Consistency Review

MURRUMBIDGEE TO GOOGONG WATER TRANSFER PROJECT
MINI HYDRO DESIGN ALTERATIONS

DECEMBER 2011

nghenvironmental

Document Verification

Job title: Consistency Review. Murrumbidgee to Googong Water Transfer Project. Mini Hydro Design Alterations.

Document Title		Consistency Review					
File Name		\\WAGGA\Active\Projects\2010\Bulk Water Alliance\Report\Consistency Reports\Mini Hydro Elevations\CR for Mini Hydro Design Alterations Final.docx					
Revision	Date	Prepared by		Checked by		Approved by	
Draft	27.9.11	name	Erwin Budde	name	Natascha Arens	name	Erwin Budde
Final	17.11.11	Name	Erwin Budde	name	Nicholas Graham-Higgs	name	Erwin Budde

102/63-65 johnston st (po box 5464) wagga wagga nsw 2650 australia
t 61 2 6971 9696 f 61 2 6971 9693

www.nghenvironmental.com.au e ngh@nghenvironmental.com.au

unit 9/65 tennant st (po box 1037)
fyshwick act 2609 australia
t 61 2 6280 5053 f 61 2 6280 9387

18/21 mary st
surry hills nsw 2010 australia
t 61 2 8202 8333 f 61 2 6494 7773

po box 8323
perth bc 68849 australia
t 61 8 9759 1985 f 61 2 6494 7773

1/216 carp st (po box 470)
bega nsw 2550 australia
t 61 2 6492 8333 f 61 2 6494 7773

suite 6/234 naturaliste tce (po box 1037)
dunsborough wa 6281 australia
t 61 8 9759 1985 f 61 2 6494 7773

Table of Contents

1 THE PROPOSED DESIGN REFINEMENT 2
1.1 BACKGROUND 2
1.2 THE APPROVED PROJECT 2
1.3 THE PROPOSED DESIGN REFINEMENT 2
1.4 STATUTORY PLANNING CONTEXT 5
1.5 PURPOSE OF THIS REPORT 5
2 CONSISTENCY REVIEW 7
2.1 ASSESSMENT OF ENVIRONMENTAL DOCUMENT ISSUES IN RELATION TO CONSISTENCY 7
2.2 STATEMENTS OF COMMITMENTS 9
2.3 CONDITIONS OF APPROVAL 10
2.4 CONSISTENCY REVIEW 10
2.5 CONCLUSION AND RECOMMENDATIONS 11
3 REFERENCES 12
4 GLOSSARY 13

TABLES

Table 1 Consistency review 10

APPENDICES

Appendix 1 Conditions of Approval
Appendix 2 CO2 Dosing System – Assessment of Impact, September 2011
Appendix 3 M2G Mini Hydro, Consistency Check for Raised Floor Level, August 2011
Appendix 4 Community Information Details

1 THE PROPOSED DESIGN REFINEMENT

1.1 BACKGROUND

ACTEW Corporation and ActewAGL have partnered with John Holland Group, Abigroup and GHD to form the Bulk Water Alliance (BWA). The BWA was formed to construct and deliver four water security projects for the ACT:

- Enlarged Cotter Dam (ECD)
- Murrumbidgee to Cotter Pump Station (M2C)
- Googong Dam spillway upgrade (GDS)
- Murrumbidgee to Googong Reservoir Water Transfer Project (M2G)

The Murrumbidgee to Googong Water Transfer Project (M2G) involves transferring up to 100 megalitres of water per day from the Murrumbidgee River through a 12 kilometre underground pipeline to Burra Creek in NSW. The water will then flow approximately 13 kilometres along Burra Creek into Googong Reservoir. Prior to discharging into Burra Creek, the water will pass through a mini hydroelectricity generating plant (mini hydro) which will provide electricity back to the pump stations.

1.2 THE APPROVED PROJECT

This Approved Project broadly involves the following activities:

- Construction of a low lift pump station and intake structure at the Murrumbidgee River
- Construction of a high lift pump station
- Construction of a 12km underground pipeline
- Construction of an outlet structure at Burra Creek
- Construction of a mini-hydro power station

The project lies within both NSW and the ACT, and is subject to approval under the Commonwealth EPBC Act. As such, three separate Planning Approvals have been obtained and the project construction and operation is subject to three separate Conditions of Approval.

1.3 THE PROPOSED DESIGN REFINEMENT

The Approved Project includes the construction of a mini hydroelectricity generating plant (mini hydro plant). The EIS included general (concept) design details for the mini-hydro as follows.

> *"The mini-hydro power generator will be substantially underground and located near the outlet structure within the pipeline construction corridor away from the immediate environs of the Burra Creek bank to minimise local impacts and to protect the infrastructure from flooding. The facility will comprise of a turbine, generator and substation, with some minor above ground auxiliary components such as air vents and access portals.*
>
> *The above ground dimensions (foot print area) of the mini-hydro power generator are approximately 75m^2. The facility will include a buried valve pit with an exposed top and enclosing structure designed to reduce the potential for any noise emissions.*

Key features of the facility will include:

- *A purpose designed generating plant comprising a hydro generating unit;*
- *Plant rooms with required air venting and power supply infrastructure;*
- *A 11 kV substation;*
- *A main water control inlet valve to the turbines;*
- *Fire detection and fire fighting facilities;*
- *Drainage structures for stormwater collection; and*
- *Oil spill collection and separation units"*

The pipeline concept design as described in the EIS was limited to the following:

"The pipeline will be constructed of mild steel, and will be located beneath ground level. Air valves and scour valves will be located at regular intervals along the pipeline to provide air release and entry and to allow cleaning"

Since receiving Planning Approval BWA has undertaken detail design of the scheme. This process included a review of the pipeline materials that will be used and the inherent performance and use characteristics there-of. In finalising the pipeline materials BWA has become aware of the potential for the leaching of soluble aluminium and hydroxide (OH-) ions from the pipe linings, particularly after extended shutdown periods, with an associated result in a pH rise in water stored in the pipeline. Further background details to this issue are contained in the Assessment of Impact report attached as Appendix 2.

BWA has also become aware of potential flood impacts to the mini-hydro structure from recent flooding at Burra Creek. Hence, BWA has identified the need for two design alterations:

- The inclusion of a CO_2 dosing system at the outlet of the mini hydro plant to rectify any potential pH anomalies prior to discharge into Burra Creek.
- The need to increase the floor level of the mini hydro plant, and construct a small levee bank, to protect the facility from future flooding of Burra Creek.

1.3.1 CO_2 Dosing System

BWA proposed to include CO_2 dosing infrastructure at the mini-hydro facility. The proposed infrastructure will be built within the construction footprint that was approved for the mini-hydro facility. The proposed CO_2 dosing facility will be constructed on an area of approximately 13m^2, immediately adjacent and to the east of the mini-hydro building. This area has been shown as part of the mini-hydro facility building in the EIS.

The infrastructure will comprise of:

- CO_2 dosing infrastructure within a secure enclosure that include:
  - A 3.6mx1.74m DIA CO_2 storage vessel
  - CO_2 Vaporiser
  - CO_2 injector
- Supporting infrastructure such as pipework, valving and engineering services
- 4.8m x 3.5m secure cage enclosure with gates and signage.

BWA have designed the infrastructure to be in keeping with the mini-hydro building style so that it will not project above the roof line of the adjacent building. BWA advise it will be partly screened by vegetation and the earth embankment located to the south of the mini-hydro building.

BWA expect that the CO_2 dosing system will be temporarily operated as it is anticipated that the requirement for pH correction will reduce as leaching of hydroxide (OH-) ions from the OPC (ordinary portland cement) and HAC (high alumina cement) linings will reduce over time and as transfers occurs. BWA anticipate that pH correction and the operation of this facility may no longer be required within 5 years from commissioning.

Dosing will be associated primarily with the initial release of water within the pipeline during the period when the system is in-operative, and initially may require minor levels of dosing during initial operation. Dosing levels are automatically controlled in "real time" to ensure that the minimum CO_2 dose is added to the water to affect the pH correction sought. pH monitoring equipment will be installed to manage this process.

The operational requirement for this facility includes the delivery of CO_2 via a CO_2 tanker as and when required. BWA anticipate that the initial frequency of CO_2 deliveries will be less than 1 truck/fortnight and that this will reduce over time as the need for dosing diminishes. System monitoring will be conducted via the telemetry system.

Full details, including drawings, are included in Appendix 2.

1.3.2 Flood Mitigation and Protection

The mini hydro design was based on flood data obtained from the Burra Creek gauging station (Site 410774) for the period from 1985 to 2008. Using this data, a flood frequency analysis was undertaken to determine the flood discharge for the 1 in 100 year Annual Exceedance Probability (AEP) flood (equivalent to 100 year Average Recurrence Interval (ARI)). This discharge was input to a validated HEC-RAS model of Burra Creek at this location and hence a floor level was determined.

During bulk excavation for the mini hydro, debris was noted in the trees along the adjacent section of Burra Creek that was approximately 2 metres above the proposed floor level. The level of the debris was surveyed and this information used to investigate the flood levels. This indicated that a substantially greater flood had occurred in Burra Creek on 9 December 2010 than had occurred previously during the period of records since mid 1985.

Subsequently the assessed 1 in 100 year AEP flood level has been increased. Based on the amended flood levels for the 1 in 100 year AEP flood, there are three options for providing flood immunity. These are:

1. Maintain the existing floor level of RL 749.89 and flood proof the building. This would eliminate the side access, require through the roof access for maintenance, add considerable cost and significantly vary the concept of the proposed building. Nonetheless back flooding through the pipeline to the discharge structure is still possible and a flap valve could not be relied upon to secure the electrical equipment from inundation.

2. Raise the floor level to RL 750.8. This eliminates the risk of back flooding from the discharge structure pipeline. Side access is maintained and the concept is maintained. An earth mound is required alongside the southern side of the access being the old Williamsdale Road. The earth mound will add cost, but is more cost effective than a retaining wall.

3. Raise the floor level to RL 751.8. This eliminates the need for the earth mound and maintains the side access. However it raises the roof of the building to one metre above the top of the hill into which the mini hydro is being incorporated. It results in an excessively deep tank under the mini hydro building and significantly increases the earthworks immediately around the building.

Of the three options, the second has been adopted for the purposes of progressing the design. This would necessitate a change to the mini hydro general arrangement combining raising the mini hydro floor level by 0.91 m to RL 750.8 and an earth mound separating the mini hydro from the creek for a distance downstream of approximately 50 metres.

Full details are contained in Appendix 3.

1.4 STATUTORY PLANNING CONTEXT

The proposed design alterations at the mini hydro are a result of the detailed design process of the pipeline project. The proposed design alterations would occur only within the NSW component of the project. In NSW, the Approved Project was approved through an Environmental Assessment under Part 3A of the *Environmental Planning and Assessment Act 1979*. While this Part has since been repealed, transitional provisions apply and any potential modification to the Approved Project continues to be appropriately assessed under Section 75W of the EP&A Act.

Section 75W of the EP&A Act regulates the modification of a project approval under Part 3A. The Bulk Water Alliance is not required to obtain the Minister's modification of an approval, if the project as modified will be consistent with the Minister's approval.

1.5 PURPOSE OF THIS REPORT

BWA have appointed an independent Environmental Representative (ER) for the M2G project. The ER's specific roles are detailed in both the NSW and ACT approvals. The NSW condition is as follows:

NSW (Condition 6.1) - *Prior to the commencement of any construction or operational activities or as otherwise agreed by the Director-General, the Proponent shall nominate for the approval of the Director General a suitably qualified and experienced Environmental Representative(s) independent o. the design, construction and operation personnel. The Proponent shall engage the Environmental Representative(s) during any construction activities, and throughout the life of the project, or as otherwise agreed by the Director-General. The Environmental Representative(s) shall:*

a) oversee the implementation of all environmental management plans and monitoring programs required under this approval, and advise the Proponent upon the achievement of these plans/programs;

b) consider and advise the Proponent on its compliance obligations against all matters specified in the conditions of this approval and the Statement of Commitments as referred to under condition 1.1 c) of this approval, permits and licences; and

c) *have the authority and independence to recommend to the Proponent reasonable steps to be taken to avoid or minimise unintended or adverse environmental impacts, and, failing the effectiveness of such steps, to recommend to the Proponent that relevant activities are to be ceased as soon as reasonably practicable if there is a significant risk that an adverse impact on the environment will be likely to occur.*

The broad role of the ER is to advise BWA on matters relating to compliance with the NSW Approval.

