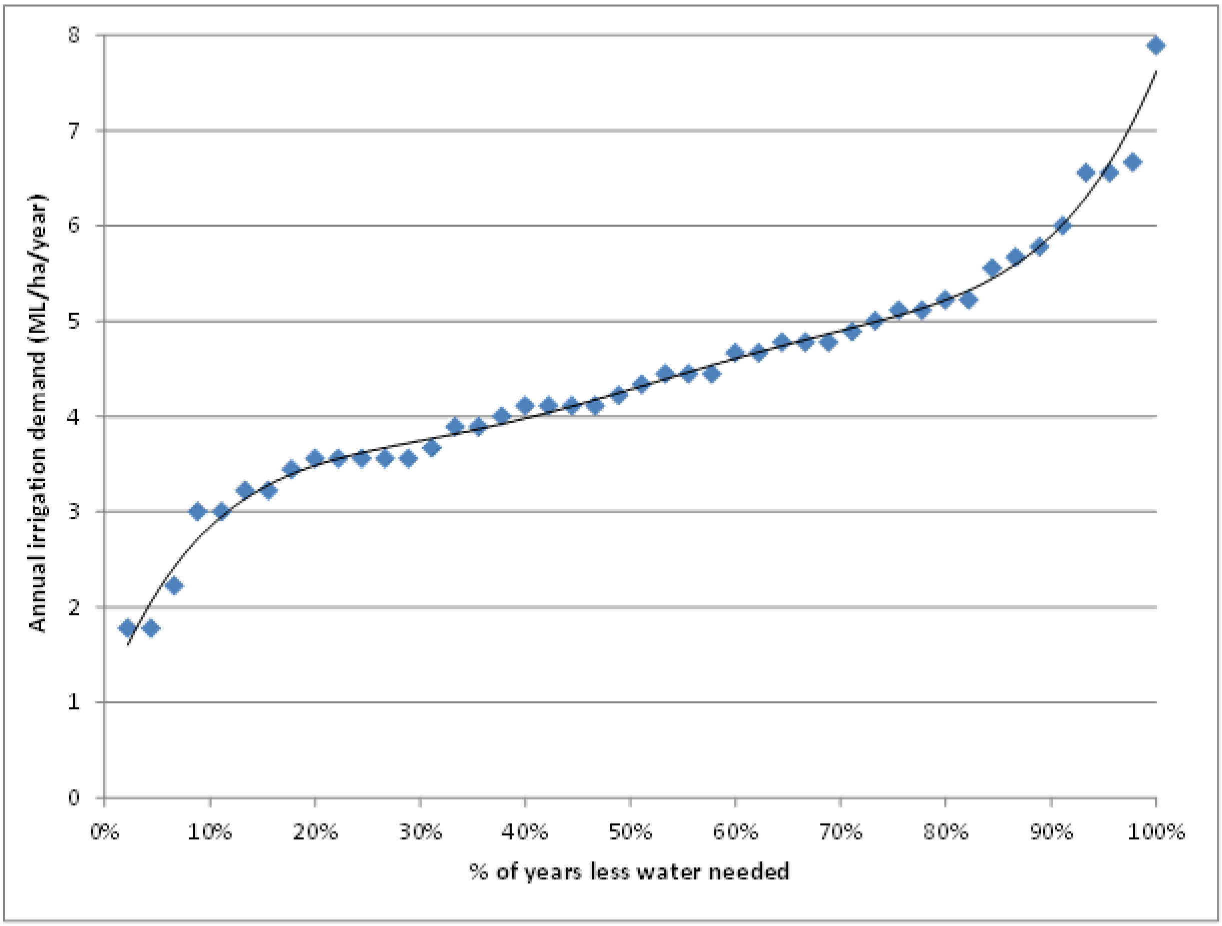

Figure 2-1: Annual irrigation demand for period of analysis

The graph shows that 10 percent of the years have an annual irrigation demand of greater than 6 ML/ha/year. This analysis was tested for the Moss Vale STP data. A continuous dataset, from 01/05/2011 to 30/04/2014, was available for Moss Vale STP. The results of the analysis of this data are presented in Table 2.7. The irrigation year percentile is the percentage of years the irrigation demand is lower than that stated, and is based on rainfall and evaporation.

Table 2.7: Analysis of annual irrigation demand in Moss Vale

Year ending	STP inflow (ML/year)	Irrigation demand (ML/ha/year)	Irrigation year (percentile)	Irrigation area for 50 % reuse (Ha)	Irrigation area for 100 % reuse (Ha)
30/04/2012	1,211.0	2.00	2.73	303	605
30/04/2013	972.4	4.67	58.37	104	208
30/04/2014	975.7	5.00	68.36	98	195
Average		4.40	50.00		

Table 2.7 shows the large irrigation area required to achieve 50 percent and 100 percent effluent reuse during very wet and also relatively dry years. In addition to the availability of land, the construction of seasonal storage also needs to be considered as due to the cold climate the irrigation demand is mainly during summer. For the Southern Highland's region, an indicative storage requirement would be expected to be 5 months of ADWF or even higher. For Moss Vale this would correspond to a storage volume of about 325 ML.

The above analysis confirms the previous claims that effluent reuse is unlikely to be a feasible strategy for achieving NorBE compliance.

Process Optimisation and Additional Treatment

Process optimisation and/or additional treatment would be required to produce a higher quality effluent to achieve NorBE compliance. When assessing further treatment the following needs to be considered:

- The cost and complexity of the additional treatment.
- The possible need to achieve further improvements in effluent quality to meet NorBE requirements arising out of other potential future upgrades.

PWA has proposed the following treatment to achieve NorBE compliance:

Total Phosphorous

- Optimised chemical dosing which includes coagulation and pH correction followed by flocculation.
- Improved filtration systems to remove the coagulated sludge.

Total Nitrogen

- Breakpoint chlorination for chemical oxidation of effluent ammonia which may remove the requirements for a UV system.
- Dechlorination prior to discharge.

2.7 Review of Cost Estimates

PWA reviewed the cost estimates provided by GHD. A comparison of the GDH cost estimates and PWA cost estimates, with comments on the differences, are provided in Table 2.8.

