

Melbourne Augmentation Program Sugarloaf Interconnector

Technical Report

June 2007

Prepared by
Capital Projects Division
Department of Sustainability
and Environment

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1.0 Context

1.1 Melbourne's water supply situation

The calendar year of 2006 saw the lowest streamflow in recorded history at Melbourne Water's main reservoir sites (Thomson, Upper Yarra, O'Shannassy and Maroondah). This followed a period of ten years in which there have been three major drought periods, 1997/98, 2002/03 and 2006/07 and no years in which streamflows were higher than the long-term average were recorded. The extended dry period has resulted in a long-term decline in storage reserves with reservoirs being drawn from almost at capacity in October 1996 to approximately 29% of capacity as at June 2007.

Figure 1 shows the decline in average streamflows at the four major reservoir sites. A summary of the observed decrease in flows over time follows:

- Average streamflow from 1913 to 1996 was 613 GL/a
- Average streamflow from 1961 to 1996 was 564 GL/a, a reduction of 8%
- Average streamflow 1997 to 2006 will be around 383 GL/a, representing a 38% reduction from 1913 to 1996 and a 32% reduction from 1991 to 1996.
- Streamflow in 2006/07, based on the assumption of a repeat of the lowest monthly recorded flows for June 2007 is expected to be around 134 GL which is around 78% lower than the 1913 to 1996 average streamflow.

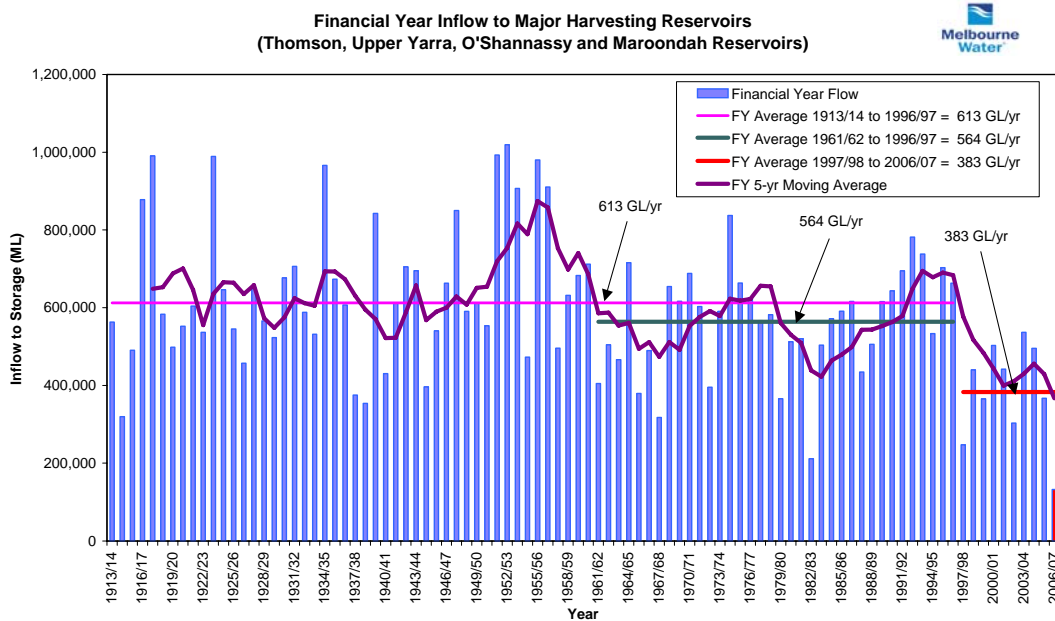


Figure 1: Financial Year Streamflow at Melbourne's Major Reservoir Sites (Thomson, Upper Yarra, O'Shannassy, Maroondah) with estimated stream flow for 2006/07 (Source: MWC)

1.2 Management of supply

Continuation of 2006/07 flows into 2007/08 would represent a rapid and substantial shift in climate and streamflow conditions as there have been no recorded years of back-to-back severe drought periods for streamflow in Melbourne's catchments.

The low inflow scenario that has been adopted for planning purposes is based on receiving a repeat of the three-year inflow period from 2004 to 2006, inclusive. The planning scenario is therefore based on:

- one year of above-average inflow (2004)
- one year of average inflow (2005)
- one year of below-average inflow (2006).