This report aims to provide an independent assessment of whether the proposed design alteration is consistent with the project's Conditions of Approval. As it is not the role of the ER to assess environmental impacts of any proposed design alterations (only to advise on consistency matters), BWA have commissioned two environmental assessments and consistency studies to identify any changes to predicted environmental impacts from the proposed design alterations:

- M2G CO_2 Dosing System and the Mini-Hydro Infrastructure, Consistency Assessment of Impact, September 2011 (Appendix 2)
- M2G Mini Hydro, Consistency Check for Raised Floor Level, August 2011 (Appendix 3)

These studies have been reviewed as part of this consistency review and are relied upon in the consistency determination provided here.

2 CONSISTENCY REVIEW

2.1 ASSESSMENT OF ENVIRONMENTAL DOCUMENT ISSUES IN RELATION TO CONSISTENCY

The proposed design alterations at the mini hydro would not alter the overall Approved Project, which is to construct and operate a water supply pipeline between the Murrumbidgee River and Burra Creek. The major features of the Approved Project remain unchanged including the overall route, location of pump stations inlet and discharge structures and the provision of a mini-hydro power station.

The proposed realignment route remains within the 'study area' for the EA. Consequently, the information obtained within the EIS is adequate for the assessment of any additional or changed impacts from the design alteration.

2.1.1 Hydrology

BWA undertook modelling of the proposed earth bund on the effects it may have on the flows in Burra Creek (Appendix 3). The modelling found that the bund would have the effect of constricting flow in large flood events which has resulted in higher velocities in the creek channel and overbank areas and some modification of the flood profile. The modelling concluded that the rise in water levels would be no more than 40mm which it was assessed that it would not have any impact on property and is not significant.

There would be no impact to hydrology from the proposed CO_2 dosing system (Appendix 2).

2.1.2 Footprint and Land Use

The footprint of the mini hydro remains less than that stated in the EIS (30 m x 25 m). The CO_2 dosing system would not require an increase in land take for the mini hydro. The EIS identified the above ground dimensions (footprint area) of the mini-hydro power generator would be approximately 75m^2. The facility will include a separate buried valve pit with an exposed top and enclosing structure designed to reduce the potential for any noise emissions. Detailed design of the mini hydro has resulted in an increase in the dimensions of the building floor plan to 12m by 10m (total floor area of 120m^2). BWA consider this to be due largely to the previously separate valve pit being deleted and the valves located inside the mini hydro building with the mini hydro equipment, requiring a larger building.

The proposed earth bund would be located within the Approved Project boundaries.

2.1.3 Water Quality

The earth bund is proposed to be stabilised with vegetation. No impacts to water quality have been anticipated from the earth bund or floor plan elevation design alterations.

Key operational procedures in relation to water quality are contained within the approved Stream Flow and Water Quality Monitoring Sub Plan (SF&WQMP). The Plan includes water quality trigger levels for Burra Creek. BWA consider two impacts from the initial operation of the pipeline:

- Leaching of soluble aluminium from the pipe lining
- pH rise in water in the pipeline from hydroxide ion leaching

BWA requested Dr Norm Mueller of ALS Global undertake a review of water quality impacts of the above. In relation to soluble aluminium, Dr Mueller believes the concentrations in the discharged water are likely to be similar to, or lower than those experienced naturally in Burra Creek (Memo 1/12/10 – Appendix 2). Therefore, BWA consider that no impacts are likely (Appendix 2)

BWA undertook investigations into the likely impacts of hydroxide ion leaching on the pH of discharge water (Memo John Dymke, 20/4/11 – Appendix 2). The investigations found that a pH change of between 1 and 3 units is possible from extended shutdown periods. This would exceed the allowable discharge limits set in the SF&WQMP.

Options for dosing were then investigated, including dosing with an acid solution or with gaseous CO_2. For safety and environmental reasons, CO_2 dosing was the preferred option. Dr Mueller was requested to comment on the likely impacts of CO_2 dosing, which include pH change and potential for carbonate precipitation. At a dosing rate of 25mg/L for 15ML of discharge, Dr Mueller expects no by-products to be formed that would affect Burra Creek environmentally or the Googong Reservoir receiving water. pH would be driven down with the resulting calcium in the raw water not reaching the expected saturation point and therefore not precipitate out (Memo, 25/8/11 – Appendix 2).

Dr Mueller further advises that it is unlikely that the quantity of CO2 dosed would lead to deoxygenation of Burra Creek.

2.1.4 Community Engagement

BWA undertook a number of community information initiatives to inform the broader community of the proposed CO_2 dosing system. It is considered that the local community may have a concern regarding the proposed CO2 dosing system. The actions undertaken included:

- A letter was sent to 4 community members (Appendix 4). No response had been received as of the 29th September 2011
- A letter was sent to Palerang Council. In addition, a meeting was held between BWA and Palerang Council. A letter response was received from Palerang Council indicating they had no further concerns (Appendix 4)
- BWA received several inquiries from community members and consequently met with Mark Hehir (near resident to the site), Kath Boyd, Peter Duffy and Sandy and Mervon Lloyd. Records were kept of these meetings (Appendix 4).

2.1.5 Traffic and Transport

BWA have identified two potential impacts to traffic from the proposed design alterations (Appendix 2):

1. Additional construction traffic
2. Heavy vehicle traffic associated with refilling of the CO_2 storage facility

BWA consider the additional construction traffic to be minor and not significant.

BWA consider the additional truck movements during operation to be up to 1 truck per fortnight, reducing over time as the need for CO2 dosing diminishes. It considers this impact to be not significant on either road and traffic safety or operation of the road network.

2.1.6 Visual Amenity

BWA undertook an assessment of impacts to visual amenity from the proposed CO_2 dosing system (Appendix 2), which concluded that the facility would not be visible from the sensitive receivers located on the opposite side of Burra Creek due in part to the presence of the earth flood protection wall. It will however be visible to people passing along Williamsdale Road and Burra Creek while passing the infrastructure. BWA considers that the facility is typical of utility installations and would not be out of character with the adjacent mini-hydro structure. It is considered that visual impacts would not be significantly different to those assessed for the Approved Project.

2.1.7 Other Environmental Issues

No other environmental issues are considered to be affected as a result of the proposed design alteration, including:

- Flora and fauna
- Air & Energy
- Waste
- Heritage (Non-Indigenous)
- Heritage (Indigenous)
- Noise

2.2 STATEMENTS OF COMMITMENTS

A review of consistency with the Statements of Commitments has been undertaken. SoC's of particular relevance include:

> *"4. All construction discharges from the area of works will meet ACT EPA legislative requirements (for the Murrumbidgee River) and NSW DECCW legislative requirements for Burra Creek.*
>
> *8. Water abstracted [sic] from the Murrumbidgee River will be released into Burra Creek without delay to minimise deoxygenisation and cooling. Operational rules will be developed to acceptable levels of turbidity in the Murrumbidgee.*
>
> *10. Regular review of water quality monitoring results for any trends toward significant impacts in Murrumbidgee River, Burra Creek or Googong Reservoir. The monitoring and adaptive management plan will include actions required to address any identified trends in a timely manner.*
>
> *46. Above ground structures along the pipeline corridor will be designed and located to be as visually unobtrusive as practicable."*

Advice received by BWA from Dr Mueller indicates that the proposed design alterations will not prevent discharges meeting necessary NSW DECCW (now OEH) legislative guidelines for Burra Creek.

As outlined in BWA's report (Appendix 2) SoC 8 is unable to be met due to the need for water to be retained in the pipeline during periods of inactivity. BWA have identified the likely impacts of this and have developed a mitigation strategy using CO_2 dosing to ensure water quality parameters can be met.

SoC 10 would not be affected by the proposed design alterations.

BWA have indicated that the proposed CO_2 dosing facility will be above ground, however as detailed in Appendix 2, the structure will be visually hidden from nearby sensitive receivers and screened with landscaping. Hence, it is considered that SoC 46 has been met.

None of the Statements of Commitments prohibit or limit the proposed flood mitigation works or CO_2 dosing facility. Similarly, the proposed design alterations would not prevent the full implementation of any of the Statements of Commitments.

2.3 CONDITIONS OF APPROVAL

A review of consistency with the Conditions of Approval has been undertaken, and is included below as Table 1. There are no Conditions of Approval specific to the mini-hydro structure. None of the Conditions of Approval prohibit or limit the proposed design alterations. Similarly, the proposed design alterations would not prevent the full implementation of any of the Conditions of Approval.

2.4 CONSISTENCY REVIEW

A review of consistency issues is presented in Table 1.

Table 1 Consistency review

Consistency Question	Discussion	Response
Would the introduction of the proposed change, either by itself or in association with any other proposed change, result in any Condition of Approval (other than Condition of Approval 1) not being met?	The activities proposed in the design alteration would not result in any of the CoA's not being met.	No
Do the proposed changes, considered together, result in a radical change to the approved project as a whole?	The overall Approved Project is not affected by the proposed changes. The proposed changes at the mini-hydro in no way radically changes the Approved Project.	No
Do the proposed changes, considered together, result in a substantive change to the objectives and functions of the approved project as a whole?	The objective of the Approved Project is to provide water security to the ACT. The function of the Approved Project is to construct and operate a water pipeline from the Murrumbidgee River to Burra Creek. The proposed design alterations at the mini hydro would not alter these objectives or functions.	No

Consistency Question	Discussion	Response
Does any single proposed change considered separately (or, as relevant, in association with any other proposed change) result in a substantive change to the objectives and functions of that element of the approved project which is to be modified and in so doing, does not help to better satisfy any other Conditions of Approval?	The proposed realignment would not alter the project objectives or function.	No
Does any single proposed change result in any change in impact of such nature or scale (including impact on different people to those who were affected by the approved project) that it would be unreasonable not to make public?	None of the impacts likely to be incurred from the proposed design alteration would change in scale or nature any previously assessed and publicly displayed impact identified for the Approved Project. It is considered that the community may have concerns regarding the treatment of water, chemically or otherwise, which was not disclosed in the publicly displayed and available documentation to which they were able to make submissions. BWA has undertaken further community information actions to inform the community of the proposed CO_2 dosing system. While it is considered the community may have concerns about dosing of discharge water, BWA consider the impacts on water quality to be minimal.	No

2.5 CONCLUSION AND RECOMMENDATIONS

Section 2.1 above identifies a range of issues in support of consistency. Although these issues are not specifically addressed by the five questions, they are relevant in verifying the proposed changes consistency to the Minister's approval of the Approved Project.

As the test questions are answered in the negative, the proposed design refinement is considered consistent with the Minister for Planning's approval of the Approved Project.

It is recommended that:

- Monitoring for soluble aluminium be included in the Stream Flow and Water Quality Monitoring Sub Plan (SF&WQMP) to ensure levels of aluminium in water discharged from the project do not exceed acceptable levels for Burra Creek.
- The revised SF&WQMP be submitted to the NSW Office of Environment and Heritage (OEH) and NSW Department of Infrastructure and Planning (DPI).
- Details of the proposed CO_2 dosing system, including advice received from Dr Mueller in regards to the likely impacts of CO_2 dosing on water quality, be made publically available.

3 REFERENCES

Minister for Planning 2007. *Project Approval Section 75J of the Environmental Planning and Assessment Act 1979.*

Murrumbidgee to Googong Water Transfer Project Environmental Impact Statement.