Table 2.8: Comparison between GHD cost estimates and PWA cost estimates

STP	Ultimate 30-year EP		Cost – no NorBE ($M)		Comments	Cost – with NorBE ($M)		Comments
	PWA	GHD	PWA	GHD		PWA	GHD	
Bowral	Upgrade by 10,000 to 19,000	Upgrade by 8,500	29.3	26.9	PWA upgrade >GHD upgrade by 1,500 EP due to derating of existing plant to achieve nutrient removal	34.0	32.6	PWA allowance for chlorination/dechlorination to meet NorBE
Mittagong	Upgrade by 5,000 to 18,500	Upgrade by 7,000	19.3	24.9	PWA upgrade less than GHD upgrade by 2,000 EP. GHD cost of $9.7M for 7,000 EP secondary treatment considered too high.	23.3	28	PWA upgrade less than GHD upgrade by 2,000 EP. GHD cost of $M9.7 for 7,000 EP secondary treatment considered too high
Moss Vale – Stage 1	Upgrade by 12,400 to 19,600	Upgrade by 4,500 to 13,500	24.2	24.9	GHD price of $6.4M for a 4500 EP secondary treatment is considered high	30.1	28.33	GHD price of $6.4M for a 4500 EP secondary treatment is considered high
Moss Vale – Stage 2	Upgrade by 12,400 to 32,000	Upgrade by 13,500 to 27,000	19.5	22.4	GHD upgrade greater by 1,000 EP. GHD price of $11M for a 13,500 EP secondary treatment is considered high.	25.7	26.6	GHD upgrade greater by 1,000 EP. GHD price of $11M for a 13,500 EP secondary treatment is considered high.

2.8 Sewerage Scheme Supply Scenarios

Based on the above review, three Shire Wide water supply Scenarios could be considered. These are outlined in

Table 2.9: Shire Wide water supply scenarios with MVEC demands

Scenario	Bowral STP	Moss Vale STP[1]	Mittagong STP	NorBE Compliance
1	Upgrade to 19,000 EP (upfront)	Stage 1 – Upgrade to 19,600 EP. Stage 2 – Upgrade to 32,000 EP in 2031.	Process optimisation upfront with capacity upgrade to 18,500 EP in 2022	No
2	Upgrade to 19,000 EP (upfront)	Stage 1 – Upgrade to 19,600 EP. Stage 2 – Upgrade to 32,000 EP in 2031.	Process optimisation upfront with capacity upgrade to 18,500 EP in 2022	Yes
3	Construct new common STP for Berrima, Bowral and Moss Vale Stage 1 – 34,000 EP Stage 2 – 51,000 EP in 2031		Process optimisation upfront with capacity upgrade to 18,500 EP in 2022	Yes

Note 1: Capacity and staging of Moss Vale STP to be confirmed following review of developments in Moss Vale Enterprise Corridor.

3 Water Supply Schemes

3.1 Overview

There are water supply schemes at Bundanoon, Medway and Wingecarribee, each with its own water treatment plant (WTP). The IWCM Issues Paper identified that by 2031 the Peak Day Demand (PDD) for the Shire is predicted to be very close to the combined production capacities of the three WTPs. Therefore the main objective of the water supply options assessment is to identify which WTP should be upgraded and/or augmented, and the 'right size' and year of the augmentation.

3.2 Medway WTP

WSC engaged GHD to assess options for the continued use of Medway WTP (report attached in Appendix B), three options were considered. These were:

- Option 1 – upgrade and retain Medway WTP to deliver 500 ML/year
- Option 2 – Decommission Medway WTP and supply from Wingecarribee WTP
- Option 3 – Minimum upgrade to Medway WTP so it can supply 100 ML/year with the balance supplied from Wingecarribee WTP
- Option 4 – Bring the Medway WTP back into operation with minimum upgrade work to supply around 400 ML/year

Whereas the WTP capacity is determined in order to meet Peak Day Demand, it is noted that the GHD options study identifies options based on annual production. In addition the options assessment also needs to take into account the avoided costs to Council through reduced extraction from Wingecarribee dam, reduced operating cost of Medway WTP and the time of use power tariff.

GHD undertook a risk assessment workshop with Council to identify the risks for each option. The main risk in decommissioning Medway WTP was the loss of flexibility of supply to the schemes when there is no supply from Wingecarribee WTP. The study found two main issues that could affect the reliability of supply from Wingecarribee WTP. These are:

- Power failure at Wingecarribee WTP
- Reliability of the supply mains from the WTP, especially the main between the Evans Lane booster pumping station and Hopewood reservoir.

These issues are being addressed by Council as follows:

<u>Power failure</u>

Council is currently undertaking an investigation to determine what units of the plant would need to be operated by a generator in the event of a power failure. The results of this investigation would be used to design a standby generator that would be procured for the Wingecarribee WTP.

<u>Reliability of supply main from Evans Lane booster pumping station and Hopewood reservoir</u>

Council has undertaken an assessment of this main and has found it to be in good condition. The system also has an ability to respond in the form of redundancy and network storage, in the event of a break.

In addition to the above issues Council will consider further projects to mitigate the risks to the operation of Wingecarribee WTP.

Council undertook a catchment to tap risk assessment of the Wingecarribee dam with WaterNSW and the outcomes are included in ………… Council meets quarterly with WaterNSW to review and manage any risks to within the catchment that could impact on water quality.

3.3 WTP Source Management

The Water Master Plan prepared by Council provided a review of some items of the WTP Source Management situation. The following components of WTP source management were examined:

Transfer availability and capacity from the Bundanoon WTP to the Moss Vale system.

- Ability of the Wingecarribee system (in conjunction with Bundanoon Creek WTP) to meet the demand of the entire WSC water supply system without contribution from the Medway WTP
- Any capital works required to support supply of the WSC system without Medway WTP
- Ability of the Medway and Bundanoon WTPs to meet system demand with limited production from Wingecarribee WTP

The Master Plan showed that the ability of the Bundanoon WTP to provide water to the Moss Vale area is limited by a number of factors. These being:

- Bundanoon WTP continuous treatment capacity
- Bundanoon WTP CWT capacity and water pumping station capacity
- Werai Balance Tank capacity and Werai water pumping station capacity
- Capacity of transfer mains from the Exeter / Bundanoon system to the Moss Vale system

The study showed that it seems reasonable to adopt a transfer capacity of 4.0 ML/d as the stated capacity of the existing Exeter / Bundanoon to Moss Vale transfer system. This capacity has been used by PWA when analysing the supply strategy of all three water treatment plants.