Under this scenario, the Melbourne supply system will experience a two-year period of storage recovery to above the Stage 3 restriction trigger followed by storage depletion below the Stage 4 restriction trigger in 2010.

In the short term, a key planning objective is to maintain storage levels above the Stage 4 restriction triggers, and if possible, to aid storage recovery. In the longer term, the objectives are to guarantee water security in light of predicted lower inflows under climate change, increased population and economic growth

1.3 The Sugarloaf Interconnector

The Sugarloaf Interconnector is one of three augmentation options that have been assessed by the Victorian Government for the supply of additional water to Melbourne. The other options considered are seawater desalination and the use of recycled water from the upgraded Eastern Treatment Plant to substitute for environmental or other purposes.

The Sugarloaf Interconnector is the only augmentation option that can potentially deliver the short-term objective of additional water supply for Melbourne in the case of continued dry conditions, as the delivery timeframe for the Sugarloaf Interconnector is just over two and a half years. The delivery timeframes for the other augmentation options are four years or beyond and these options would contribute, along with the Sugarloaf Interconnector, to meet longer term objectives for Melbourne's water supply.

The Sugarloaf Interconnector will transfer water from the Goulburn River to the Melbourne Water distribution system. Water for the Sugarloaf Interconnector will be sourced from savings achieved through the modernisation of irrigation infrastructure in the Goulburn-Murray Irrigation District. This program of irrigation modernisation works, known as the Food Bowl Modernisation Project, aims to capture approximately 450 GL of water that is currently lost due to inefficiencies in the Goulburn-Murray Irrigation District.

The Sugarloaf Interconnector is designed to transfer a maximum of 100 GL/yr from the Goulburn River, north of Yea, to the Sugarloaf Reservoir in the northeast of Melbourne. On average, it is expected that 75 GL/yr will be available for transfer. The additional design capacity of the pipeline allows for flexibility in managing the operational requirements of transferring 75 GL/yr in accordance with flow constraints in the Goulburn River and treatment capacity constraints at the Winneke Treatment Plant at Sugarloaf Reservoir.

Approximately 70 kilometres of pipeline will connect the Goulburn River to Sugarloaf Reservoir, and the pipeline corridor will generally follow the Melba Highway and Steels Creek Road. This represents the preferred option amongst a range of possible connections between the Goulburn-Murray Irrigation District and the Melbourne Water distribution system, as it best meets the construction objectives of timely delivery, appropriate design capacity, least cost and least environmental impact. Ultimately, as a result of investment in the Food Bowl Modernisation Project, a high reliability water entitlement will be secured for Melbourne from the Goulburn-Murray Irrigation District, which will provide water for transfer to Melbourne through the Sugarloaf Interconnector.

This technical report provides details of design, cost and timing for construction of the transfer pipeline along the Melba Highway, as well as the associated water treatment plant and transfer system upgrade works that are required at Sugarloaf Reservoir.

This technical report has been prepared by the Department of Sustainability and Environment. Section 2 of the report is based on works completed by Melbourne Water and GHD.

2.0 Construction of the Sugarloaf Interconnector and associated delivery infrastructure works

2.1 Scope and description of the proposal

Scope of works

The Sugarloaf Interconnector (“the pipeline”) will deliver 75 GL/yr from the Goulburn-Murray Irrigation District via the Goulburn River at Yea to the most cost effective and operationally appropriate entry point into the Melbourne system at Sugarloaf Reservoir in Yarra Glen. The water will then be treated in the upgraded Winneke Water Treatment Plant and discharged into Melbourne’s water distribution system.

The scope of work includes the design, construction and commissioning of:

- the Goulburn River intake pumping station and associated infrastructure, including water storage facilities and the supply of power to the pumping station;
- the 70 kilometre pipeline from the Goulburn River to Sugarloaf Reservoir;
- the upgrading of the existing Winneke Water Treatment Plant to a capacity of approximately 200 GL/yr to accommodate both the Yarra River catchment throughput and the 75 GL/yr from the Goulburn River;
- the downstream diversification of the pipeline to the existing Melbourne distribution network.