Murrumbidgee to Googong (M2G) CO2 Dosing System at Min-Hydro Infrastructure, September 2011

Murrumbidgee to Googong (M2G) Mini Hydro, Consistency Check for Raised Floor Level, August 2011

4 GLOSSARY

Approved Project	The Murrumbidgee to Googong Water Transfer Project based on the EIS that was approved by: The NSW Minister for Planning on under Part 3A of the *Environmental Planning and Assessment Act 1979*. The Commonwealth Minister for Environment The ACT Government
BWA	Bulk Water Alliance
DoP	NSW Department of Planning
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979*
MCoA	Ministers Conditions of Approval
Proposed design alteration	The changes to the EIS concept design

Appendix 1 Conditions of Approval

Project Approval

Section 75J of the *Environmental Planning and Assessment Act 1979*

I, the Minister for Planning, approve the project referred to in Schedule 1, subject to the conditions in Schedule 2.

These conditions are required to:

- prevent, minimise, and/or offset adverse environmental impacts;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the ongoing environmental management of the project.

The Hon. Tony Kelly MLC
Minister for Planning

Sydney 31 MAR 2010 2010 File No: S08/01311

SCHEDULE 1

Application No:	08_0160
Proponent:	ACTEW Corporation
Approval Authority:	Minister for Planning
Land:	The pipeline route traverses approximately 12 kilometres on land between New South Wales and the Australian Capital Territory. Approximately 9 kilometres of the pipeline will traverse land within the Palerang Local Government Area of New South Wales.
Project:	Murrumbidgee to Googong Water Transfer project involves construction and operation of a water pipeline that transfers up to 100 megalitres of water per day from the Murrumbidgee River at Angle Crossing (Australian Capital Territory) to Burra Creek (New South Wales) approximately 10 kilometres south of Googong Reservoir.
Major Project:	The proposal is declared a Major Project under section 75B(1)(a) of the *Environmental Planning and Assessment Act 1979*, because it is a project of a kind described in Group 8, clause 26A of Schedule 1 to *State Environmental Planning Policy (Major Projects) 2005.* Namely development for the purpose of a pipeline in respect of which an application for a licence is made under the *Pipelines Act 1967* on or after the commencement of this clause
Critical Infrastructure Project:	The Project is "critical infrastructure" by virtue of an order made by the Minister on 26 June 2009 under section 75C. project within the meaning of section 75C of the Act.

KEY TO CONDITIONS

1.	**ADMINISTRATIVE CONDITIONS**	**4**
	Terms of Approval	4
	Limits of Approval	4
	Statutory Requirements	4
2.	**SPECIFIC ENVIRONMENTAL CONDITIONS**	**4**
	Soil and Water Quality Impacts	4
	Ecological Impacts- Terrestrial	5
	Ecological Impacts- Aquatic	6
	Noise Impacts	6
	Traffic and Transport Impacts	7
	Heritage Impacts	8
	Waste Generation and Management	8
	Air Quality Impacts	8
3.	**ENVIRONMENTAL MONITORING AND AUDITING**	**9**
	Morphological Monitoring	9
	Water Quality Monitoring	9
	Ecological Monitoring	10
4.	**COMMUNITY INFORMATION, CONSULTATION AND INVOLVEMENT**	**10**
	Provision of Electronic Information	10
	Community Information Plan	10
	Complaints Procedure	11
5.	**COMPLIANCE TRACKING PROGRAM**	**11**
6.	**ENVIRONMENTAL MANAGEMENT**	**12**
	Environmental Representative	12
	Construction Environmental Management Plan	12
	Operation Environmental Management Plan	14
7.	**ENVIRONMENTAL REPORTING**	**15**
	Incident Reporting	15

SCHEDULE 2

Act, the	*Environmental Planning and Assessment Act, 1979.*
Conditions of Approval	The Minister's conditions of approval for the project.
Construction	All pre-operation activities associated with the project other than survey, acquisitions, fencing, investigative drilling or excavation, building/road dilapidation surveys or other activities determined by the Environmental Representative to have minimal environmental impact such as minor access roads, minor adjustments to services/ utilities, establishing temporary construction sites (in accordance with the requirements of this project approval), or minor clearing (except where threatened species, populations or ecological communities would be affected).
Council	Palerang Council.
DECCW	Department of Environment, Climate Change and Water.
Department, the	Department of Planning.
Director-General, the	Director-General of the Department of Planning (or delegate).
Director-General's Approval	A written approval from the Director-General (or delegate) where the Director-General's Approval is required under a condition. The Director-General may ask for additional information if the approval request is considered incomplete.
Director-General's Report	The report provided to the Minister by the Director-General of the Department under section 75I of the EP&A Act.
Dust	any solid material that may become suspended in air or deposited.
EA	*Murrumbidgee to Googong Water Transfer Environmental Assessment* prepared by GHD and dated 7 August 2009.
Minister, the	Minister for Planning.
Pipeline	The water pipeline proposed in the *Murrumbidgee to Googong Water Transfer Environmental Assessment*.
Preferred Project Report	*The Murrumbidgee to Googong Water Transfer Preferred Environmental Impact Statement incorporating the Preferred Project Report* prepared by ACTEW and dated 21 December 2009.
Proponent	ACTEW Corporation, or any party acting under authorisation from and on behalf of ACTEW Corporation.
Project	Development to which Major Projects Application 08_0160 applies.
Publicly Available	Available for inspection by a member of the general public (for example available on an internet site or at a display centre).
Reasonable and feasible	Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the New South Wales and Australian context. **Feasible** relates to engineering considerations and what is practical to build. **Reasonable** relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community views and nature and extent of potential improvements.
Site	The land to which this approval applies.

1. ADMINISTRATIVE CONDITIONS

Terms of Approval

1.1 The Proponent shall carry out the project generally in accordance with the:
   a) Major Project Application 08_0160;
   b) the *Murrumbidgee to Googong Water Transfer Environmental Assessment* prepared by the Proponent and dated 7 August 2009;
   c) the *Murrumbidgee to Googong Water Transfer Preferred Project Report contained in the Environmental Impact Statemen* prepared by the Proponent and dated 21 December 2009; and
   d) the conditions of this approval.

1.2 In the event of an inconsistency between:
   a) the conditions of this approval and any document listed from condition 1.1a) to 1.1c) inclusive, the conditions of this approval shall prevail to the extent of the inconsistency; and
   b) any document listed from condition 1.1a) to 1.1c) inclusive, and any other document listed from condition 1.1a) to 1.1c) inclusive, the most recent document shall prevail to the extent of the inconsistency.

1.3 The Proponent shall comply with any reasonable requirement(s) of the Director-General arising from the Department's assessment of:
   a) any reports, plans or correspondence that are submitted in accordance with this approval; and
   b) the implementation of any actions or measures contained in these reports, plans or correspondence.

Limits of Approval

1.4 This project approval shall lapse five years after the date on which it is granted, unless the works subject of this approval has been completed on the site before that time.

Statutory Requirements

1.5 The Proponent shall ensure that all licences, permits and approvals are obtained and maintained as required throughout the life of the project. No condition of this approval removes the obligation of the Proponent to obtain, renew or comply with such licences, permits or approvals. The Proponent shall ensure that a copy of this approval and all relevant environmental approvals are available on the site at all times during the project.

1.6 This approval does not operate unless and until the Proponent has obtained relevant associated approvals for the Murrumbidgee to Googong Water Transfer project from the Australian Capital Territory Government under the *Planning and Development Act 2007* and the Commonwealth Government under the *Environment Protection and Biodiversity Conservation Act 1999*.

2. SPECIFIC ENVIRONMENTAL CONDITIONS

Soil and Water Quality Impacts

2.1 The Proponent shall comply with section 120 of the *Protection of the Environment Operations Act 1997* which prohibits the pollution of waters.

2.2 Soil and water management controls shall be employed to minimise soil erosion and the discharge of sediment and other pollutants to lands and/or waters during construction activities, in accordance with *Managing Urban Stormwater: Soils and Conservation* (Landcom, 2004).

2.3 The Proponent shall design, construct, operate and maintain the project to avoid impacts on bank stability within the Burra Creek riverine corridor and Googong Reservoir outlet and does not increase local flooding risk.

2.4 The Proponent shall not transfer water when Burra Creek is in flood based on a one in two year event or greater nor should the Proponent operate the pipeline where it results in water levels in Burra Creek being greater than the one in two year flood level.

2.5 Prior to the commencement of construction the Proponent shall conduct a review of potential conflicts between the project alignment and any identified hard rock resources existing along or adjacent to the pipeline easement. The review shall consider all reasonable and feasible options for resolving any identified conflicts, and shall be submitted for the Director-General's approval prior to the commencement of construction.

Ecological Impacts- Terrestrial

2.6 In regards to the Endangered Purple Pea, *Swainsona recta* the Proponent shall:

a) avoid and protect the identified population of the species during construction of the crossing at the Goulburn to Cooma railway line;

b) submit to the Director-General and DECCW, as part of the Construction Environmental Management Plan required under condition 6.2, a pre construction survey of all potentially suitable habitat along the pipeline easement. The survey shall be conducted during the species flowering period; and

c) minimise impacts to any population identified during the surveying described in b), through detailed design and alignment refinements.

2.7 The pipeline easement width shall be reduced to the minimum feasible width in areas along the easement that are known to contain endangered ecological communities and/or threatened species habitat. Details regarding the extent and location of these reductions shall be included in the Construction Environment Management Plan contained in condition 6.2.

2.8 Any clearing of native vegetation, native grassland particularly Box Gum Grassy Woodland and rocky outcrops during construction of the pipeline shall be limited to the minimum feasible extent.

2.9 Areas specified in Table 1 that are expected to be cleared shall be offset utilising the compensatory habitat offset package described in documentation represented by Condition 1.1 c). The package located on the Williamsdale Property in the Australian Capital Territory shall be implemented prior to commissioning of the project. The package shall offset in perpetuity the value of habitat lost as a result of the project. A final review of the compensatory habitat offset package shall be provided to the Director-General in the Operation Environment Management Plan. This version shall:

a) demonstrate the implementation of the offset;

b) describe how the offset shall be guaranteed and monitored in perpetuity; and

c) demonstrate a post construction review has been undertaken that confirms the extent of clearing was not greater than predicted. If clearing was greater, then the package shall demonstrate how the offset was modified and increased to the value of the actual habitat lost.

Table 1 – Habitat areas expected to be cleared

Endangered Ecological Community Habitat	Native Vegetation (Hectares)
Box-Gum Grassy Woodland	11.1
Natural Temperate Grassland	1.7
Snow Gum Grassy Woodland	0.3
Other Native Vegetation	3.6
Total	**16.7**

2.10 After construction is complete and for a period of two years after that time (or as otherwise required by the Director-General) the Proponent shall monitor areas along the project alignment, for weed infestation. Any infestations shall be actively managed to remove or minimise their spread.

Ecological Impacts- Aquatic

2.11 The Proponent shall implement the aquatic ecology management measures committed to in the documents set out in condition 1.1c) or elsewhere in these conditions of approval, including;

a) monitoring and subsequent maintenance of flow transfer volumes to reasonably and feasibly mimic the natural flow regime based on stochastic data defined in the Preferred Project Report of Burra Creek during the native fish breeding season in order to protect any spawning populations of threatened fish species;
b) design measures to prevent the spread of invasive fish species;
c) design measures for the protection of natural ponding habitat. If the current natural ponds along Burra Creek are lost as a result of increased flows, the Proponent is required to re-establish natural ponding habitat; and
d) regular review of aquatic ecology monitoring results for any trends toward significant impacts in Burra Creek or Googong Reservoir.

2.12 Prior to the commencement of construction, the Proponent shall consult with the Department of Industry and Investment regarding the final design of the fish egg screens and proposed operating procedures of the pump stations. The pumping station shall be designed and operated in such a way that pumping cannot occur when adequate fish egg screens are not in place.

Noise Impacts

Construction Noise

2.13 The Proponent shall only undertake construction activities associated with the project that would generate an audible noise at any residential premises during the following hours:

a) 7:00 am to 6:00 pm, Mondays to Fridays, inclusive;
b) 8:00 am to 1:00 pm on Saturdays; and
c) at no time on Sundays or public holidays.

2.14 This condition does not apply in the event of a direction from police or other relevant authority for safety reasons, to prevent environmental harm or risk to life.