3.4 Extension of Bundanoon WTP Service Area

PWA reviewed the system supply to meet PDD with and without Medway WTP. This includes the extension of the Bundanoon WTP supply zone with a maximum transfer capacity of 4 ML/d from Exeter/ Bundanoon to supply Moss Vale and New Berrima. If the Bundanoon WTP service area is to be extended to include Moss Vale and New Berrima, the following issues would need to be considered:

<u>Capacity of transfer system from Werai Balance Tank to Exeter Reservoir</u>

The Bundanoon WTP and transfer system to Werai balance tank has a capacity of 120 L/s (10 ML/d). However the transfer system from Werai balance tank to Exeter reservoir is constrained (estimated at 8 ML/d) which means that the maximum production capacity cannot be transferred from Werai balance tank to Exeter reservoir. Council is currently upgrading the pumps but it is believed that the flow may be constrained by the capacity of the pipeline. There are two pressure gauges on the pump discharge but these provide different readings.

<u>Turnover of Moss Vale reservoirs</u>

The elevation at Exeter reservoir is roughly 764 m, whereas the elevation of the Hill Road and Blakes Hill reservoirs at Moss Vale are at about 743 m. Supply from Exeter to Moss Vale reservoirs is via the reticulation, and the difference in elevation would mean little contribution from Moss Vale reservoirs to the supply, resulting in poor reservoir turnover. Appropriate zoning would be required to overcome this problem.

<u>Low residual chlorine at Berrima and New Berrima</u>

Berrima (1,100) and New Berrima (500) are small communities with small demands and chlorine levels in these reticulation systems drop in winter due to poor turnover. A suggested option is to combine New Berrima with the Berrima system to make it a larger system that can have a higher turnover during off-peak seasons. It is understood that valving arrangements exist to combine these systems. If this is done then New Berrima will continue to be supplied from Wingecarribee WTP and not become part of the extended Bundanoon WTP service area.

Proposed Bundanoon Service Area

Information on the WTP production requirements during the summer of 2017 was obtained. The Peak Day Demand (PDD) for the individual WTPs occurred on different days. The Wingecarribee WTP PDD of 27.2 ML occurred on 30th January, and the Bundanoon WTP PDD of 4.3 ML occurred on 6th of February. The highest total PDD on 30th January and was 29.3 ML. The Figures show the estimated 2017 Peak Day Demands for Bundanoon, Medway and Wingecarribee supply areas to be 6, 4 and 23 ML/d respectively without the MVEC. The estimated PDD (27 ML) for the Wingecarribee and Medway system is very close to that experienced, whereas the estimated Bundanoon system PDD is more than that experienced in 2017.

3.5 Water Treatment Plants' capacity augmentation

The actual 2017 and estimated peak day demands for the current Wingecarribee and Bundanoon supply area, and for Moss Vale that is proposed to be supplied from Bundanoon, are listed in Table 3.1.

Table 3.1: Peak Day Demands for current and Bundanoon WTP supply areas

Service area	Actual 2017 PDD (ML)	Estimated PDD (ML)	Plant Capacity (M/d)
Wingecarribee	-	24.0	40
Wingecarribee + Medway	27.2	28.0	
Bundanoon	4.3	6.5	10
Moss Vale 2031 (without MVEC)	-	5.0	

With a lower than expected PDD at Bundanoon in 2017, the plant would still have some spare capacity. With an existing capacity of 4.0 ML/d for the transfer system from Bundanoon to Moss Vale, it would be possible to supply about 2 to 3 ML/d to Moss Vale from the Bundanoon WTP.

Graphs showing the WTP capacity and PDD of the supply area are provided in Figure 3-1, Figure 3-2, Figure 3-3, and Figure 3-4.