The extent of work undertaken to date includes:

- the selection of the preferred pipeline route, utilising the Melba Highway for much of its length;
- the identification of the preliminary functional performance requirements of the components of the integrated pipeline system;
- an initial assessment of the environmental issues;
- an initial assessment of the planning, heritage and land acquisition issues;
- the preparation of an estimate of costs to deliver and operate the pipeline system;
- the preparation of a delivery schedule.

Description of the proposal

The scope of work involves the diversion of up to 300 megalitres/day from the Goulburn River to deliver 75 GL/yr into the Melbourne water distribution network. Included in this volumetric assessment is provision for up to 35 days per year when the pipeline would not be operated, to allow for the fact that water in the Goulburn River can become highly turbid at times both in winter and following thunderstorms at other times of the year. A schematic layout of the pipeline system is provided in Figure 2 overleaf.

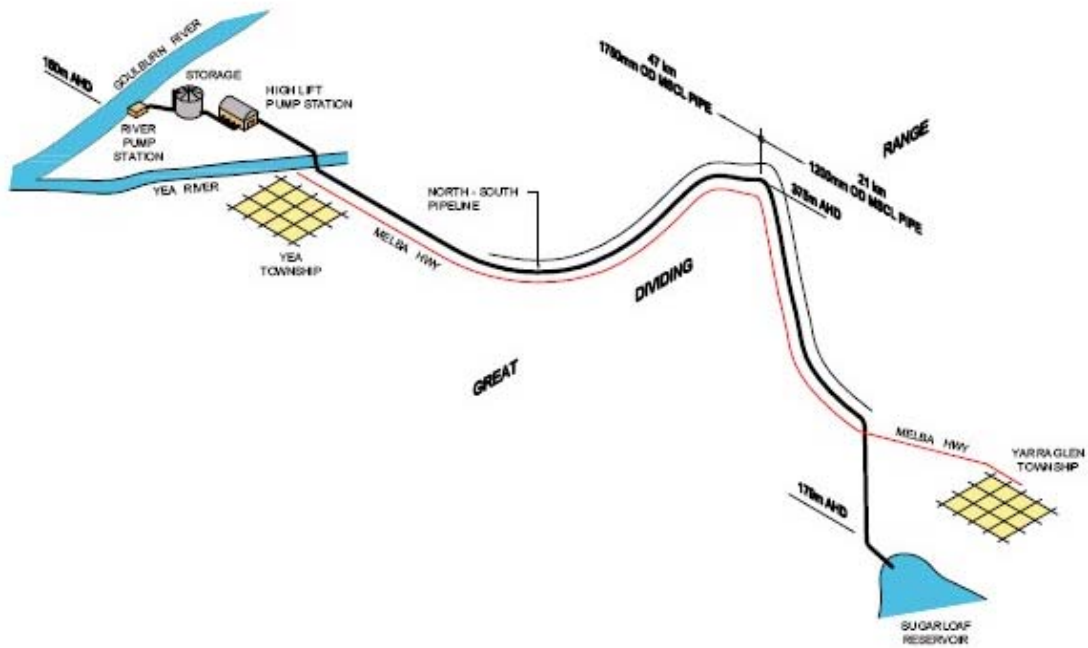


Figure 2: Schematic layout of the pipeline system

The preferred route commences with a river diversion on the south bank of the Goulburn River, north of the Yea township, where Killingworth Road meets the river. At this point, the main river stream is on the southern side of the floodplain where the bed and banks of the river appear to be stable. Further investigations will be undertaken to survey the river bed and to confirm that the river morphology is suitable as the take-out point.

This section of the Goulburn River is within a Heritage River Area and consultation with the Goulburn-Broken Catchment Management Authority will also be required to fully assess the impact of the river diversion works.

Cultural heritage investigations will be undertaken at the off-take site as they will be along the full length of the pipeline corridor to Sugarloaf Reservoir.

The intake facility will include low-lift submersible pumps to the low-lift pump station, the construction of a storage or balancing tank approximately 30 megalitres in capacity, and a high lift pump station to deliver the water to Sugarloaf Reservoir via pipeline approximately 70 kilometres in length. The pipeline corridor generally follows the Melba Highway, Hunts Lane and Steels Creek Road alignments.