2.15 The hours of construction activities may be varied with the prior written approval of the Director-General. Any request to alter the hours of construction shall be:

a) considered on a case-by-case basis;
b) accompanied by details of the nature and need for activities to be conducted during the varied construction hours and any other information necessary to reasonably determine that activities undertaken during the varied construction hours will not adversely impact on the acoustic amenity of receptors in the vicinity of the site; and
c) affected residential receivers being informed of the timing and duration of work approved under this condition at least 48 hours before that work commences.

Construction Blasting

2.16 Blasting associated with the construction of the project shall only be undertaken during the following hours:

a) 9:00 am to 5:00 pm, Mondays to Fridays, inclusive;
b) 9:00 am to 5:00 pm on Saturdays; and
c) at no time on Sundays or public holidays.

2.17 The Proponent shall ensure that air blast overpressure generated by blasting associated with the project does not exceed the criteria specified in Table 2 when measured at the most-affected residential or sensitive receiver.

Table 2 – Airblast Overpressure Criteria

Airblast Overpressure (dB(Lin Peak))	Allowable Exceedance
115	5% of total number of blasts over a 12 month period
120	Never

2.18 The Proponent shall ensure that the ground vibration generated by blasting associated with the project does not exceed the criteria specified in Table 3 when measured at the most-affected residential or sensitive receiver.

Table 3 – Peak Particle Velocity Criteria

Peak Particle Velocity Criteria	Allowable Exceedance
5	5% of total number of blasts over a 12 month period
10	Never

2.19 Prior to each blasting event, the Proponent shall notify the relevant local council and potentially-affected landowners, including details of time and location of the blasting event and providing a contact point for inquiries and complaints.

Operation Noise and Vibration

2.20 The Proponent shall take all reasonable measures to minimise noise emissions and vibration from all plant and equipment operated on the site such that they do not exceed noise and vibration criteria derived by application of the *NSW Industrial Noise Policy* (DECC, 2000) and *Assessing Vibration: A Technical Guideline* (DECC, 2006).

Traffic and Transport Impacts

2.21 Where the pipeline is located along and within a public road formation the Proponent shall:

a) commission a qualified person to undertake a Road Dilapidation Report of all roads proposed to be used for construction and access activities in consultation with relevant road authorities. The Report shall assess the current condition of the relevant roads.

b) following completion of construction a subsequent Road Dilapidation Report shall be prepared to assess any damage that may have resulted due to traffic and transport related to the construction and ongoing operation of the project.

The Proponent shall restore the relevant roads to a state, described in the original Road Dilapidation report. The cost of any restorative work described in the subsequent Report or recommended by the relevant road authorities after review of the subsequent Report, shall be funded by the Proponent. Such work shall be undertaken at a time as agreed upon between the Proponent and the relevant road authorities. In the event of a dispute between the parties with respect to the extent of restorative work that may be required under this condition, any party may refer the matter to the Director-General for resolution. The Director-General's determination of any such dispute shall be final and binding on the parties.

2.22 The Proponent shall ensure that all pipeline crossings of roads are constructed using construction methods and depth cover determined in consultation with the relevant road authority.

2.23 The Proponent shall apply to the relevant authority for any proposed temporary road closures at least one month prior to the proposed closure. Advertisement of the closure shall be funded by the Proponent.

2.24 The Proponent shall obtain the relevant consent to utilise the nominated Council storage areas within Williamsdale Road Reserve subject to Council requirements.

2.25 The Proponent shall consult with the Australian Railway Historical Society to ensure the timing of any construction impacts on the use of the Goulburn to Cooma Railway (Michelangelo Tourist Railway) are minimised.

Heritage Impacts

2.26 If during the course of construction the Proponent becomes aware of any previously unidentified significant Aboriginal object(s), all work likely to affect the object(s) shall cease immediately and the DECCW informed in accordance with the *National Parks and Wildlife Act 1974*. Relevant works shall not recommence until written authorisation from the DECCW advising otherwise is received by the Proponent.

2.27 If during the course of construction the Proponent becomes aware of any previously unidentified heritage object(s), all work likely to affect the object(s) shall cease immediately and the Heritage Council of New South Wales shall be notified immediately in accordance with the *NSW Heritage Act 1977*. Management measures set out in the Unanticipated Discovery Protocol discussed in the Statement of Commitments contained in the Preferred Project Report represented by condition 1.1c) shall be implemented.

2.28 Any indigenous or non-indigenous items of heritage significance located along or within the vicinity of the pipeline easement shall be avoided including sites and/or objects along Burra Creek and London Bridge karst formations as well as at Williamsdale School.

2.29 Monitoring of London Bridge karst formations is to occur subject to commitments made in the Proponent's Statement of Commitments contained in documents referred to in condition 1.1c).

Waste Generation and Management

2.30 All waste materials removed from the site shall only be directed to a waste management facility lawfully permitted to accept the materials.

2.31 The Proponent shall maximise the treatment, reuse and/or recycling on the site of any excavated soils, slurries, dusts and sludges associated with the project, to minimise the need for treatment or disposal of those materials outside the site.

2.32 The Proponent shall not cause, permit or allow any waste generated outside the site to be received at the site for storage, treatment, processing, reprocessing, or disposal on the site, except as expressly permitted by a licence under the *Protection of the Environment Operations Act 1997*, if such a licence is required in relation to that waste.

2.33 The Proponent shall ensure that all liquid and/or non-liquid waste generated and/or stored on the site is assessed and classified in accordance with *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes* (DEC, 2004), or any future guideline that may supersede that document.

Air Quality Impacts

Dust Generation

2.34 The Proponent shall construct and operate the project in a manner that minimises dust emissions from the site, including wind-blown and traffic-generated dust. All activities on the site shall be undertaken with the objective of preventing visible emissions of dust from the site. Should such visible dust emissions occur at any time, the Proponent shall identify and implement all practicable dust mitigation measures, including cessation of relevant works, as appropriate, such that emissions of visible dust cease.

Odour

2.35 The Proponent shall not cause or permit the emission of offensive odours from the site in accordance with the provisions of Section 129 of the *Protection of the Environment Operations Act 1997.*

3. ENVIRONMENTAL MONITORING AND AUDITING

Geo-Morphological Monitoring

3.1 Prior to the commencement of construction the Proponent shall prepare and implement a **Geo-Morphological Monitoring Program** to monitor the impact of the project on the present morphology of Burra Creek at the pipeline outlet location and downstream to Googong Reservoir. The Program shall be developed in consultation with the DECCW and shall include but not necessarily be limited to:

a) set out monitoring requirements in order to assess the impact of the project on the present geo-morphology of Burra Creek at the pipeline outlet location and downstream to Googong Reservoir.
b) baseline monitoring prior to the introduction of flows through Burra Creek in order to establish any geo-morphological changes resulting from the project.
c) provisions for monitoring during construction, operational and non-operational phases;
d) mechanisms for immediately investigating any anomalous monitoring results;
e) mechanisms for the management and mitigation of any impacts on the waterways including cessation of flows where necessary; and
f) details of how the monitoring results will be reported to the Director-General and the DECCW.

The Program shall be submitted for the approval of the Director-General no later than one month prior to the commencement of construction, or within such period otherwise agreed by the Director-General, accompanied by written evidence that the DECCW has been consulted and that the DECCW is satisfied with the Program. Construction shall not commence until written approval has been received from the Director-General.

Water Quality Monitoring

3.2 Prior to the commencement of construction, the Proponent shall prepare and implement a **Surface Water Monitoring Program** to monitor and manage the impact of the project on the waterways into which any extracted Murrumbidgee River water is discharged. The Program shall be prepared in accordance with sections 8.2.3.3 and 8.2.3.4 of *Australian and New Zealand Guidelines for Fresh and Marine Water Quality – Volume 2: Aquatic Ecosystems* (ANZECC & ARMCANZ, 2000) The Program shall be developed in consultation with the DECCW and shall include but not necessarily be limited to:

a) the monitoring framework detailed in the documents referred to in condition 1.1;
b) a baseline monitoring program;
c) an evaluation of the discharges in terms of temporal and spatial scales;
d) a comparison of discharge data with baseline data;
e) sampling and data collection at representative sites, both impact (downstream of the discharge point) and control (upstream of the discharge point) sites;
f) sampling and data collection for the discharges and immediate receiving environment to quantify the changes in ecosystem health and water quality with specific reference to phytoplankton, aquatic vegetation, macroinvertebrates, fish, temperature, salinity, dissolved oxygen, iron and manganese;
g) provisions for the review of the Program within six months of commencement of the first full operational flow into Burra Creek;
h) identification of key water parameters including but not limited to flow rate, temperature, ph, salinity, total dissolved solids and nutrient parameters for the operation of the project;
i) management actions for the parameters identified in h) should they be breached; and
j) details of how the monitoring results will be reported to the Director-General and DECCW.

The Program shall be submitted for the approval of the Director-General no later than one month prior to the commencement of construction, or within such period otherwise agreed by the Director-General, accompanied by evidence that the DECCW has been consulted regarding the Program. Construction shall not commence until written approval has been received from the Director-General.

Ecological Monitoring

3.3 Prior to the commencement of construction the Proponent shall prepare and implement an **Ecological Monitoring Program** to monitor the impact of the project on the ecology that may be impacted by the proposal. The Program shall be developed in consultation with the DECCW and Department of Industry and Investment NSW and shall include but not necessarily be limited to:

a) set out monitoring requirements as detailed in the documents referred to in Condition 1.1 c), in order to assess the impact of the project on Ecology present along the easement and at Burra Creek at the pipeline outlet location and downstream including the Googong Reservoir.
b) baseline monitoring prior to the introduction of flows through Burra Creek in order to establish any ecological changes resulting from the project.
c) provisions for monitoring trench areas for any native fauna impacts likely to result from this work. Any native fauna found in the open trench shall be recorded and managed in consultation with DECCW;
d) provisions for monitoring during construction, operational and non-operational phases;
e) mechanisms for immediately investigating any anomalous monitoring results;
f) mechanisms for the management and mitigation of any impacts on the waterways including cessation of flows where necessary; and
g) details of how the monitoring results will be reported to the Director-General and the DECCW and the Department Industry and Investment NSW.

The Program shall be submitted for the approval of the Director-General no later than one month prior to the commencement of construction, or within such period otherwise agreed by the Director-General, accompanied by evidence that the DECCW has been consulted regarding the Program. Construction shall not commence until written approval has been received from the Director-General.

4. COMMUNITY INFORMATION, CONSULTATION AND INVOLVEMENT

4.1 Subject to confidentiality, the Proponent shall make all documents required under this approval available for public inspection on request.

Provision of Electronic Information

4.2 Prior to the commencement of construction of the project, the Proponent shall establish a dedicated website or maintain dedicated pages within its existing website for the provision of electronic information associated with the project subject to confidentiality. The Proponent shall publish and maintain up-to-date information on this website or dedicated pages including, but not necessarily limited to:

a) the current implementation status of the project;
b) a copy of this approval and any future modification to this approval;
c) a copy of each relevant environmental approval, licence or permit required and obtained in relation to the project;
d) a copy of each plan, report, or required monitoring program under this approval; and
e) details of the outcomes of compliance reviews and audits of the project.

Community Information Plan

4.3 Prior to the commencement of construction, the Proponent shall prepare and implement a **Community Information Plan** which sets out the community communications and consultation processes to be undertaken during construction and operation of the project. The Plan shall include but not be limited to:

a) procedures and timing to consult with the community and Palerang Council in order to come to an agreement regarding revegetation of Burra Creek adjacent to Burra Village, raising of pedestrian access to London Bridge Homestead above the predicted high water mark and the construction of a bridal trail along areas where roadwork is required.
b) procedures to inform the local community of planned investigations and Construction activities, including blasting works;
c) procedures to inform the relevant community of Construction traffic routes and any potential disruptions to traffic flows and amenity impacts;
d) procedures to consult with local landowners with regard to Construction traffic to ensure the safety of livestock and to limit disruption to livestock movements;
e) procedures to inform the community where work has been approved to be undertaken outside the normal Construction hours, in particular noisy activities;
f) procedures to inform and consult with affected landowners to rehabilitate impacted land;
g) procedures to notify relevant landowners of the process available to review potential impacts on radio and television transmission; and
h) procedures to notify relevant landowners of the process available to review potential impacts on aerial spraying.

