

7. Alternatives considered

7.1 Overview

Alternatives for the Project were considered in three stages:

1. Consideration of all the available options for securing Goulburn's future water supply;
2. Consideration of further options to secure Goulburn's future water supply including the investigation of three preferred options for the construction of a pipeline to supply water to Goulburn; and
3. For the construction of a pipeline from Wingecarribee Reservoir to Goulburn, investigation of five different route options.

Water treatment options are currently under consideration for the Project. These options require different plans and designs at either end of the pipeline (Section 7.6).

7.2 Water source and delivery options

Critical levels in the Goulburn water supply dams forced severe water restrictions to be enforced on the Goulburn community in 2007. The use of available water in the community was restricted to priority household uses and water saving measures were implemented by the Goulburn community. As a result, the only option to secure Goulburn's water supply into the future was to investigate an alternative water supply.

A workshop was held in April 2007 to determine and discuss the water source and delivery options available to secure the future of Goulburn's water supply. The workshop was attended by the Proponent, Wingecarribee Shire Council, Sydney Catchment Authority (SCA), NSW Department of Water and Energy (DWE) (now known as Investment and Infrastructure) and the NSW Department of Commerce (GMC & DoC, 2007).

7.2.1 Source options

The following water source options were identified and considered:

1. Extract unfiltered water from Wingecarribee River at the disused Berrima Cement Works Dam;
2. Extract unfiltered water from Wildes Meadow Canal (*i.e.* between Fitzroy Falls Reservoir and Wingecarribee Dam);
3. Extract unfiltered water from Medway Dam;
4. Extract unfiltered water from Bundanoon Dam;
5. Extract unfiltered water from Wingecarribee Dam; and
6. Supply filtered water from Wingecarribee Distribution System.

A summary of these options, as discussed in the Drought Emergency Pipeline Route Corridor Option Study (GMC & DoC, 2007), is provided below.

Source Option 1: Extract raw water from the Berrima Cement Works dam

The disused Berrima Cement Works Dam is an on-stream storage located on the Wingecarribee River, some 20 km downstream of Wingecarribee Dam near the township of Berrima. The dam wall is in close

proximity to the Hume Highway and near the intersection with Illawarra Highway. The main source of water comes from the releases from Wingecarribee Dam.

Although, the extraction and transfer of water from this source to Goulburn could significantly reduce the length of pipeline it was considered as an inefficient means of extracting the Wingecarribee Dam water. This is because of the potentially high in-stream losses and the potential for diversion of released water by users along the river reach.

Concerns were also raised over releasing significant quantities of water above the target requirement of 5 ML/d and the impact this release could have on the overall negotiations of changing environmental flow requirements downstream of Wingecarribee Dam.

This option was not considered further as an extraction source option.

Source Option 2: Extract raw water from Medway Dam

Medway Dam is an on-stream storage located on the Medway Rivulet and is the source of water supply to the township and residents of Berrima. The dam has a capacity of 1 400 ML and is owned and operated by WSC.

The reliability and sustainability of the Medway Rivulet flow is not known and that WSC's drought security to Berrima residents is based on releases from Wingecarribee Dam. It was recognised that significant additional studies would be required to establish the reliability and sustainability of the Medway Rivulet flow and that such studies are unlikely to be completed within the short timeframe required to complete the Project.

This option was not considered further as an extraction source option.

Source Option 3: Extract raw water from Bundanoon Creek Dam

Bundanoon Dam is an on-stream storage located on Bundanoon Creek and is the source of water supply to the townships and residents of Bundanoon and Exeter. The dam has a capacity of 2 100 ML and is owned and operated by WSC. The reliability and sustainability of the Bundanoon Creek stream flow is not known and that WSC's drought security to Bundanoon and Exeter residents is based on releases from Wingecarribee Dam. Again it was recognised that significant additional studies would be required to establish the reliability and sustainability of the Bundanoon Creek flow and that such studies are unlikely to be completed within the short timeframe.

This option was not considered further as an extraction source option.

Source Option 4: Extracted raw water from Wildes Meadow Canal

SCA's Burrawang Pumping Station, located in a cut at the northern end of Wildes Meadow Canal is used to deliver water from Fitzroy Falls Reservoir into the Wingecarribee Reservoir to supplement the water supply to Sydney and Wollongong.