Further development of the specific details of the route will be undertaken to minimise the impact of the construction activities on the communities along the length of the pipeline route and on the users of the road system.

Proposal details

The preliminary design of the river diversion and the pipeline corridor including pumping and power supply requirements, pipe sizing, hydraulics design considerations and traffic impacts has been carried out.

2.2 Identification of the preferred route

Two pipeline routes were examined prior to the selection of the preferred route.

2.2.1 Melba Highway route

This option follows a Melba Highway / Hunts Lane/ Steels Creek Road route from the Goulburn River off-take north of the Yea township directly to Sugarloaf Reservoir.

Details of the proposed route are summarised below. Further details are provided in Appendix 1.

Goulburn River to Yea

From the high lift pump station, the pipeline route will follow the Killingworth Road to Yea in private, cleared farmland. At Yea the pipeline will follow the edge of the floodplain south and cross the Yea River south of Yea to avoid construction through the township.

It is expected that the preferred construction method across the river will be boring or similar trenchless techniques but this will require geotechnical investigation to evaluate the feasibility and the construction risks.

Yea to Glenburn

From Yea to Glenburn, the pipeline follows the Melba Highway in private land, generally on the eastern side. This area is generally cleared farmland with some obstacles such as stockyards. It is expected that the pipeline route will need to alternate from one side of the highway to the other at some locations to minimise impact on vegetation and waterways.

The pipeline will also cross a disused railway line near Yea. It is expected that the area adjacent to the railway line will contain significant vegetation values. The crossing of the railway line will require consultation with VicTrack.

Toolangi State Forest

At Glenburn, approximately 28 kilometres south of Yea, the farmland ends and the Melba Highway enters the forest. The Toolangi State Forest is on the eastern side and the King Lake National Park and Yea River is on the western side. The preferred route in this section is through the State Forest on the east side, as this is likely to result in fewer environmental impacts than a route through the National Park.

The six kilometre section of the State Forest as the Melba Highway climbs up the Great Dividing Range will be difficult construction. There are several options for construction through this section:

- Construction within the road reserve. This will require closure of the highway to permit construction. Parts of the highway are wider, with three lanes, and construction may be possible with traffic reduced to one lane only.
- Widening the highway formation to permit pipeline construction. This will require clearing of vegetation and substantial earthworks along the eastern

side of the highway, and will include flora, fauna and traffic management considerations.

- Construction within the forest on the eastern side of the highway formation. This will require clearing of trees and substantial earthworks to provide a flat trafficable corridor through the forest, which currently has a steep cross-fall toward the highway. Protection measures will be necessary to control risks of falling rocks for traffic below the works.
- Trenchless construction. This option limits the environmental and traffic impacts of the above options, however it is the highest cost option.

At the top of the range there are one and half kilometres of private cleared land before the highway again enters the forest to descend from the Great Dividing Range toward Yarra Glen. Through this area the pipeline will be constructed on private land on the eastern side of the highway.

The route then re-enters State Forest for the steep descent toward Yarra Glen. The pipeline will follow the highway for one and half kilometres, then diverge east towards an existing track, which follows a ridge to farmland at the foot of the range. This avoids forested land with steep cross slopes. Some clearing and earthworks will still be required for the construction corridor.

Toolangi State Forest to Yarra Glen

After leaving the forest, the route crosses to the west side of the Melba Highway and follows the highway for about four kilometres to Hunts Lane. The route then follows Hunts Lane to the west towards Steels Creek Road. The route then follows Steels Creek Road towards Yarra Glen, in private land generally on the east side of the road.

An alternative to the Hunts Lane / Steels Creek section is to follow the Melba Highway for 12 kilometres to Yarra Glen. However, this section is through more intensively farmed properties with a large number of vineyards increasing construction impact and acquisition issues.

The Hunts Lane / Steels Creek Road section is preferred because it will have less overall impact on community, commercial and tourism activities.