Complaints Procedure

4.4 Prior to the commencement of construction of the project, the Proponent shall ensure that the following are available for community complaints for the life of the project (including construction and operation):
a) a 24 hour telephone number on which complaints about construction and operational activities at the site may be registered;
b) a postal address to which written complaints may be sent; and
c) an email address to which electronic complaints may be transmitted.

The telephone number, the postal address and the e-mail address shall be advertised in a newspaper circulating in the locality on at least one occasion prior to the commencement of construction and at six-monthly intervals for two years following commencement of operation of the project. These details shall also be provided on the Proponent's internet site. The telephone number, the postal address and the email address shall be displayed on a sign near the entrance to the site, in a position that is clearly visible to the public.

4.5 The Proponent shall record details of all complaints received through the means listed under condition 4.4 of this approval in an up-to-date Complaints Register. The Register shall record, but not necessarily be limited to:
a) the date and time, where relevant, of the complaint;
b) the means by which the complaint was made (telephone, mail or email);
c) any personal details of the complainant that were provided, or if no details were provided, a note to that effect;
d) the nature of the complaint;
e) any action(s) taken by the Proponent in relation to the complaint, including timeframes for implementing the action; and
f) if no action was taken by the Proponent in relation to the complaint, the reason(s) why no action was taken.

The Complaints Register shall be made available for inspection by the Director-General upon request.

4.6 The Proponent shall provide an initial response to any complaints made in relation to the project during construction or operation within 48 hours of the complaint being made. The response and any subsequent action taken shall be recorded in accordance with condition 4.5.

5. COMPLIANCE TRACKING PROGRAM

5.1 Prior to the commencement of construction, the Proponent shall develop and implement a **Compliance Tracking Program** for the project, to track compliance with the requirements of

this approval during the construction and operation of the project and shall include, but not necessarily limited to:

a) provisions for periodic reporting of the compliance status to the Director-General including at least prior to the commencement of construction of the project, prior to the commencement of operation of the project and within two years of operational commencement;
b) a program for independent environmental auditing in accordance with *AS/NZ ISO 19011:2003 - Guidelines for Quality and/or Environmental Management Systems Auditing*;
c) procedures for rectifying any non-compliance identified during environmental auditing or review of compliance;
d) mechanisms for recording environmental incidents and actions taken in response to those incidents;
e) provisions for reporting environmental incidents to the Director-General during construction and operation; and
f) provisions for ensuring all employees, contractors and sub-contractors are aware of, and comply with, the conditions of this approval relevant to their respective activities.

6. ENVIRONMENTAL MANAGEMENT

Environmental Representative

6.1 Prior to the commencement of any construction or operational activities or as otherwise agreed by the Director-General, the Proponent shall nominate for the approval of the Director-General a suitably qualified and experienced Environmental Representative(s) independent of the design, construction and operation personnel. The Proponent shall engage the Environmental Representative(s) during any construction activities, and throughout the life of the project, or as otherwise agreed by the Director-General. The Environmental Representative(s) shall:

a) oversee the implementation of all environmental management plans and monitoring programs required under this approval, and advise the Proponent upon the achievement of these plans/programs;
b) consider and advise the Proponent on its compliance obligations against all matters specified in the conditions of this approval and the Statement of Commitments as referred to under condition 1.1c) of this approval, permits and licences; and
c) have the authority and independence to recommend to the Proponent reasonable steps to be taken to avoid or minimise unintended or adverse environmental impacts, and, failing the effectiveness of such steps, to recommend to the Proponent that relevant activities are to be ceased as soon as reasonably practicable if there is a significant risk that an adverse impact on the environment will be likely to occur.

Construction Environmental Management Plan

6.2 The Proponent shall prepare and implement a **Construction Environmental Management Plan** (CEMP) to outline environmental management practices and procedures to be followed during construction of the project. The Plan shall be consistent with the *Guideline for the Preparation of Environmental Management Plans* (DIPNR, 2004) and shall include, but not necessarily be limited to:

a) a description of all relevant activities to be undertaken on the site during construction including an indication of stages of construction, where relevant;
b) details of the areas designated for the erection of public information signage;
c) statutory and other obligations that the Proponent is required to fulfil during construction including all relevant approvals, consultations and agreements required from authorities and other stakeholders, and key legislation and policies;
d) details of how the environmental performance of the construction works will be monitored, and what actions will be taken to address identified potential adverse environmental impacts;
e) a description of the roles and responsibilities for all relevant employees involved in the construction of the project;
f) details of any construction camp sites and the management of these sites;

g) specific consideration of relevant measures to address any requirements identified in the documents referred to under conditions 1.1b) and 1.1c) of this approval;
h) the additional monitoring listed in this approval;
i) complaints handling procedures during construction; and
j) route alignment sheet to identify the final pipeline alignment including identification of areas where the easement area has been reduced to minimise impacts to threatened species as contained in condition 2.6.

The Construction Environment Management Plan shall be submitted for the approval of the Director-General no later than one month prior to the commencement of any relevant construction works associated with the project, or within such period otherwise agreed by the Director-General. Construction works shall not commence until written approval has been received from the Director-General.

6.3 As part of the Construction Environmental Management Plan required under condition 6.2 of this approval, the Proponent shall prepare and implement the following:

a) a **Surface and Groundwater Water Management Plan** to manage water quality impacts during construction. The Plan shall be prepared in consultation with the DECCW and shall include, but not necessarily be limited to:
   i) detailed engineering designs for the outlet structure;
   ii) detailed engineering designs for each category of watercourse crossing;
   iii) rehabilitation methodology of each category of watercourse crossing;
   iv) a description of any dewatering activities associated with groundwater interception;
   v) monitoring measures listed in condition 3.1 and 3.2;
   vi) a description of the quantity and source of all water supplies relating to construction, hydro-testing and operation; and
   vii) a description of any dewatering activities associated with groundwater interception along the pipeline easement that includes the quantity of groundwater to be used and a description of any expected impacts associated with the works.

b) a **Flora and Fauna Management Plan** to outline measures to protect and minimise loss of terrestrial and aquatic native vegetation and native fauna habitat as a result of construction of the project. The Plan shall include, but not necessarily be limited to:
   (i) plans showing terrestrial vegetation communities; important flora and fauna habitat areas; locations where threatened species such as the *Swainsona Recta*, Pink-tailed Worm Lizard and Rosenberg's Goanna as well as iconic species such as the Platypus, have been recorded or are likely to occur; and areas to be cleared. The plans shall also identify vegetation adjoining the site where this contains important habitat areas and/or threatened species, populations or ecological communities;
   (ii) methods to manage impacts on flora and fauna species and their habitat which may be directly or indirectly affected by the project, such as location of fencing, procedures for clearing of vegetation or soil and procedures for re-locating hollows or installing nesting boxes;
   (iii) rehabilitation details and a program for reporting on the effectiveness of flora and fauna management measures, including a schedule for planting and seeding within areas supporting Endangered Ecological Communities. Management methods shall be reviewed where found to be ineffective.

c) a **Construction Noise and Vibration Management Plan** to manage noise and vibration impacts during construction and to identify all feasible and reasonable noise and vibration mitigation measures. This plan shall be developed by a qualified acoustic consultant, agreed to by the Director-General and demonstrate the maximum feasible noise attenuation. The Plan shall address the requirements of the DECCW and shall include, but not necessarily be limited to:
   i) details of all potentially affected sensitive receivers modelled to have noise construction exceedances according to the NSW Interim Construction Noise Guidelines (July 2009.) where exceedances are shown an analysis of all feasible mitigation measures to reduce construction noise and vibration impacts including the use of noise attenuation barriers, alternative construction methods and work practices where potential noise impacts exceed the relevant objectives;

ii) an alternative construction schedule may be developed with the prior consent of the potentially affected receivers
iii) description and commitment to work practices which limit noise;;
iv) procedures for notifying residents of construction activities that are likely to affect their noise and vibration amenity.
v) extent of noise monitoring (as well as blast monitoring)
vi) contingency plans to be implemented in the event of non-compliance and / or noise and vibration complaints
vii) site contact person to follow up complaints

d) a **Traffic Management Plan** to manage traffic conflicts that may be generated during construction of the project. The Plan shall address the requirements of the relevant road authority and shall include, but not necessarily be limited to:
i) details of how construction of the project will be managed in proximity to local and regional roads;
ii) details of traffic routes for heavy vehicles, including any necessary route or timing restriction for oversized loads;
iii) demonstration that all statutory responsibilities with regard to road traffic impacts have been complied with;
iv) details of measures to minimise interactions between the project and other users of the roads such as the use of fencing, lights, barriers, traffic diversions etc;
v) procedures for informing the public where any road access will be restricted as a result of the project;
vi) procedures to manage construction traffic to ensure the safety of livestock and tc minimise disruption to livestock;
vii) speed limits to be observed along routes to and from the site and within the site;
viii) minimum requirements for vehicle maintenance to address noise and exhaust emissions, particularly along roads in close proximity to residences; and
ix) details of the expected behavioural requirements for vehicle drivers travelling to and from the site and within the site

Operation Environmental Management Plan

6.4 The Proponent shall prepare and implement an **Operation Environmental Management Plan** in accordance with the *Guideline for the Preparation of Environmental Management Plans* (DUAP, 2004) or its latest revision. The Plan shall include but not necessarily be limited to:
a) identification of all statutory and other obligations that the Proponent is required to fulfil in relation to the operation of the development, including all consents, licences, approvals and consultations;
b) a management organisational chart identifying the roles and responsibilities for all relevant employees involved in the operation of the project;
c) overall environmental policies to be applied to the operation of the project;
d) standards and performance measures to be applied to the project, and means by which environmental performance can be periodically monitored, reviewed and improved, (where appropriate) and what actions would be taken in the case that non-compliance with the requirements of this approval are identified. In particular the following environmental performance issues shall be addressed:
(i) bushfire hazard and risk management; and
(ii) management and maintenance of offsets including the presentation to the Director-General of the final offset compensatory habitat package post-construction impact review;
(iii) management measures for easement areas, including management of vegetation, soil erosion, weed control and landholder liaison.
e) the environmental monitoring requirements outlined under this approval;
f) complaints handling procedures as identified in conditions 4.4 to 4.5; and
g) the Management Plans listed under condition 6.5 of this approval;
h) specific consideration of relevant measures to address any requirements identified in the documents referred to under conditions 1.1b) and 1.1c) of this approval; and

i) management policies to ensure that environmental performance goals are met and to comply with the conditions of this approval;

The Plan shall be submitted for the approval of the Director-General no later than one month prior to the commencement of Operation of the project or within such period as otherwise agreed by the Director-General. Operation shall not commence until written approval has been received from the Director-General. Upon receipt of the Director-General's approval, the Proponent shall make the Plan publicly available as soon as practicable.

6.5 As part of the Operation Environmental Management Plan required under condition 6.4, the Proponent shall prepare and implement a **Flow Management Plan** that identifies the quantity, timing, duration and velocity of water transfer flows to Burra Creek. The Plan shall be developed in consultation with the DECCW.

7. ENVIRONMENTAL REPORTING

Incident Reporting

7.1 The Proponent shall notify the Director-General and any relevant Government authority of any incident with actual or potential significant off-site impacts on people or the biophysical environment as soon as practicable after the occurrence of the incident. The Proponent shall provide written details of the incident to the Director-General within seven days of the date on which the incident occurred.

7.2 The Proponent shall meet the requirements of the Director-General to address the cause or impact of any incident, as it relates to this approval, reported in accordance with condition 7.1 of this approval, within such period as the Director-General may require.