The proposed point of extraction would be close to the pumping station that lifts the canal water into the tunnel to Wingecarribee Dam. If this extraction point became the preferred source then further analysis would need to be undertaken in conjunction with SCA's current and future operating requirements.

SCA staff also indicated that Fitzroy Falls Reservoir also has occasional blue-green algal blooms. Although, power supply may be readily available for the pumping facility it adds an additional pipe length of approximately 5 km.

The option was retained as a less favourable or fallback option. No further analysis was undertaken.

Source Option 5: Extracted raw water from Wingecarribee Dam

The Wingecarribee Dam is owned and operated by SCA. The dam has a capacity of 25 900 ML. The dam receives water from both the local Wingecarribee River catchment and transfers from Fitzroy Falls Reservoir. Due to environmental requirements the operating level of the storage is maintained within a narrow bandwidth. Extraction of water to Goulburn was identified as unlikely to have an impact on dam operation and supply commitments. For example, 5 ML/d extraction equals 1 800 ML/a. This annual transfer is equivalent to slightly more than Sydney's 2006 average daily demand (1 500 ML/d) and would therefore have negligible impact on Sydney's supply security. Wingecarribee Dam water is relatively soft and has occasional blue-green algal blooms.

This option was identified as the preferred source of supply extraction option.

Source Option 6: Supplied treated water from Wingecarribee Distribution System

The supply of filtered water to Goulburn from the vicinity of Exeter, Sallys Corner and Blackes Hill Reservoir was considered. This source option was only considered viable if the villages such as Wingello, Penrose, Tallong and Marulan were to be provided with water from the proposed pipeline. This could optimally be achieved by either following the Main Southern Railway corridor or the series of roads from a supply point in the vicinity of Exeter via the villages to Marulan.

In view of these two pipeline route corridors having the longest length and the significant design and construction works, this source option was eliminated along with the pipeline route corridor options. Further, supply from the vicinity of Exeter would have also resulted in some transfer system upgrade within the Wingecarribee distribution system resulting in possible perceived compromise to their stated objective of the pipeline proposal proceeding on the basis of no cost to WSC.

Although, this option could save approximately 19 km of pipeline compared to extraction of raw water from Wingecarribee Dam, it would require upgrading of an existing pumping station, construction of additional pipelines, construction in built-up areas, higher water purchase price and advancement of the Wingecarribee Water Filtration Plant upgrade, and hence would be more expensive.

This option was not considered further as an extraction source option.

7.2.2 Delivery options

The following delivery options were considered:

1. Deliver unfiltered water into Sooley Dam near the dam wall;
2. Deliver unfiltered water into the Copford Park Balance Tank;
3. Deliver unfiltered water into the interconnecting pipework between Sooley Dam and Rossi Weir Pumping Station;
4. Deliver unfiltered water into the inlet works (or into a new balance tank at the inlet works) of the Goulburn Water Treatment Plant; and
5. Deliver filtered water directly into the Bradfordville Reservoir near Kenmore area.

Delivery Option 1: Deliver raw water into Sooley Dam near the dam wall

Direct delivery of the Wingecarribee Dam water to Sooley Dam near the dam wall was considered as it would reduce the length of the pipeline by approximately 5 km compared to discharging at the inlet works of the Goulburn WTP. However, due to the prevailing dry weather pattern, delivery of Wingecarribee Dam water into Sooley Dam could result in significant loss due to evaporation and possible seepage losses. These losses could result in an availability of less than 5 ML/d of water for the consumers.

The frequency, magnitude and duration of blue-green algal blooms in Wingecarribee Dam is very low compared to Sooley Dam, which has regular, prolonged and high magnitude blooms. This meant there would be a potential need to manage the blue-green algal growth and bloom in Sooley Dam as well as the cost of treating the by-products of blue-green algal blooms.

The option was not considered further as a delivery option.