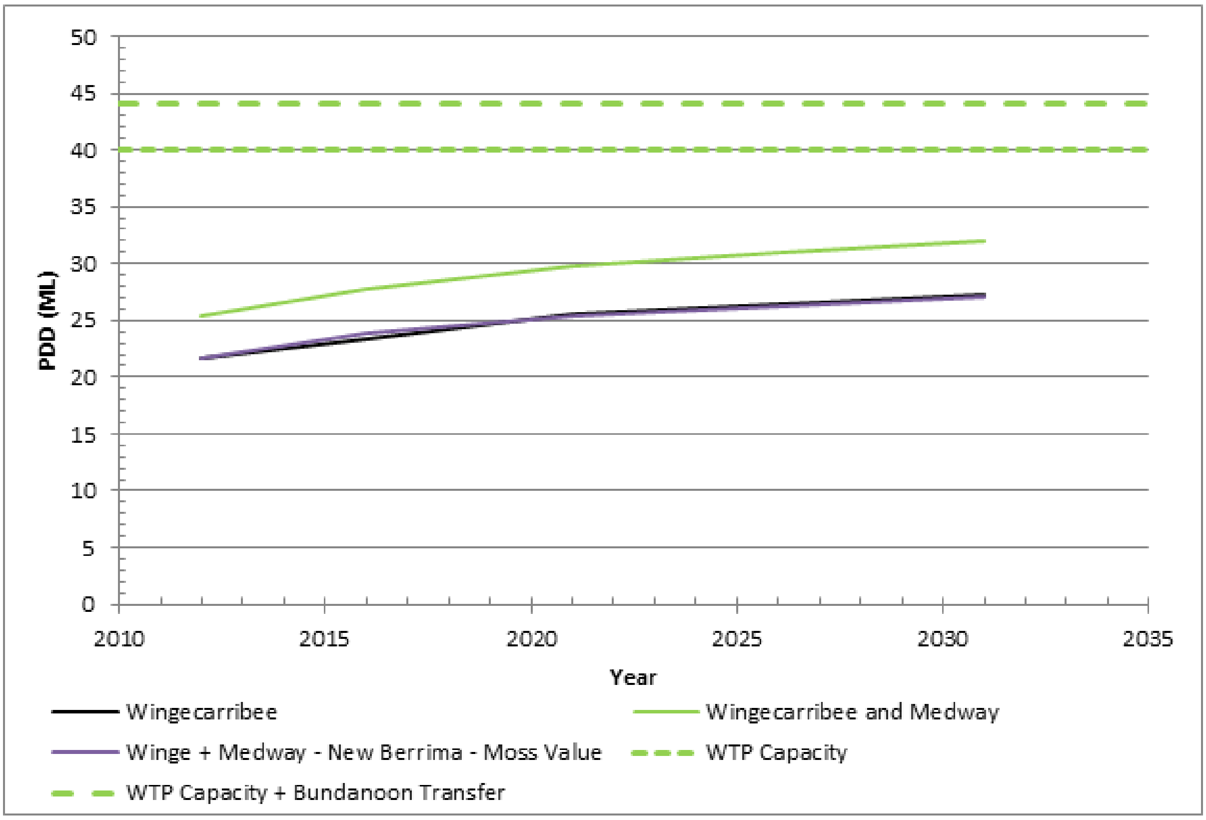

Figure 3-1: Wingecarribee PDD and WTP capacity with and without Medway, New Berrima and Moss Vale (without MVEC demands)

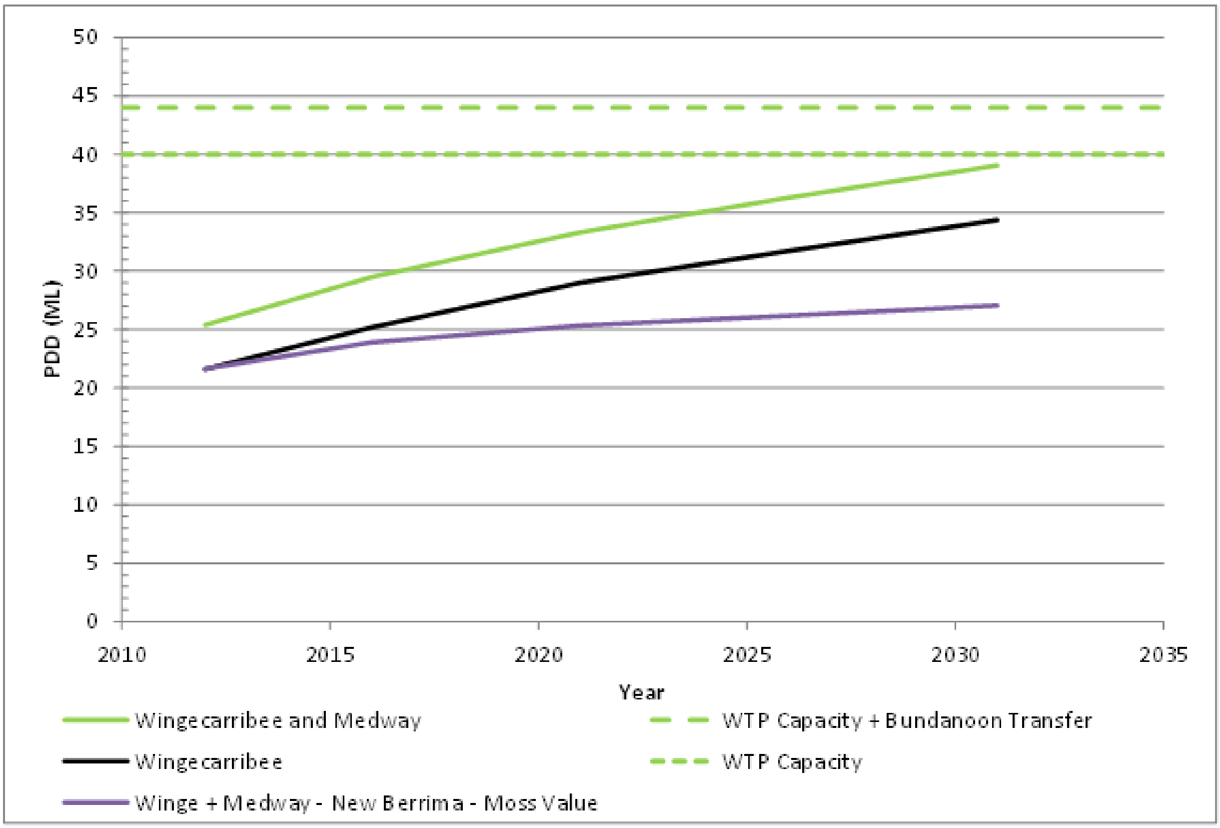

Figure 3-2: Wingecarribee PDD and WTP capacity with and without Medway, New Berrima and Moss Vale (with MVEC demands)

Figure 3-3: Bundanoon PDD & WTP Capacity with and without transfer to New Berrima and Moss Vale