Appendix 2 CO2 Dosing System – Assessment of Impact, September 2011

Bulk Water Alliance

Murrumbidgee to Googong (M2G) CO2 Dosing System at Mini-Hydro Infrastructure

Consistency Assessment of Impact

September 2011

securing **water** for life

Certificate of approval for issue of documents

Document number

Title	Murrumbidgee to Googong (M2G) CO2 Dosing System at Mini-Hydro Infrastructure
Document status	Proposed Final
Date of issue	September 2011

	Position	Name	Signature	Date
Prepared by	BWA	Pieter van der Walt	Pieter van der Walt Digitally signed by Pieter van der Walt DN: cn=Pieter van der Walt, o=CB Richard Ellis, ou=Town Planning, email=pieter.vanderwalt@cbre.com.au, c=AU Date: 2011.12.08 12:29:02 +11'00'	7/12/2011
Reviewed by	M2G Owner's Representative	Simon Webber		8/Dec/2011
Approved by	M2G Project Manager	Jason Julius		8/12/2011

Contents

1	**INTRODUCTION**	**1**
1.1	Background	1
1.2	Materials review and problem	1
1.3	Make-up of the pipeline	3
2	**THE PROJECT**	**4**
2.1	The Approved Scheme	4
2.2	CO_2 Dosing System	4
2.3	Operation of the CO_2 Dosing system	5
2.4	Objectives	6
2.5	Planning Approval Context	6
2.6	Context of the Land	6
3	**IMPACT COMPARISON ASSESSMENT**	**7**
3.1	General	7
3.2	Natural Environment (Habitats, Flora and Fauna)	8
3.3	Matters of Heritage interest	8
3.4	Traffic and Transport	9
3.5	Spoil Management	9
3.6	Soils and Ground Water	9
3.7	General Environmental Risk/Impact	9
4	**CONCLUSIONS**	**12**
Appendix A Design of CO_2 Dosing System		13
Appendix B Technical Memorandum: Review of requirement for seal coating of M2G DICL Piping		14
Appendix C Technical Memorandum: Mini-Hydro CO_2 Dosing – Fate of Carbonate Byproducts		15

1 Introduction

1.1 Background

The Murrumbidgee to Googong Water Transfer is one of the recommended options for delivering improved security to the water supply for the ACT and Region. It involves pumping water from the Murrumbidgee River (within the ACT) and transferring it via a pipeline to Burra Creek (in NSW), from where it will flow for approximately 13.2 km to the Googong Reservoir.

The Murrumbidgee to Googong Water Transfer is located within the ACT and NSW and impacts on Commonwealth owned land.

In order to secure NSW Planning consent a Preferred Project Report (PPR) was completed for the Murrumbidgee to Googong Water Transfer (the Project) in December 2009. Following review of the PPR, the NSW Department of Planning (DoP) conditionally approved the proposal.

Since receiving Planning Approval the proponent has continued detail design and optimisation of the scheme. These processes included a review of the pipeline materials that will be used and the inherent performance and use characteristics there-off.

In finalising the pipeline materials the proponent has become aware of a potential matter relating to the pipeline materials proposed. This problem relates to the leaching of soluble aluminium and hydroxide (OH-) ions from the pipe linings, particularly after extended shutdown periods, with an associated result in a pH rise in water stored in the pipeline. The proponent wishes to construct CO2 dosing infrastructure near the outlet structure that will be used to correct any pH changes that may occur as a result of the pipeline materials used. The CO2 dosing infrastructure was not specifically mentioned in the Preferred Project Report (PPR) that was prepared for the Murrumbidgee to Googong Water Transfer. This assessment has been prepared to allow a consistency assessment to be undertaken by the Independent Auditor for the project, to confirm that the proposed work is consistent with the initial assessment and Project approval that was received in 2010.

1.2 Materials review and problem

The use of cement linings is associated with leaching of substances into the water that is being transferred, and specifically the leaching of hydroxide ions, which result in the rise of the pH in the potable water in the pipe in Ordinary Portland Cement (OPC) lined piping, and soluble aluminium from High Alumina Cement (HAC) mortar lining.

Leaching is generally exacerbated in circumstances where the water in contact with the lining is of low alkalinity (i.e. soft water such as Murrumbidgee water) and particularly in pipelines with low flow rates and particularly in pipes with stagnant water. Leaching of hydroxide ions also results in a loss of the cement lining in the pipe over time (i.e. a loss of corrosion protection over time and asset life reduction).

Testing conducted by the BWA on the impacts of OPC and HAC cement lining of both MSCL and DICL pipes showed that seal coating of these pipes would have had no major difference to elevated pH levels after being subjected to inundation by water. It was, therefore, concluded that seal coating of the DICL or MSCL pipes would not be undertaken due to this small difference in pH level and the manufacturer of the DICL pipe could not guarantee the effectiveness of the internal pipe coating as:

- the seal coat will not provide the expected service life as experienced on OPC lining; and

- the seal coat may delaminate from HAC mortar resulting in stranding of the coating impacting on the operation of the mini-hydro.

Two possible water quality impacts have been identified from the M2G pipeline lining materials:

- Leaching of soluble aluminium (Al) from the HAC lining of the DICL pipe; and
- pH rise in water in the pipeline due to the leaching of hydroxide (OH-) ions from the OPC and HAC linings, particularly after extended shutdown periods (i.e. one month or longer).

Leaching of aluminium from the HAC lining

The leaching of aluminium from the HAC lining of the pipeline is anticipated based on the low alkalinity of water in the Murrumbidgee River, particularly in the early years of pipeline operation. This conclusion is supported by information from the US EPA paper "*Permeation and Leaching*" which states that:

> "*Aggressive, soft, and poorly buffered (i.e. low alkalinity) water promote aluminium leaching from cementitious materials".*

A pH rise in water stored in the pipeline

The leaching of hydroxide (OH-) ions from the OPC and HAC linings, particularly after extended shutdown periods (i.e. one month or longer) is anticipated to result in a pH rise in water stored in the pipeline for extended periods.

Testing of the potential pH increase in water in contact with uncoated HAC pipe lining has been undertaken by the BWA and shows that a likely pH rise of circa 1 – 2 pH units for water stored in the pipeline for a period in excess of 72 hours may be experienced.

The likely change in pH and leaching of soluble aluminium may, if uncontrolled, impact on the water quality and habitat values of the aquatic environs of Burra Creek. The NSW project approval at condition 2.1 requires:

> ***Condition 2.1:*** *The Proponent shall comply with section 120 of the Protection of the Environment Operations Act 1997 which prohibits the pollution of waters.*

The likely leaching, as well as the potential impacts on the project's performance against Condition 2.1, warrant consideration.

The BWA investigated these risks and found that the expected aluminium concentrations in the discharged water are likely to be similar to or lower than those experienced naturally in Burra Creek and hence pose no ecological risk to Burra Creek.

Impacts of pH changes may be more severe and require management. The proponent is proposing the construction of carbon dioxide (CO_2) dosing infrastructure as part of the mini hydro facility, which will operate to correct the pH of water at the downstream side of the mini hydro, prior to release in Burra Creek.

1.3 Make-up of the pipeline

The M2G pipeline upon construction will comprise 690 m of DN1000 mild steel cement lined (MSCL) pipe and 11,600 m of DN1000 ductile iron cement lined (DICL) pipe. All pipeline fittings on the DICL section are epoxy lined.

All MSCL piping is OPC lined and 'seal *coated*' which is the industry standard for MSCL pipelines with OPC lining and will reduce opportunities for leaching to occur.

The DN1000 DICL pipe for the M2G will have an alumina cement (HAC) mortar lining as decided in January 2011 at the time of ordering pipe. It is not proposed to seal coat the DICL pipe.

2 The Project

2.1 The Approved Scheme

The Murrumbidgee to Googong Water Transfer was approved by the NSW Planning Minister on 31 March 2010. The approved project included circa 12km of transfer pipeline with operating infrastructure (air and scour valves and vents), a mini-hydro facility and a discharge structure on Burra Creek in the vicinity of the intersection between Williamsdale and Burra Roads near the township of Burra.

The PPR described the mini-hydro facility and discharge infrastructure as follows:

Mini-hydro power generator

The mini-hydro power generator will be located near the outlet structure within the pipeline construction corridor away from the immediate environs of the Burra Creek bank to minimise local impacts and to protect the infrastructure from flooding.

The power will be transferred to the high lift pump station via an underground cable in the same trench as the water transfer pipeline.

The mini-hydro power generator will have a footprint of approximately 30 m x 25 m, however the majority of this facility will be located underground and will not be visible. Earth mounds will be constructed against the structure to assist in the mitigation of visual impacts. Visual elements will include one side of the facility with access doors, an access road (existing) and car parking area, air vents and a hand rail around the roof of the structure.

Outlet structure

The outlet structure will be located on the west bank of Burra Creek approximately 60m upstream from the low level crossing on Williamsdale Road, near the junction of Burra and Williamsdale roads.

The visible elements of the outlet structure will comprise a concrete topped outlet stretching approximately 12 m along the creek bank with a 250 mm grated opening. There will also be pipeline scour valves and air valves in the vicinity of the outlet structure. Other works associated with the outlet structure will include ground modelling/re-contouring along the bank of the creek and rehabilitation planting in the immediate surrounding area.

2.2 CO_2 Dosing System

The proposal is to include CO_2 dosing infrastructure at the mini-hydro facility. The proposed infrastructure will generally be constructed within the construction footprint that was approved for the mini-hydro facility and will be wholly contained within the zone of disturbance associated with the construction of the Mini-hydro facility and discharge pipeline and discharge structure.

The size of the proposed carbon dioxide dosing facility is relatively minor and will be constructed on an area of circa 13 sqm, immediately adjacent and to the east of the mini-hydro building. This area has been shown as part of the mini-hydro facility building in the PPR.

The infrastructure will comprise of:

- CO_2 Dosing infrastructure within a secure enclosure that include:
    - A 3.6m high x 1.74m diameter CO_2 storage vessel;
    - CO_2 Vaporiser,
    - CO_2 injector;
- Supporting infrastructure such as pipework, valving and engineering services; and
- 4.8m x 3.5m secure cage enclosure with gates and signage.

The infrastructure is designed to be in keeping with the mini-hydro building style and will not project above the roof line of the adjacent building. It will be partly screened by vegetation and the earth embankment located to the south of the mini-hydro building.

Dangerous goods licensing will be required for this facility, and will be managed through the vessel and gas supply contractor.

Drawings GHD-M2G-MHY-Cl-DRG-2000: Site Plan, and GHD-M2G-MHY-Cl-DRG-2010: Section A describe the proposed CO_2 dosing facility and are included in Appendix A of this report.

2.3 Operation of the CO_2 Dosing system

The CO_2 Dosing system will be temporarily installed and operated as it is anticipated that over time the requirement for pH correction will reduce as leaching of hydroxide (OH-) ions from the OPC and HAC linings will reduce over time and as transfers occurs. It is anticipated that the need for pH correction and the operation of this facility may no longer be required within 5 years from commissioning.

Dosing will be associated primarily with the initial release of water that was within the pipeline during the period when the system was in-operative, and initially may also require minor levels of dosing during initial operations.

Dosing levels are automatically controlled in "*real time*" to ensure that the minimum CO_2 dose is added to the water to affect the pH correction sought. PH monitoring equipment will be installed to manage this process.

The operational requirement for this facility includes the delivery of CO_2 via a CO_2 tanker as and when required. It is anticipated that the initial frequency of CO_2 deliveries will be less than 1 truck/fortnight and that this will reduce over time as the need for dosing diminishes. The requirement for CO_2 dosing will disappear over time and deliveries are not considered a permanent impact. System monitoring will be conducted via the approved telemetry system and will not require attendance to site, except for periodic system maintenance. This will be performed in conjunction with site visits associated with the mini-hydro facility.

2.4 Objectives

The objective of the CO_2 dosing system is to temporarily facilitate the correction of the pH of water at the downstream side of the mini hydro, prior to release in Burra Creek.

2.5 Planning Approval Context

Planning for the Project commenced in 2005 as part of ACTEW Corporation's water security program. Planning approvals for the project were obtained from the following authorities:

- NSW Department of Planning;
- ACT Planning and Land Authority;
- Department of Sustainability, Environment, Water, Population and Community (SEWPAC) (previously Department of Environment, Water, Heritage and the Arts - DEWHA); and
- National Capital Authority.

2.5.1 NSW Planning Approval

The Project has been assessed under Part 3A of the NSW Environmental Planning and Assessment Act 1979. A period of approximately 2 years has been spent fulfilling NSW DoP requirements starting with the application for Part 3A approval through to receipt of project approval in March 2010 (note: this excludes the time period for addressing the Conditions of Approval) including preparation of the PPR. The proposal received conditional approval that include to both construction and operational requirements.