Yarra Glen to Sugarloaf Reservoir

At Yarra Glen, two routes are feasible. The pipeline could follow the Eltham-Yarra Glen road, crossing the Maroondah Aqueduct and entering Sugarloaf Reservoir via Ridge Road. These roads are narrow and in lightly forested hills. This route is less attractive hydraulically because there is a high point close to Big Hill where the pipeline crosses the ridge west of the Yarra River.

Alternatively, the preferred route is for the pipeline to follow Glenview Road and then cross the ridgeline at a lower level and enter the eastern end of Sugarloaf Reservoir. This route will reduce the pumping requirement slightly and hence, power costs. It is also considered to have less environmental impact.

At the crossing of the Yarra Ridge into Sugarloaf, tunnelling may be used to both reduce the environmental impact and to eliminate a highpoint where the pipeline crosses the ridge.

2.2.2 Hume Highway route

This option follows a Hume Highway route to Yan Yean Reservoir and then a further transfer across country to Sugarloaf Reservoir.

Following an assessment of both routes, the Melba Highway route has been selected for the following reasons:

- It is approximately 20 kilometres shorter in length than the Hume Highway route.
- It has the lowest capital cost in terms of both the cost of the construction of the pipeline and also the cost of the associated water treatment plant works. It should also be noted that the Hume Highway route would have taken water from the Goulburn River much further downstream where the water quality is inferior to the Melba Highway route take-off.
- It has fewer identified environmental and planning issues with respect to approvals processes.

An assessment of the Hume Highway route is provided in Appendix 2.

2.3 Preliminary design details

Design capacity of the Sugarloaf Interconnector

The design capacity of the Sugarloaf Interconnector is 100 GL/yr.

Pipeline infrastructure at the Goulburn River

A low lift pump station at the Goulburn River will lift water from the river to a storage or balancing tank. A high lift pump station will pump from the tank to Sugarloaf Reservoir, via the transfer pipeline.

The low lift pump station will consist of up to four submersible centrifugal pumps mounted in a major concrete structure constructed into the bank of the Goulburn River. A similar structure is shown in Appendix 3. The preliminary duty for this pump station is to transfer 300 megalitres/day with a duty head of 40 metres.

The pumps will deliver water to a 30 megalitre steel tank at the pump station site. This will provide balancing storage for the two pump stations and will also trap some of the sand and silt pumped from the river. Further details are provided in Appendix 3. An alternative to a steel tank is a lined earthen storage. This would have less visual impact but further geotechnical investigations will be required to confirm the feasibility of an earthen storage.

The high lift pump station would consist of a large concrete pump station building with up to six high-pressure centrifugal pumps pumping direct to Sugarloaf Reservoir. An example is provided in Appendix 3. The preliminary assessment is that the pump station will transfer 300 megalitres/day with pump lift of up to 250 metres.

The pump stations will require a major upgrade to the power supply in the region to provide adequate power not only for the project but to also maintain an uninterrupted supply to the local residents and businesses. Preliminary indications are that the pump station complex will consume around 10 megawatts of electrical power.

Preliminary investigations with the power supply authority for the region will continue in order that the project's power requirements can be serviced in time for the delivery of the project in 2010.

Pipe diameter and length

The overall length of pipeline along this route is approximately 70 kilometres.

The preliminary pipeline sizing is for a 1700 mm nominal diameter pipeline from the high lift pump station to the high point on the alignment, a distance of approximately 47 kilometres.

The preliminary sizing for the remainder of the pipeline to Sugarloaf Reservoir is 1150 mm nominal diameter. Appendix 4 provides details of design criteria which are applicable to the design of the pipe system.

Other potentially compatible uses for the pipeline trench will be considered during the detailed design stage of the development of the project.

Geotechnical aspects

A preliminary review of geological maps indicates that the pipeline route will be mainly through alluvial and sedimentary zones. It appears unlikely that extremely hard rock will be encountered. The geological map is provided in Appendix 5.

A detailed geotechnical field investigation will be undertaken as part of the detailed engineering stage.

Winneke Water Treatment Plant and the downstream water distribution network

The Winneke Water Treatment Plant currently treats water that is pumped from the Yarra River Basin to Sugarloaf Reservoir. Preliminary investigations have identified that the water treatment plant can be cost-effectively upgraded to a capacity of approximately 200 GL/yr. This upgrade can be achieved within the project delivery timeframe. Further details of the upgrade requirements to the treatment plant are provided in Appendix 6.