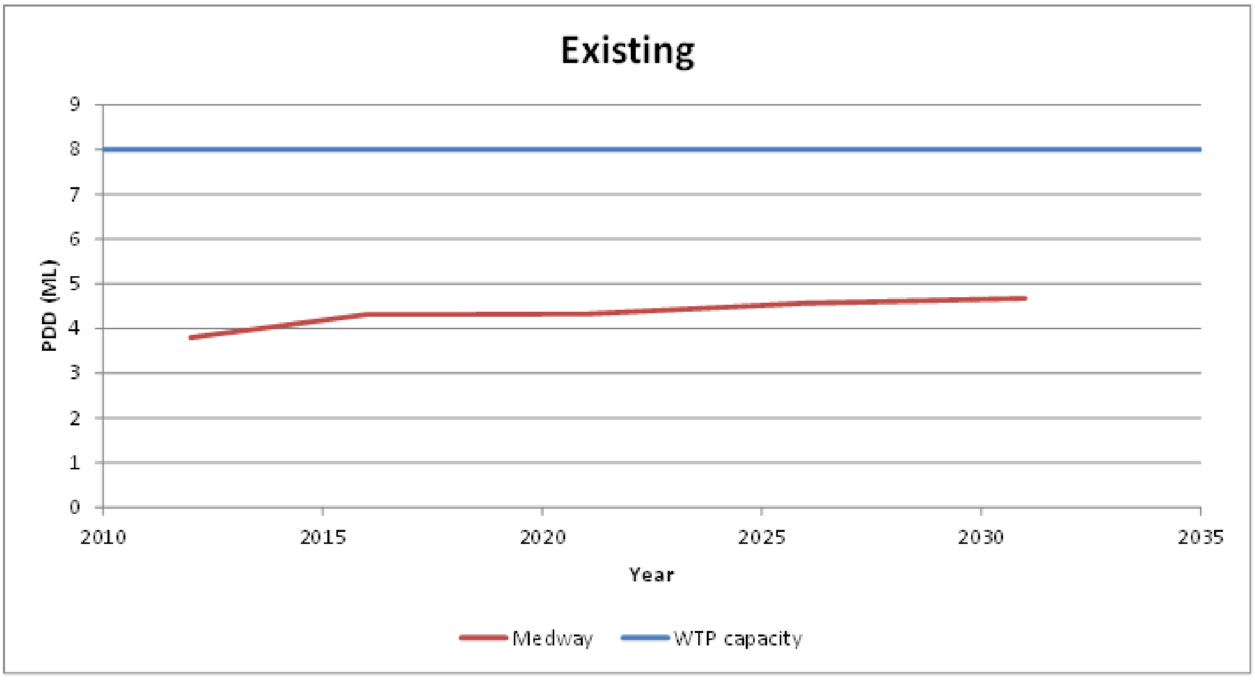

Figure 3-4: Medway PDD and WTP Capacity

For each supply combination, the year of augmentation for the Wingecarribee and Bundanoon WTPs were identified. The results are presented in Table 3.2.

Table 3.2: Year of augmentation for Wingecarribee and Bundanoon WTPs for different PDD supply options with MVEC demands

Medway WTP operational	Moss Vale and New Berrima Supply from Bundanoon (ML/d)	Medway Supply from Wingecarribee WTP	Wingecarribee WTP augmentation	Bundanoon WTP augmentation
Yes	0	No	2040	No
Yes	4	No	No[2]	2017
Yes	2	No	No[1]	2027
No	0	Yes	2032	No
No	4	Yes	No[1]	2017
No	2	Yes	2045	2027

Note 1: Not in this planning horizon.

<u>Moss Vale Enterprise Corridor (MVEC)</u>

As can be seen from Figure 3-1 and Figure 3-2, the development of the MVEC will have a significant impact on the capacity and augmentation requirements identified in Table 3.2. Without the MVEC demands or with demands much lower than estimated, the augmentation of the Wingecarribee and/or the Bundanoon WTPs may be deferred beyond this 30-year planning horizon.

3.6 Water Supply Scenarios

Based on the above review, three Shire Wide water supply Scenarios could be considered. These are outlined in Table 3.3. the water supply zones for the three scenarios are shown in Table 3.3.

Table 3.3: Shire Wide water supply scenarios with MVEC demands

Scenario	Moss Vale and New Berrima Supply from Bundanoon (ML/d)[1]	Medway Supply from Wingecarribee WTP	Wingecarribee WTP augmentation	Bundanoon WTP augmentation
1	0	No	2041	No
2	0	Yes	2031	No
3	2 to 3	Yes	No[2]	2020 – 2030[(1)]

Note 1: Bundanoon system PDD experienced in 2017 was less than that estimated for 2017. Hence there may be more spare capacity than expected in the Bundanoon WTP.