2.5.2 ACT Planning Approval and Development Application

An EIS was prepared for the Project to meet the ACT approval requirements. ACT Planning Approval was obtained in August 2010.

2.5.3 Commonwealth EPBC Approval Requirements

The project was "referred" to DEWHA/SEWPAC in October 2009 as per the requirements under the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 and a Public Environment Report (PER) was prepared. Project approval was received on 29 October 2010.

2.5.4 National Capital Authority (NCA) Works Approval

Works Approval from the NCA has been received to construct the pipeline across the Monaro Highway Road Corridor. The application for Works Approval was lodged in June 2010 and approved in August 2010.

2.6 Context of the Land

The land upon which the CO_2 dosing infrastructure will be constructed is in the Williamsdale Road reserve and is "*state*" land. Project approval for the Murrumbidgee to Googong Water Transfer included construction of engineering infrastructure at this location.

3 Impact Comparison Assessment

3.1 General

The impacts of the proposed CO_2 dosing system should be considered in accordance with the assessments, prepared for the Murrumbidgee to Googong Water Transfer PPR and the NSW Part 2 approval conditions. This will allow consideration whether the proposal is consistent with the project approval.

The EIS has been prepared in accordance with the Director General (NSW Department of Planning) requirements (summarised in the table below). In order to consider the consistency of this proposal against the original approval (dated 31st March, 2010) the impacts during construction and operation is considered in the assessment below.

Table 3.1 Director General requirements relevant to the CO_2 Dosing System

DG Requirements	Impact Timing	Relevant to Assessment	Comments
Water Quality and Hydrology	Construction and Operation	Yes	Minor risk during Construction, more likely impact during Operation
Flora and Fauna	Construction and Operation	Yes	Minor risk during Construction, more likely impact during Operation
Heritage	Construction	Yes	Minor risk during Construction, no impact during Operation
Traffic and Transport	Construction and Operation	Yes	Minor risk during Construction, minor additional impact during Operation
Spoil Management	Construction	Yes	Minor risk during Construction, no impact during Operation
Soils and Ground Water	Construction and Operation	Yes	Minor risk during Construction, no impact during Operation
General Environmental Risk/Impact	Construction and Operation	Yes	Minor risk during Construction, minor or no additional impact during Operation

3.2 Natural Environment (Habitats, Flora and Fauna)

Impacts on the natural habitat during construction of the CO_2 dosing system is minimal as the proposed works will be contained wholly within the approved works area that will be used for construction of the mini-hydro facility. There is no requirement to extend the construction impact area for this facility.

From an operational perspective, however, the pipeline lining and coating may have an impact on the receiving environment, specifically the aquatic habitat environs of Burra Creek by:

- Leaching of soluble aluminium (Al) from the HAC lining of the DICL pipe; and
- Raise the pH in the water within the pipeline due to the leaching of hydroxide (OH-) ions from the OPC and HAC linings. This impact may be significant after an extended shutdown period (i.e. one month or longer) when the pipeline is not in use.

The proponent undertook an assessment of these impacts on the natural environment.

The inclusion of a CO_2 Dosing system ensures effective ongoing management of the pH of pipeline water prior to discharge to Burra Creek, thus protecting the natural environment from impacts associated with large changes in the pH of water within the Creek.

The release of soluble aluminium in the discharged water to Burra Creek has been assessed by Norm Mueller (ALS). Mr. Mueller concluded that the aluminium concentrations in the discharged water are likely to be similar to or lower than those experienced naturally in Burra Creek and unlikely to affect the water quality in the Creek.

In relation to the introduction of CO_2 to the system ALS found that the proposed CO_2 dosing rates the operation of this facility is unlikely to produce any by-products that would affect Burra Creek environmentally or the Googong Reservoir receiving water.

CO_2 dosing changes carbonate ions to bicarbonate ions driving the pH down. The calcium in the raw water will not reach a saturation point at the expected discharge pH levels and therefore will remain in solution and not precipitate out.

On the above advice, it is not expected that carbon dioxide dosing at the proposed rates will have a significant impact on the ecology of Burra Creek or Googong reservoir.

The difference in impact on other matters relating to the natural environment does not significantly differ when considering the proposal under consideration with the PPR proposal. The inclusion of the CO_2 dosing system ensures that in relation to pH management, the system can comply with Condition 2.1 of the Part 3A approval given for the Murrumbidgee to Googong Water Transfer.

3.3 Matters of Heritage interest

The proposal will be constructed on land that is approved for disturbance of the Murrumbidgee to Googong Water Transfer. This facility is unlikely to impact on any matters of Heritage interest.

During operation, managing the pH of waters discharged to Burra Creek will ensure that the limestone cast formation at London Bridge is not impacted upon. The CO_2 Dosing system enables the Murrumbidgee to Googong Water Transfer to operate in accordance with the Part 3A approval in relation to matters of Heritage interest.

3.4 Traffic and Transport

The construction of the CO_2 dosing facility is associated with a minor increase of construction traffic. The construction of the facility will require additional deliveries associated with the CO_2 vessel, monitoring and operating equipment, CO_2 dosing system enclosure and construction materials such as concrete. The deliveries will be made over a number of weeks during the construction of the mini-hydro facility.

In the context of the traffic movements associated with the construction of the approved mini-hydro facility this additional impact is considered to be minor and non-significant. The additional traffic will be managed under the approved CEMP to ensure that any additional impacts are effectively and safely managed.

The operational requirement for this facility includes the delivery of CO_2 via tanker as and when required. It is anticipated that the initial frequency of CO_2 deliveries will be less than one truck/fortnight and that this will reduce over time as the need for dosing diminishes. The requirement for CO_2 dosing will disappear over time and deliveries are not considered a permanent impact. The anticipated delivery frequency will not have a significant impact on the safety and/or operation of the local road network.

System monitoring will be conducted via the approved telemetry system and will not require attendance to site. Site attendance requirements for the dosing facility are only required to perform periodic system maintenance. This will be performed in conjunction with site visits associated with the mini-hydro facility and will not increase the impacts associated with operational attendance to the mini-hydro facility.

3.5 Spoil Management

The proposal will be constructed on land that is approved for construction of the Murrumbidgee to Googong Water Transfer. The inclusion of this minor addition will not impact on the ability to manage spoil from the project and will not result in significant volumes of spoil that require management.

3.6 Soils and Ground Water

The proposal will be constructed on land that is approved for construction of the Murrumbidgee to Googong Water Transfer and will be constructed in accordance with the management plans that has been developed for the construction of this project. The inclusion of this minor addition will not significantly alter the risk on soils and groundwater associated with construction of the pipeline scheme.

No ongoing impacts on Soils or Groundwater have been identified as a result of adding the CO_2 dosing to the scheme.

3.7 General Environmental Risk/Impact

3.7.1 Social and Land Use

The inclusion of the CO_2 dosing system comprises a minor extension of the mini-hydro facility. In the context of the larger Murrumbidgee to Googong Water Transfer scheme and the operation of the mini-hydro facility and discharge structure this addition does not significantly alter the impacts from those described and approved in the Part 3A approval given for the Murrumbidgee to Googong Water Transfer.

3.7.2 Visual Amenity

The proposed CO_2 dosing facility will be installed immediately adjacent to the Mini-hydro facility (as depicted in GHD-M2G-MHY-Cl-DRG-2010: Section A). The facility is lower than the Mini-hydro building and will be installed behind the retaining wall and earth embankment that is associated with the construction of the Mini-hydro facility.

It will not be visible from the sensitive receivers located on the opposite site of Burra Creek and to the east. The facility will be located in front of the mini-hydro building and will be visible to passing traffic from both Williamsdale and Burra Roads for a short time while passing the infrastructure.

The character of the proposed infrastructure is commonly associated with utility installations and location of the infrastructure adjacent to the mini-hydro facility and earth embankment assist in accentuating the minimal visual impact of the facility. It is considered that passers-by will view the proposed dosing facility as part of the larger mini-hydro installation.

Given the minimal nature of the installation in the context of the mini-hydro facility and its location behind the earth embankment hiding it from the nearest sensitive receiver its inclusion does not alter the impact from what is described and approved in the Part 3A approval given for the Murrumbidgee to Googong Water Transfer.

3.7.3 Construction Impacts

Works area

The CO_2 dosing system comprises a minor extension of the mini-hydro facility and will be constructed on land that has been approved for construction disturbance in the PPR. There is no requirement to increase the works area associated with the construction of the mini-hydro facility to facilitate the construction of the dosing system. In the context of the larger Murrumbidgee to Googong Water Transfer scheme and the operation of the mini-hydro facility and discharge structure this addition does not alter the impact from what is described and approved in the Part 3A approval given for the Murrumbidgee to Googong Water Transfer

Air Quality/Dust Generation

The inclusion of the CO_2 dosing system comprises a minor extension of the mini-hydro facility and some additional construction activities at this location. In the context of the larger Murrumbidgee to Googong Water Transfer scheme and the construction of the mini-hydro facility and discharge structure this addition does not significantly alter the impacts from described and approved in the Part 3A approval given for the Murrumbidgee to Googong Water Transfer. The works will be undertaken under the provisions of the CEMP, which will facilitate the appropriate management of air quality.

Noise

The inclusion of the CO_2 dosing system comprises a minor extension of the mini-hydro facility and some additional construction activities at this location. In the context of the larger Murrumbidgee to Googong Water Transfer scheme and the construction of the mini-hydro facility and discharge structure this addition does not significantly alter the impacts from described and approved in the Part 3A approval given for the Murrumbidgee to Googong Water Transfer. The works will be undertaken under the provisions of the CEMP, which will facilitate the appropriate management of construction noise.

The proposed facility does not include refrigeration equipment, pumps or any "*noisy*" infrastructure that require acoustic treatments. The inclusion of this facility will not impact on the system's ability to be

operated within the noise limits associated with the project and the locality. It is not considered that the operation of this facility will alter the impacts described and approved in the Part 3A approval given for the Murrumbidgee to Googong Water Transfer.

4 Conclusions

Based on the review of the impact associated with the chosen pipeline lining, the findings are that:

- The expected aluminium concentrations in the discharged water are likely to be similar to or lower than those experienced naturally in Burra Creek and pose no ecological risk to Burra Creek ; and
- Impacts associated with pH changes may be more severe and require management.

The proponent is proposing the construction of carbon dioxide (CO_2) dosing infrastructure as part of the mini hydro facility, which will operate to correct the pH of water at the downstream side of the mini hydro, prior to release in Burra Creek. The inclusion of this infrastructure will ensure that the Murrumbidgee to Googong Water Transfer will be able to be operated in accordance with Condition 2.1 of the Part 3A approval for the scheme.

The installation of a CO_2 Dosing system at the Mini-Hydro facility will not result in a significant change to the impacts associated with the project as assessed in the PPR in relation to:

- The Natural Environment (including Teresterial and Aquatic habitats, flora and fauna);
- Matters of Heritage Interest,
- Traffic and Transport,
- Soils and ground water;
- Spoil management; and
- General environmental risk (including general construction impacts and ongoing operational impacts including visual amenity).