The upgrade of the downstream transfer system will also be achieved within the project delivery timeframe. Appendix 7 provides further details of the additional system interconnecting pipeworks.

2.4 Preliminary environmental assessment

Whilst much of the route crosses private land that has been cleared for farming, there will still be significant tree and vegetation removal required in private land and state forest. This will require approval of State authorities and potentially Federal agencies.

Based on previous experience it is proposed that environmental issues may be avoided or minimised through actions such as route realignments, the use of trenchless technology and minimising easement width. Such actions also avoid protracted delays in obtaining project approvals.

A preliminary assessment of ecological values of both the Hume Highway and Melba Highway Options was carried out. The report, GHD, June 2007, 'Sugarloaf Interconnector, Preliminary Assessment of Ecological Values', is provided as Appendix 8.

The findings of the report can be summarised as follows:

- there appear to be no potentially major flaws on environmental grounds to either pipeline route;
- the project is likely to require a Commonwealth EPBC (Environment Protection and Biodiversity Act 1999) referral and potentially a FFG (Flora and Fauna Guarantee) permit if vegetation clearing is required. Based on previous experience with pipelines, if appropriate mitigation measures are identified in the referral, it is likely that an EPBC Approval will be considered “not a controlled action” and thus take the statutory 20 business days for approval to be obtained;
- it is expected that a Net Gain Assessment will be required;
- areas of particular sensitivity such as National Parks are likely to be avoidable;
- areas such as remnant native vegetation are likely to be avoided by changing the pipeline route where necessary;
- stream crossings are likely to require the use of trenchless technology for crossings;
- all efforts will be made to use existing corridors such as roads, noting however that the roadside vegetation is often of high conservation significance.

A preliminary assessment of the Hunts Lane/Steels Creek Road section of the Melba Highway route has also been carried out. The assessment included a FIS (Flora Information System) search and consideration of the EVC (Ecological Vegetation Class) mapping for this section of the route. This additional assessment revealed that:

- the Hunts Lane/Steels Creek section intersects additional areas of native vegetation. These EVCs are also intersected elsewhere along the alignment. However, this new section would require additional removal of native vegetation when compared to continuing along the Melba Highway, according to the EVC mapping. Ground-truthing is required to confirm this. This additional area of native vegetation does include areas of vulnerable listed EVCs; and
- an additional four VROT (Very Rare Or Threatened) flora species potentially occur in the Hunts Lane/Steels Creek Road section, which have not been recorded elsewhere along the Melba Highway route. These species are rare within Victoria but are not EPBC or FFG listed. Three of these four species have also been recorded within the section from Yarra Glen to Sugarloaf Reservoir, via the Eltham-Yarra Glen Road.

2.5 Planning, heritage and land acquisition requirements

A preliminary assessment of the planning and heritage approvals related to the selected Melba Highway route has been carried out.

Legislation considered as part of this preliminary planning and cultural heritage analysis and the associated implications for the project are as follows:

- *Environment Protection, Biodiversity and Conservation Act (EPBC) 1999* (Commonwealth legislation)
This Act applies to listed species and communities and wetlands under international conventions. Any project that is likely to have a significant impact on these requires approval from the Federal Minister. Initial investigations indicate that the pipeline is likely to require an EPBC referral but that if appropriate mitigation measures are undertaken, the pipeline will be considered “not a controlled action”.