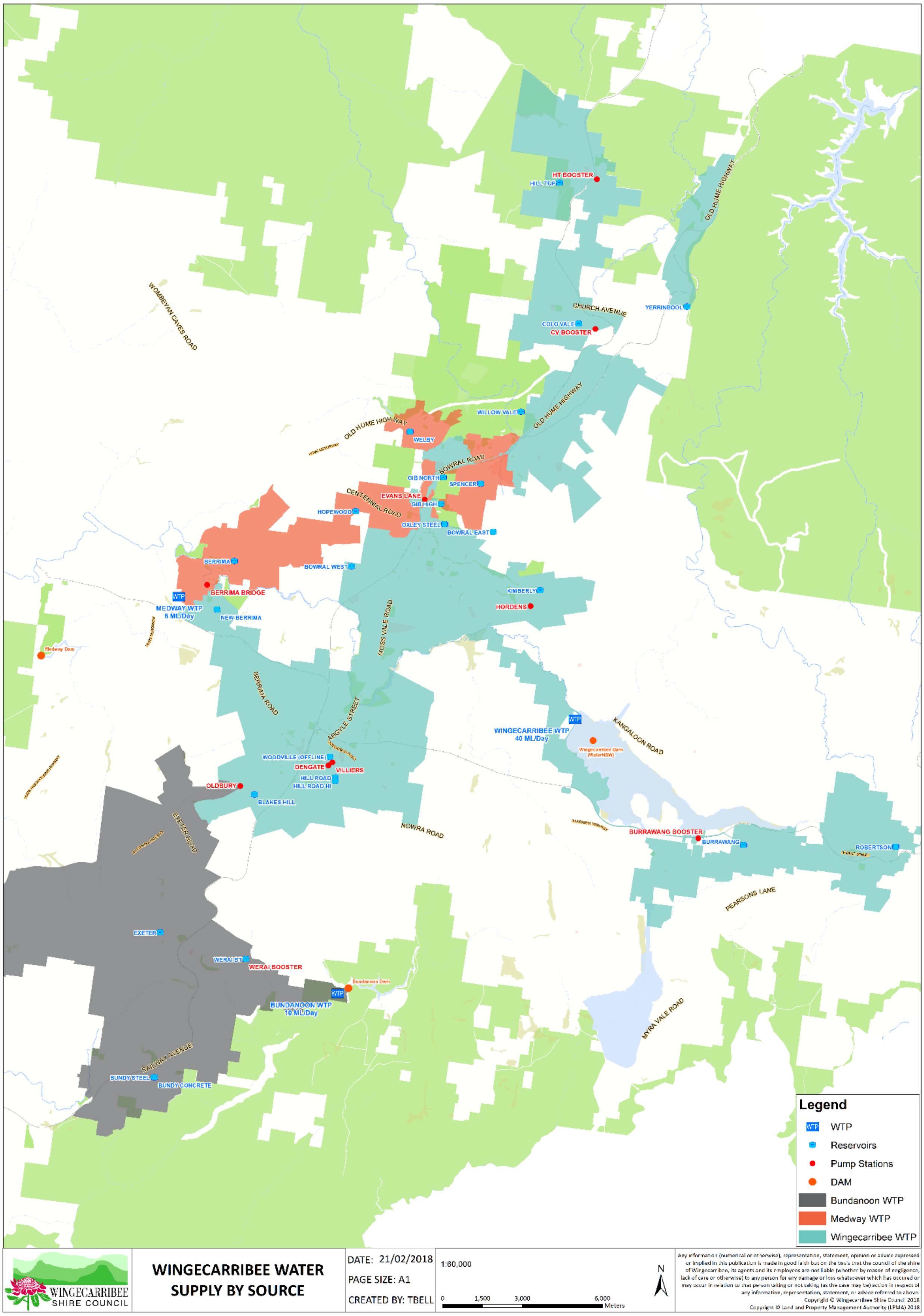

Figure 5: Water supply scenario 1 – retain all three plants

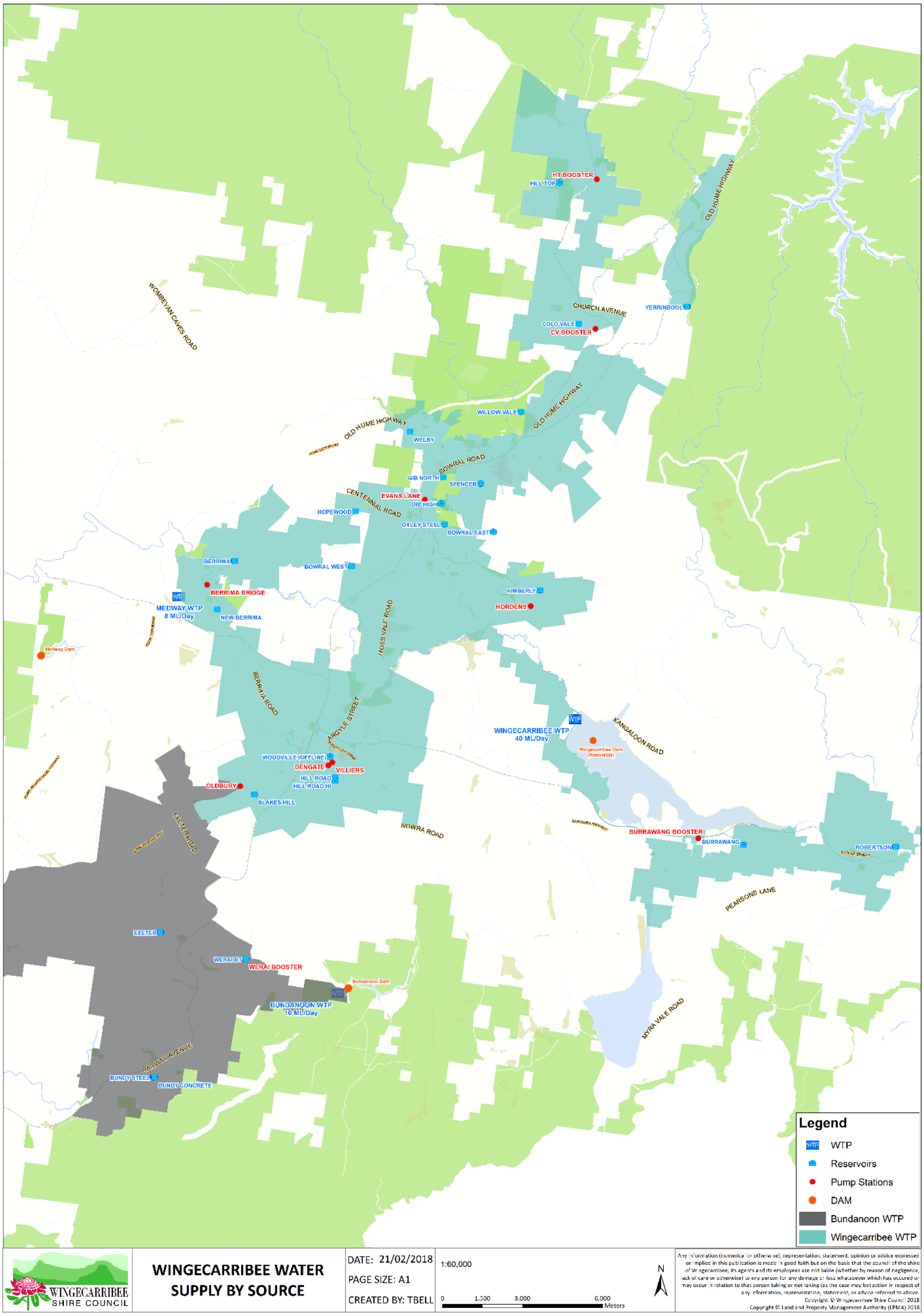

Figure 6: Water supply scenario 2 – Supply Medway zone from Wingecarribee WTP

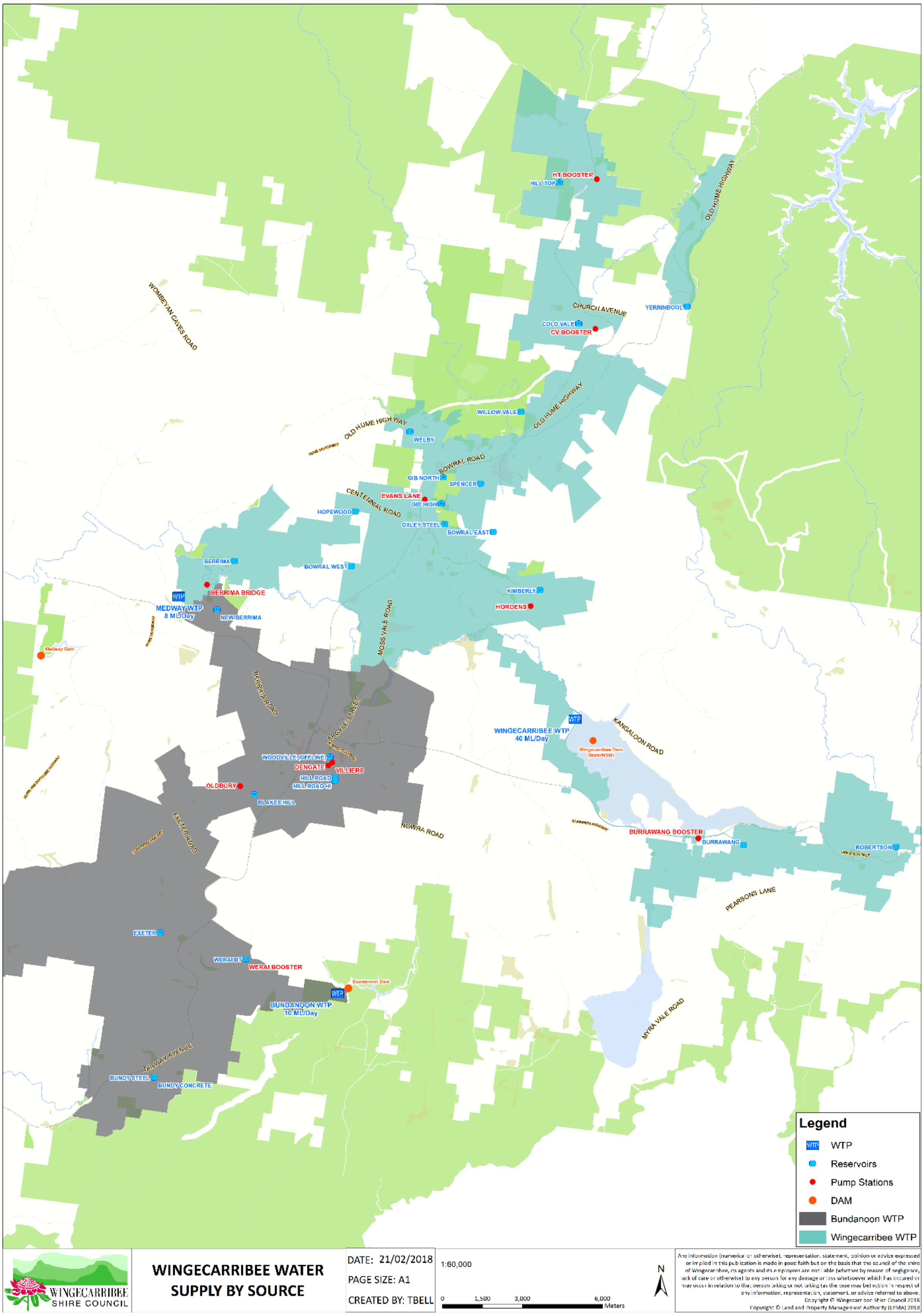

Figure 7: Water supply scenario 3 – Supply Medway zone from Wingecarribee WTP and extend Bundanoon supply area

Appendices

A.1 Bowral STP Review

Process unit	GHD Upgrade Strategy	PWA Comments	PWA Upgrade Strategy
Inlet works	Increase screening capacity and provide grit removal system		New inlet works complete with grit removal facilities
Secondary treatment systems (ie IDEA and Pasveer Channels)	Decommission Pasveer Channels. Build new IDEA reactor (Noted: that capacity of IDEA reactor was assessed to be less than 10600EP	The IDEA is designed to treat the 10600EP design load at 20 days sludge age at ADWF. The quality of the effluent Pasveer Channels at design load is unlikely to be as good as the quality of effluent from the IDEA reactor. There is also an increased risk of scouring from the Pasveer due to the reactor being shallower.	The original IDEA reactor was designed for 20 day sludge age. The capacity of the reactor to be re-assessed based on a 25 day sludge age which allows for improved nitrification capability. The new reactor provide the remaining capacity up to year 2036.
Alum system	Provide additional storage	Concur	Provide additional storage to allow for the additional capacity required to treat design load and to account for what appears to be greater than design, influent TP
Caustic system	Provide additional storage and relocate dosing point to flow splitter	Prefer to relocate dosing point into each reactor with provision of pH meters into each reactor for greater flexibility and pH control optimisation.	Relocate caustic dosing point to dose directly into each IDEA reactor. Install pH meters in each IDEA reactor to optimise caustic dosing.