Delivery Option 2: Deliver raw water into the Copford Park Balance Tank

Although, discharging into the Copford Park Balance Tank for subsequent transfer to Sooley Dam would result in a reduction to the pipeline length, the need to extend the lagoon outlet pipe, with polyethylene pipe, up to the dam wall would negate any savings achieved. Further in addition to having the above mentioned evaporation and seepage losses and blue-green algal bloom issues, this arrangement would also require additional pumping effort.

The option was not considered further as a delivery option.

Delivery Option 3: Deliver raw water into the interconnecting pipework between Sooley Dam and Rossi Weir Pumping Station

This option would eliminate the above-mentioned evaporation and seepage losses and blue-green algal bloom issues. However, this option would require provision of valves on the Rossi Weir suction pipe work to prevent flow of Wingecarribee Dam water into Rossi Weir and possible modification to existing Rossi Weir pumps and switchgear to match the flows from Wingecarribee Dam water. Use of the interconnecting pipe could also limit the opportunity to harvest and store excess flows in Wollondilly River at Rossi Weir for transfer to Sooley Dam. Further, if GMC wish to blend both the Wingecarribee Dam water and Sooley Dam or Rossi Weir water, there could be additional valves and flow measuring devices required.

The option was not considered further as a delivery option.

Delivery Option 4: Deliver raw water into the inlet works of the Goulburn Water Treatment Plant

This option avoids the evaporation and seepage losses, blue-green algal bloom issues and additional pumping energy. Further it also retains the flexibility to pump and store in Sooley Dam any excess flows in Wollondilly River at Rossi Weir.

Blending of both Wingecarribee Dam water and Sooley Dam or Rossi Weir water is also made easy including the flexibility to add different water treatment chemicals and dosages that are applicable to each water source. There could also be added benefit (e.g., flexibility with plant operating time, power outage, simple control, etc) if the Wingecarribee Dam water was delivered into a balance tank at the inlet to the water treatment plant than directly into the plant inlet works. The added benefits together with the balance tank cost needed to be assessed during the concept design stage.

This option was identified as the preferred delivery method.

Delivery Option 5: Deliver treated water directly into the Bradfordville Reservoir near Kenmore Area

This option was not considered further as a filtered water source was no longer an option was water supply.

7.2.3 Identified preferred option

Based on the above analysis, it was recommended that the raw water be sourced from Wingecarribee Dam and delivered into the inlet works (or into a new balance tank at the inlet works) of the Goulburn WTP. On further consideration of this option an alternative was included to source treated water direct form the Wingecarribee WTP. Discussion of the alternative is provided in Section 7.6.

7.3 Further options to secure Goulburn's future water supply

7.3.1 Water cartage option

In 2005, GMC considered the option of using water carting to support Goulburn's water supply in continuing drought periods. Two main options considered were road cartage by trucks and rail cartage. Water cartage options were considered from Sallys Corner Service Station and Oldbury Pump Station or a combination of both for road cartage and Calwalla Siding for rail cartage.

It was determined that water cartage to a city the size of Goulburn was an expensive exercise and all other options should be exhausted prior to taking up this option (DoC, 2005). If the drought conditions were to persist for 6 months or longer, the recommendation was to further consider the option of constructing a pipeline from Moss Vale to Goulburn.

7.3.2 Further consideration of water saving options

Although the pipeline from Wingecarribee Reservoir to Goulburn was identified as the preferred options for the source and delivery of water to Goulburn, consideration of additional or alternative measures to increase the security of Goulburn's water was undertaken. The short listed options included (NSW Public Works, 2010):

- Pejar to Sooley Pipeline – One way transfer to increase Goulburn secure yield;
- Pejar to Sooley Pipeline – Two way transfer to increase Goulburn secure yield;
- Pipeline transfer from Wingecarribee Dam to increase Goulburn secure yield (would be suitable to meet Marulan's growing demand as well);
- Evaporation Control for the dams – to reduce storage losses;
- Site specific non-potable bore supplies to public parks – to reduce use of potable water in parks at both Goulburn and Marulan subject to obtaining bore licenses and availability of adequate yield and suitability of water quality;
- Reuse of stormwater collected in the former Goulburn brick pits for reuse in public open spaces and industries subject to approvals and licenses;
- Harvesting of urban stormwater from Copford Reach & transfer to Sooley Dam to increase yield in the short-term subject to approvals and licenses;
- Decentralised (sewer mining) reuse in greenfield residential subdivision (third pipe) at Marulan only;