- *Environment Effects Act 1978* (State legislation)
An Environmental Effects Statement (EES) referral may be required in accordance with the Ministerial Guidelines for EES.
- *Flora and Fauna Guarantee Act 1988* (State legislation)
Consideration has been given to any impact on listed species in the assessment of environmental impacts of the project. It is likely that some permits may be required, even though the works will be designed to avoid any listed species or communities. Consideration will need to be given to managing threatening processes during construction as per standard practice.
- *Planning and Environment Act 1987* (State legislation)
Planning approval will be required from all relevant planning authorities. Referral to a number of agencies will also be required. Consideration will be given to the Minister for Planning acting as the planning authority in place of the municipalities, given the significance of the project.
- *Catchment and Land Protection Act 1994* (State legislation)
Consultation with the relevant Catchment Management Authorities of Goulburn and Port Philip may be required with regard to how the proposal may affect the implementation of any relevant Regional Catchment Strategy.
- Various land acts relevant to public land
If the project affects the Kinglake National Park, then a Section 27 agreement under the National Parks Act 1975 between Melbourne Water Corporation (MWC) and Parks Victoria under the National Parks Act will be required. If the project affects the Toolangi State Forest, the existing lease and Forestry Agreement requirements must be considered, with particular regard to the forestry that the project affects.
- *Land Acquisition and Compensation Act (LACA) 1986* (State legislation)
MWC will be required to acquire land and easements to facilitate the construction of this project, and undertake this process through steps outlined in this Act. Land acquisition may take up to eight months and may begin upon receipt of all relevant approvals. Compulsory acquisition processes provide a predictable and timely method of obtaining access to land for construction. However, experience on other pipeline projects indicates a willingness by owners to negotiate regarding the placement of easements. Compensation will be paid in accordance with LACA, which clearly outlines the specific process and entitlements to be addressed in such cases.
- *Water Act 1989* (State legislation)
The Act serves to outline the scope of works to which MWC are entitled as a public authority, which in turn outlines activities exempt from planning permits in the Public Use Zone if undertaken by or on behalf of MWC as a public authority.
- *Aboriginal Heritage Act 2006* (State legislation)
Mapping indicates that there are a number of listed aboriginal sites within the project area. A Cultural Heritage Assessment will therefore be undertaken in regard to the requirements of the Aboriginal Heritage Act 2006. This will include an assessment of the significance of these sites, and the field work and consultation required to meet the requirements of these Acts. Consultation with Aboriginal Affairs Victoria (AAV) will also be undertaken as to the approvals required and the preferred process to be undertaken for this project.

This Act came into force on the 28 May 2007 and an activity that may damage any aspect of Aboriginal cultural heritage will only be permitted to occur if there is in place a cultural heritage permit or approved cultural heritage management plan.

If required, a cultural heritage management plan must be prepared and approved before any other approval can be granted.

- *Heritage Act 1995* (State legislation)
This Act, administered by Heritage Victoria, provides for the protection and conservation of places and objects of cultural heritage significance, including:
 - historic archaeological sites and artefacts
 - historic buildings, structures and precincts
 - gardens, trees and cemeteries
 - cultural landscapes
 - shipwrecks and relics
 - significant objects.

Consultation with Heritage Victoria will be undertaken in regard to the location of the cultural heritage places and objects to ensure that any development does not impact on the heritage places.

- *Native Title Act 1993* (Commonwealth legislation)
Based on Native Title Tribunal mapping to date, it is not expected that there is a Native Title claim on the project area. If in fact there is a Native Title Claim, further specialist advice will be required.

2.6 Preliminary cost estimate

The current day cost estimate is as follows:

	\$ million
Capital project cost	
Pump station complex and associated infrastructure, including power supply	45
Pipeline and related works	580
Upgrade to Winneke Water Treatment Plant	55
Distribution diversification downstream of the Water Treatment Plant	70
Total estimated project cost	750
Annual operating expenses	17.5

2.7 Preliminary delivery schedule

Based upon initiating the next stage in the development of the project by the end of July 2007, the Sugarloaf Interconnector and associated infrastructure will be constructed and commissioned by the first half of 2010.

The preliminary project delivery schedule is provided in Appendix 9.

3.0 Next phase in delivery of the Sugarloaf Interconnector

Project development and pre-construction activities are scheduled to commence immediately. These activities include:

- undertaking a detailed alignment survey of the proposed route;
- initiating activities associated with land acquisition for the project;
- initiating activities associated with the resolution of all matters required to be addressed under statutory planning, heritage & environmental processes;
- commencement of the detailed design of the project to ensure that the procurement of long lead items is progressed expeditiously.

A key part of the next phase of the project is to establish a comprehensive community consultation and communication program with key stakeholders, particularly property owners that could be affected by land acquisition or easements.

Tenders for the construction activities will be issued by early 2008 with construction commencing in 2008.

4.0 Appendices