Catch/balance pond	Construct new (additional) catch pond to operate in parallel with existing catchpond.	An additional catchpond may not be necessary depending on size of new reactor. Existing reactor has very long hydraulic retention time (HRT) which makes it more susceptible to algae formation. Should aim to reduce HRT.	Provide a suitable mechanical dewatering system to prevent excessive sludge build up. Modify the catchpond to suit the dewatering system.
Filtration system	Retain existing filtration system and overflow excess	Filtration system should be upgraded to system capable of achieving	Upgrade filters. Note the sludge storage facilities will also have to be

Process unit	GHD Upgrade Strategy	PWA Comments	PWA Upgrade Strategy
	secondary treated effluent to old tertiary pond.	effluent TP limits for NorBE and for processing non-wet weather inflows,	upgraded to accommodate additional solids capture.
UV disinfection	Upgrade UV system for full treatment of peak dry weather diurnal flows	UV disinfection may not be necessary if breakpoint chlorination/ dechlorination is implemented to meet effluent TN NorBe requirements.	Consider replacement of UV system with a chorination/ dechloriantion system to facilitate disinfection and TN removal (for NorBE purposes).
Chlorination/ Dechlorination	Not considered	May be required to comply with NorBe TN removal requirements. If this is required, UV system may not be necessary.	Provide chlorine contact tank with upstream chlorine dosing and downstream dechlorination system prior to discharge.
Sludge stabilisation	Build additional sludge lagoons to cater for projected loads	Concur	Build additional sludge lagoons.
Sludge dewatering	Build additional sludge drying beds or consider mechanical dewatering	Mechanical dewatering system prefer over sludge drying beds due to reduced footprint and possible wet climate .	Consider mechanical dewatering system. It may be possible to share a portable dewatering system between Council's STPs.