- ▶ Centralised reuse for new dwellings (third pipe) in both green and brown field subdivisions if combined with public open space reuse;
- ▶ Centralised reuse for public open spaces (e.g., golf course, Carr Conroy fields and the Recreation area);
- ▶ Highly treated effluent as environmental flow replacement in Wollondilly River to increase yield of Goulburn system if environmental flow releases are needed below Rossi Weir;
- ▶ Extraction from Mulwaree River near Tarago Village as source for a reticulated village scheme subject to approvals and licenses;
- ▶ Extraction from Lake Bathurst as source for Tarago reticulated village scheme subject to approvals and licenses; and
- ▶ Evaluate Demand Management measures to enhance the existing program.

Three preferred options have been investigated further (DoC, 2009) as follows:

1. One-Way Pejar Pipeline: The scheme involves construction of a pipeline from Pejar Dam to Sooley Dam to avoid losses which occur when water is released down river from Pejar to Rossi Weir.
2. Two-Way Pejar Pipeline: The second scheme adds extra pumping capacity from Rossi Weir to Sooley Dam to harvest more water from high flows at Rossi Weir and a pump station to transfer water through the pipeline from Sooley to Pejar Dam.
3. Highlands Source: The third scheme involves piping water to Goulburn from the Wingecarribee Reservoir which is part of the Sydney and Southern Highlands supply system.

The Pejar Pipeline Schemes (options 1 and 2) did not satisfy the DWE secure yield criteria for NSW regional water supply schemes, there would be a significant risk of the Goulburn storages dropping to Level 5 restriction levels within a decade, triggering the need for water cartage or construction of a Wingecarribee - Goulburn pipeline or another major source (DoC, 2009).

Cost/yield comparisons of the three pipeline options showed that the Highlands Source is more cost-effective than the Pejar Pipeline Schemes, and that the advantage in favour of the Highlands Source increases when climate change impacts are taken into account (DoC, 2009).

The remaining options identified above would be further investigated as part of the GMC IWCM Strategy which is due for completion in March 2010.

7.4 Wingecarribee to Goulburn pipeline alternatives

The Project was based upon the pipeline route defined by GMC from Wingecarribee Reservoir to Goulburn WTP. The original proposed route, described and examined as a possible emergency pipeline route (GMC & DoC, 2007), utilised existing gas and electricity easements for a large proportion of its alignment. On commencing the Project, the APA Group advised the owners of the Moomba to Sydney gas pipeline that the pipeline could not be located within the existing gas easement as originally proposed by GMC.

In response to the inability to utilise the existing alignment as initially proposed, GHD investigated five alternative routes to determine if perceived constraints on the original route could be reduced. The five alternative routes were analysed with both positive and negative aspects identified for all in light of aspects as follows:

- ▶ Minimising the number of landholdings traversed;
- ▶ An assessment of potential pipe construction and operating costs as dictated by pipe length, number of creek and road crossings;
- ▶ A consideration of the difficulty of construction (due to factors such as ground conditions and gradient); and
- ▶ Selecting the route that would likely result in minimal disturbance of local vegetation and need less clearing, etc.

A multi criteria analysis was undertaken based on available mapping data and brief field inspections but only from public access roads and viewing the possible route alignments from these viewing points. The outcome of the analysis gave little to suggest that any of the alternative routes would provide significant benefits over the original route.

Whilst the presence of other services including the high pressure gas pipeline and Telstra service cables were of concern with the original route, all alternative routes posed a similar level of constraint. In particular, other routes which maximised the use of existing power easements raised issues due to the hazard of working adjacent to overhead power lines.

It was accepted by the Proponent that the route could generally be retained by offsetting the alignment adjacent to the gas pipeline easement. In this location the pipeline would require greater vegetation clearing, thus widening the existing cleared easement.

In order to utilise the original route an additional 6 to 15 m clearing would be required adjacent to the existing 25 m wide cleared gas easement. The alternative options considered impacted a lesser area of dense vegetation but still traversed through land which contains threatened ecological communities, which currently have little fragmentation as a result of existing easements.

Following the investigation of the five alternative routes, it was recommended that an alignment based on the original route be retained as the preferred alignment for the Project.

The preferred pipeline route corridor would predominately be located adjacent to existing infrastructure easements that have previously been cleared and either remain cleared or have regenerating vegetation present. From Wingecarribee Reservoir, the pipeline route largely runs adjacent to existing power line easements until it crosses the Hume Highway. After crossing the Hume Highway, the pipeline route would be located adjacent to and outside of an existing gas pipeline easement, which it follows almost the entire way to Goulburn.

7.5 The 'do nothing' option

DoC (2009) notes that climate change is expected to reduce the streamflows in the Goulburn catchment, and that mid-range projections (CSIRO, 2007) show a decline in secure yield from the Goulburn catchments of 20 percent per degree of global warming is possible.

Goulburn has implemented high level water restrictions throughout the drought. Despite the implementation of water use efficiency measures such as installation of home water saving devices and rainwater tanks under Council rebates, there is a real risk that Goulburn could in the near future be placed on Level 5 water restrictions as water levels in the supply continue to fall (DoC, 2009).

The option of doing nothing would not alleviate the risk that the city may run out of water. The Goulburn community would be severely disadvantaged and the option is therefore unacceptable.

7.6 Water treatment options

Two options are under consideration for the operation of the proposed pipeline; one option being to transfer raw water, and the second option being to transfer treated water. These options require different plans and designs at either end of the pipeline. A preferred option would be selected during detailed design.

7.6.1 Raw water

For the raw water option, untreated water would be transferred from Wingecarribee Reservoir to Goulburn. The pipeline would be designed to accommodate a flow of approximately 7.5 ML/d (over a 22 hour period). Initially the pipeline will deliver 5 ML/d until such time that a booster pump station is installed.

The system would be based on drawing water from the existing outlet works at the Wingecarribee Dam upstream of the offtake to the water treatment works. A high lift pumping station would be located adjacent to the existing raw water pumping station between the dam and the Wingecarribee WTP.

The raw water option would require a longer pipeline than the treated water option, with the construction of the pipeline around the northern side of the city of Goulburn to connect to the Goulburn WTP on the western side of the city. The pipeline would be operated as a raw water transfer system and would discharge directly into one of the raw water balancing tanks upstream of the Goulburn WTP, prior to any treatment there. Alternatively it may be delivered to the existing 600 mm diameter rising main from the Rossi Weir system in Goulburn and taken directly to the intake works.

Two options are under consideration for the mode of operation of the raw water transfer pipeline:

1. Continuous operation – where water from the Wingecarribee Reservoir would be delivered daily to Goulburn so as to contribute some set percentage of the overall daily water demand;
2. Intermittent operation – where water from the Wingecarribee Reservoir would be pumped to the Goulburn water supply system only on occasions where Goulburn's existing water supply resources were measured to be below a predetermined trigger level.

7.6.2 Treated water

For the treated water option, treated water would be transferred from the Wingecarribee WTP to Goulburn.

The water transfers will be made by a pump station located at the Wingecarribee Reservoir. The pipeline would be designed to accommodate a flow of approximately 7.5 ML/d (over a 22 hour period). Initially the pipeline will deliver 5 ML/d.

A new treated water pump station would be located near the Wingecarribee WTP. A booster pump station may be located along the pipeline alignment to provide additional pressure in the pipeline.

The pipeline would be shorter than for the raw water option due to its termination on the eastern side of Goulburn. The pipeline would be operated as a treated water system. It is possible that chlorine dosing or similar disinfection treatment may be required along the pipeline route; however this will depend partly on the residual levels from the Wingecarribee treatment plant. The water would be delivered from the pipeline into a new covered balance potable water reservoir at Governor's Hill in East Goulburn. The water would then be piped directly into the eastern zone of the Goulburn water reticulation system.



Alternatively, the pipeline may connect directly to the existing Goulburn water main in North Goulburn, which, through water supply rezoning work, could supply Goulburn's entire network with water from the Wingecaribee Reservoir.

As for the raw water transfer pipeline, two options are under consideration for the mode of operation of the treated water transfer pipeline, continuous operation or intermittent operation.