A.2 Mittagong STP Review

Process unit	GHD Upgrade Strategy	PWS Comments	PWA Upgrade Strategy to meets year 2036 loads
Inlet works	Increase screening capacity and provide grit removal system	Concur	New inlet works complete with grit removal facilities
Secondary treatment systems	Build 3rd IDEA reactor 6,000EP to 7,000 EP capacity with upstream selector	Concur with requirements for new reactor	The original IDEA reactor were designed for a 20 day sludge. The capacity of the reactor to be rerated based on a 25 day sludge age which allows for improved nitrification capability. The new reactor provide the remaining capacity up to year 2036. New reactor to include DO

Process unit	GHD Upgrade Strategy	PWS Comments	PWA Upgrade Strategy to meets year 2036 loads
			control to prevent over aeration and maximise denitrification. Selector may be required due to relatively low BOD (compared with Bowral and Moss Vale STPs)_
Alum system	Provide additional storage	Concur	Provide additional storage to allow for the additional capacity. Install flocculation system downstream of secondary dose (ie. in clarification tank)
pH correction	No comment	pH correction maybe required with increase TN and TP (greater alum dosage) requirements for NorBe compliance	Install caustic storage and dosing facility. Dose directly into each IDEA reactor. Install pH meters in each IDEA reactor to optimise dosing.
Clarification (catch/balance) pond	Construct new (additional) clarification to operate in parallel with existing clarification.	An additional catchpond may not be necessary depending on size of new reactor. Existing reactor has very long hydraulic retention time which makes it more susceptible to algae formation. Should aim to reduce HRT.	Confirm catch/balancing requirement which will be subject to downstream filtration and disinfection capacities. Install a flocculation system upstream of or inside the clarification pond to maximise solids capture.
Filtration system	Retain existing filtration system and overflow whilst retaining excess secondary treater	Filtration system should be upgraded to system capable of achieving effluent TP limits for NorBe and for processing non-wet weather inflows,	Upgrade filters. Note the sludge storage facilities will also have to be upgrade to accommodate additional solids capture.
UV disinfection	Upgrade UV system for full treatment of peak dry weather diurnal flows	UV disinfection may not be necessary if breakpoint chlorination/dechlorination is implemented to meet effluent TN NorBe requirements.	Consider replacement of UV system with a chorination/dechloriantion system to facilitate disinfection and TN removal (for NorBE purposes).
Chlorination/Dechlorination	Not considered	May be required to comply with NorBE TN removal requirements. If this is required, UV	Provide chlorine contact tank with upstream chlorine dosing and downstream

Process unit	GHD Upgrade Strategy	PWS Comments	PWA Upgrade Strategy to meets year 2036 loads
		system may not be necessary.	dechlorination system prior to discharge.
Sludge stabilisation	Existing sludge lagoons have been sized for 21,000EP. Therefore, no additional requirements	Concur subject to confirmation of sludge lagooning capacity where the additional sludge produced by increased alum dosage to facilitate greater TP removal will have to be considered.	Confirm available sludge lagooning capacity.
Sludge dewatering	Build additional sludge drying beds or consider mechanical dewatering	Mechanical dewatering system prefer over sludge drying beds due to reduced footprint and possible wet climate .	Consider mechanical dewatering system. It may be possible to share a portable dewatering system between Councils STPs.

A.3 Moss Vale STP Review

Process unit	GHD Upgrade Strategy	PWS Comments	PWA Upgrade Strategy to meets year 2036 loads
Inlet works	Increase screening capacity and provide grit removal system	Concur	New inlet works complete with grit removal facilities
Secondary treatment systems	Build 3rd IDEA reactor 6,000EP to 7,000 EP capacity with upstream selector	Two stage upgrade suggested. Stage 1 additional 12,400 EP reactor to provide capacity up to 2023. Stage 2 a further 12,400 EP reactor to provide capacity up to 2046.	The original IDEA reactor were designed for a 20 day sludge. The capacity of the reactor to be rerated based a 25 day sludge age which allows for improved nitrification capability. The new reactor provide the remaining capacity up to year 2036. New reactor to include DO control to prevent over aeration and maximise denitrification. Selector may be required due to relatively low BOD (compared with Bowral and Moss Vale STPs)
Alum system	Provide additional storage	Concur	Provide additional storage to allow for the additional capacity. Install flocculation system

Process unit	GHD Upgrade Strategy	PWS Comments	PWA Upgrade Strategy to meets year 2036 loads
			downstream of secondary dose (ie. in clarification tank)
pH correction	No comment	pH correction maybe required with increase TN and TP (greater alum dosage) requirements for NorBE compliance	Install caustic storage and dosing facility. Dose directly into each IDEA reactor. Install pH meters in each IDEA reactor to optimise dosing.
Clarification (catch/balance) pond	Construct new (additional) clarification to operate in parallel with existing clarification.	An additional catchpond may not be necessary depending on size of new reactor. Existing reactor has very long hydraulic retention time which makes it more susceptible to algae formation. Should aim to reduce HRT.	Confirm catch/balancing requirement which will be subject to downstream filtration and disinfection capacities. Install a flocculation system upstream of or inside the clarification pond to maximise solids capture.
Filtration system	Retain existing filtration system and overflow whilst retaining excess secondary treater	Filtration system should be upgraded to system capable of achieving effluent TP limits for NorBE and for processing non-wet weather inflows.	Upgrade filters. Note the sludge storage facilities will also have to be upgraded to accommodate additional solids capture.
UV disinfection	Upgrade UV system for full treatment of peak dry weather diurnal flows	UV disinfection may not be necessary if breakpoint chlorination/dechlorination is implemented to meet effluent TN NorBE requirements.	Consider replacement of UV system with a chorination/dechloriantion system to facilitate disinfection and TN removal (for NorBE purposes).
Chlorination/Dechlorination	Not considered	May be required to comply with NorBE TN removal requirements. If this is required, UV system may not be necessary.	Provide chlorine contact tank with upstream chlorine dosing and downstream dechlorination system prior to discharge.
Sludge stabilisation	Existing sludge lagoons have been sized for 21,000EP. Therefore, no additional requirements	Concur subject to confirmation of sludge lagooning capacity where the additional sludge produced by increased alum dosage to facilitate greater TP removal will have to be considered.	Confirm available sludge lagooning capacity.

Process unit	GHD Upgrade Strategy	PWS Comments	PWA Upgrade Strategy to meets year 2036 loads
Sludge dewatering	Build additional sludge drying beds or consider mechanical dewatering	Mechanical dewatering system prefer over sludge drying beds due to reduced footprint and possible wet climate .	Consider mechanical dewatering system. It may be possible to share a portable dewatering system between Councils STPs.