Appendix A - **Design of CO2 Dosing System**

- GHD-M2G-MHY-Cl-DRG-2000: Site Plan, and
- GHD-M2G-MHY-Cl-DRG-2010: Section A

PRESSURE GAUGE

DN50 ELECTRIC ACTUATED BALL VALVE PN16

PRESSURE RELIEF VALVE SET AT 50m

PRESSURE GAUGE

PRESSURE REDUCTION VALVE SELECTABLE TO 25-50m

DN50 MANUAL BALL VALVE PN16

DN20

DN50

DN50

MINI HYDRO BUILDING

pH METER WITH DRAIN TO TANK UNDER

4800

6148 (RECOMMENDED CLEARANCE OF 6000)

900x2000 HIGH GATE

HOSE COCK AND HOSE CABINET FOR 15m GARDEN HOSE

VAPORISER

BOC. VI3T CO_2 STORAGE VESSEL (1700 DIAx3600 HIGH) 2.5t

1750

BOLLARD

2x1200x2000 HIGH LIGHT GATES

3500

DN1000 PIPE

2400

1650

524

POWER SUPPLY TO 415V OUTLET AND SAMPLING PUMP

415V OUTLET

RETAINING WALL 1:1 SLOPE

TO SAMPLE PUMP AT DISCHARGE STRUCTURE

A
2010

PLAN
SCALE 1:25

0 0.25 0.5 0.75 1.0 1.25m
SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

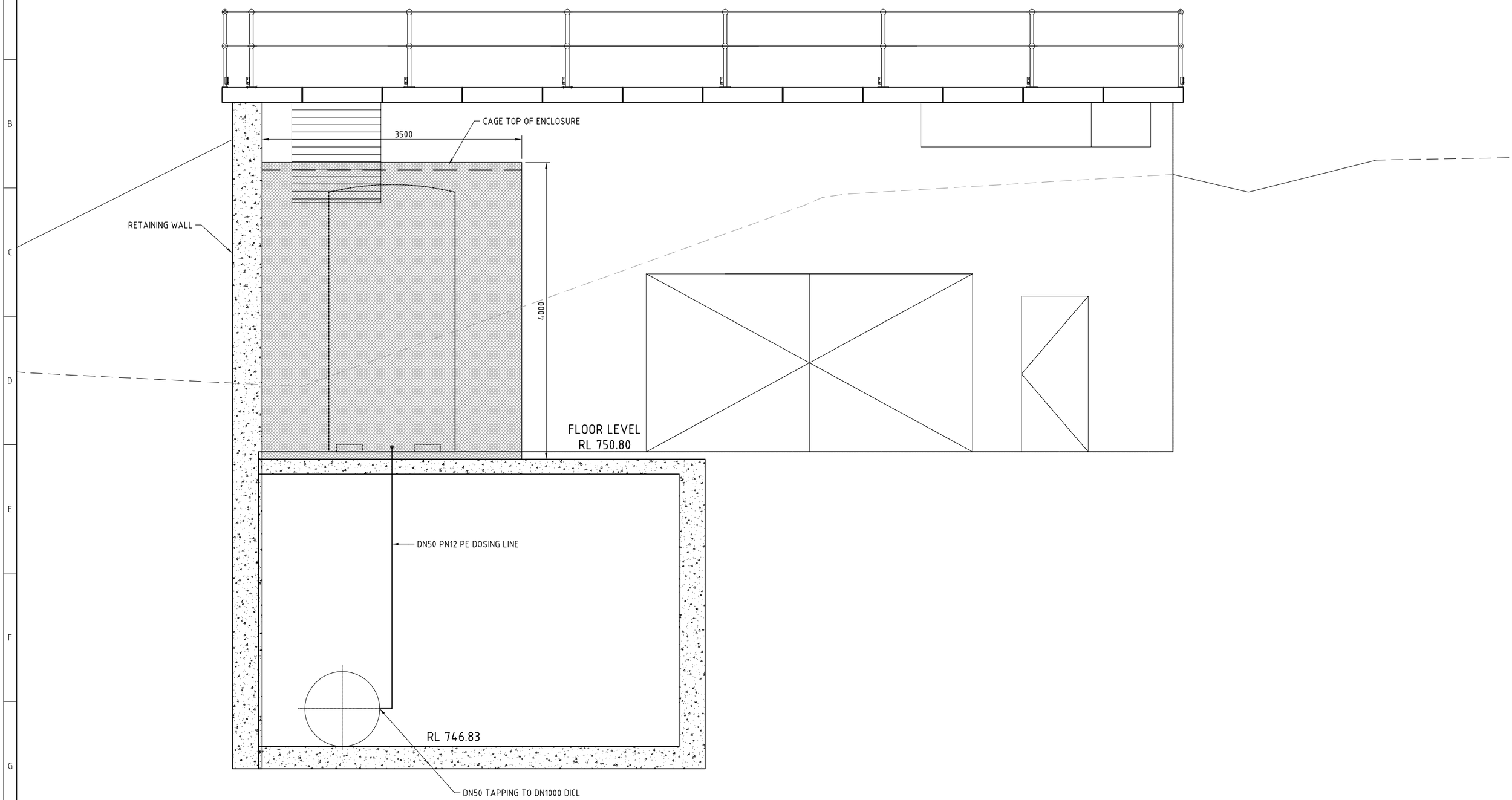
No.	REVISION	DATE	CKD	AUTH
A	ISSUED FOR 50% REVIEW	23.08.2011	GM	RF

BULK WATER ALLIANCE

ACTEW CORPORATION

Drawn: G. JONES	Designed: M. O'KEEFFE	MURRUMBIDGEE TO GOOGONG WATER TRANSFER PROJECT MINI HYDRO STATION CO2 DOSING UNIT SITE PLAN	Scale: 1:25
Checked:	Checked:		Date: JUNE 2011
Program Design Manager:			Sheet No.:
Contractor's Drawing No.: GHD-M2G-MHY-CI-DRG-2000			ACTEW Project No.:
ACTEW – Owner's Chief Engineer:			Tender No.:
			MURRUMBIDGEE TO GOOGONG
			A1 Rev. A

CADD File Name: C:\Arenium_Projects\23-12615_BWA\CADD\DRAWINGS\M2G\GHD-M2G-MHY-CI-DRG-2000.dwg
Date Plotted: 25/08/2011 CTB FILE: ACTEWAGL.CTB



A / 2000 SECTION
SCALE 1: 25

0 0.25 0.5 0.75 1.0 1.25m
SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

No.	REVISION	DATE	CKD	AUTH
A	ISSUED FOR 50% REVIEW	23.08.2011	GM	RF

BULK WATER ALLIANCE

ACTEW CORPORATION

Drawn: G. JONES	Designed: M. O'KEEFFE
Checked:	Checked:
Program Design Manager:	
Contractor's Drawing No.: GHD-M2G-MHY-CI-DRG-2010	
ACTEW – Owner's Chief Engineer:	

MURRUMBIDGEE TO GOOGONG WATER TRANSFER PROJECT
MINI HYDRO STATION
CO2 DOSING UNIT
SECTION A

Scale: 1:100	Date: JUNE 2011	Sheet No.:
ACTEW Project No.:	Tender No.:	

MURRUMBIDGEE TO GOOGONG

A1 | Rev. A

CADD File Name: C:\Arenium_Projects\23-12615_BWA\CADD\DRAWINGS\M2G\GHD-M2G-MHY-CI-DRG-2010.dwg

Appendix B - **Technical Memorandum: Review of requirement for seal coating of M2G DICL Piping**

Bulk Water Alliance

Memorandum

24 MAY 2011

SUBJECT	Review of requirement for seal coating of M2G DICL Piping
TO	Jason Julius, Simon Webber, Ian Carmody, Lachlan Marks
FROM	John Dymke

Purpose

To outline the background detail to the decision by the BWA to not proceed with seal coating of the DN1000 DICL component of the Murrumbidgee to Googong (M2G) pipeline.

Background

Introduction

Typically all cement lined mild steel and ductile iron piping used by ACTEW and the Australian water industry for potable water supply pipelines are lined with an Ordinary Portland Cement (OPC) mortar lining. Additionally the cement lining is also 'seal coated' [with a bitumen based paint] to limit the leaching of hydroxide ions from the cement mortar and subsequently limit the change (rise) in pH in the water in the pipe.

The leaching of hydroxide ions, and subsequent rise of the pH in potable water in the pipe in non seal coated OPC lined piping, is exacerbated in circumstances where the water in contact with the lining is of low alkalinity (i.e. soft water) and particularly in pipelines with low flow rates and particularly in pipes with stagnant water. Leaching of hydroxide ions also results in a loss of the cement lining in the pipe over time (i.e. a loss of corrosion protection over time and asset life reduction).

The Water Services Association of Australia (WSAA)[1] comments, in relation to ductile iron cement lined pipes, '*Seal coating of the lining with bitumen seal coats reduces leaching by 99%, thereby mitigating the issue with increasing pH.*'

Pipe lined with high alumina cement (HAC) mortar lining is typically not used for potable water transfer in Australia due to the leaching of aluminium from the lining. However, this lining is commonly in pipelines used for transfer of wastewater due to its higher chemical attack (i.e. sulphide) and abrasion resistance compared with OPC.

Murrumbidgee to Googong (M2G) Pipeline

The M2G pipeline comprises 690 m of DN1000 mild steel cement lined (MSCL) pipe and 11,600 m of DN1000 ductile iron cement lined (DICL) pipe. All pipeline fittings on the DICL section are epoxy lined.

[1] WSAA Product and Material Information and Guidance for Water Supply Code of Australia WSA 03-2002 pg10, clause 1.5.1.1 Cement mortar lining.

MSCL piping

All MSCL piping is OPC lined and 'seal coated'. This is industry standard for MSCL pipelines with OPC lining.

DICL piping

The DN1000 DICL pipe for the M2G has alumina cement (HAC) mortar lining (this decision was taken in January 2011 at the time of ordering pipe). The decision relating to whether the pipe needed to be 'seal coated' was deferred until after additional research was undertaken by the BWA relating to the expected pH rise from water contact with HAC lining.

The initial review, leading to the decision to have the pipe supplied with a HAC lining in lieu of OPC, was based on HAC being likely to lead to a lower pH rise than OPC (due to the mortar composition) and it being more abrasion resistant. Consideration was also give to the possible leaching of aluminium from the HAC lining and resultant environmental water quality impacts on release of water to Burra Creek.

The direct cost of seal coating of the DICL piping is in the order of approximately $540,000.

Water Quality – Murrumbidgee River and Burra Creek

Water quality data (pH and alkalinity) for the Murrumbidgee River at Angle Crossing (the withdrawal point) is shown in Figure 1 and Figure 2 below.

Figure 1 - Murrumbidgee R @ Angle Crossing – pH Data

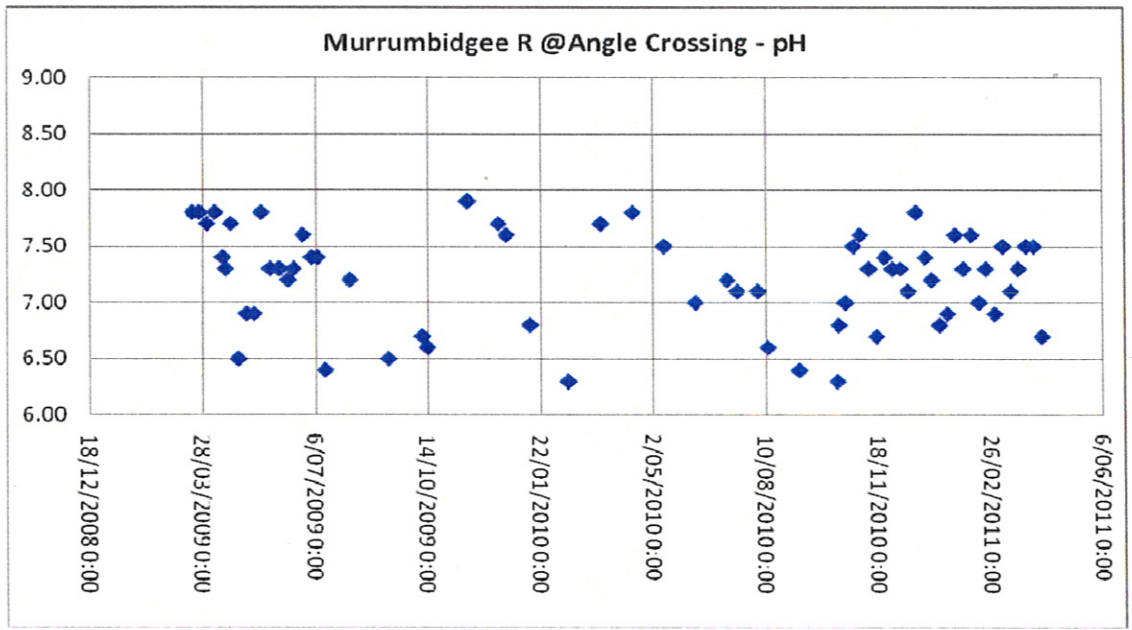
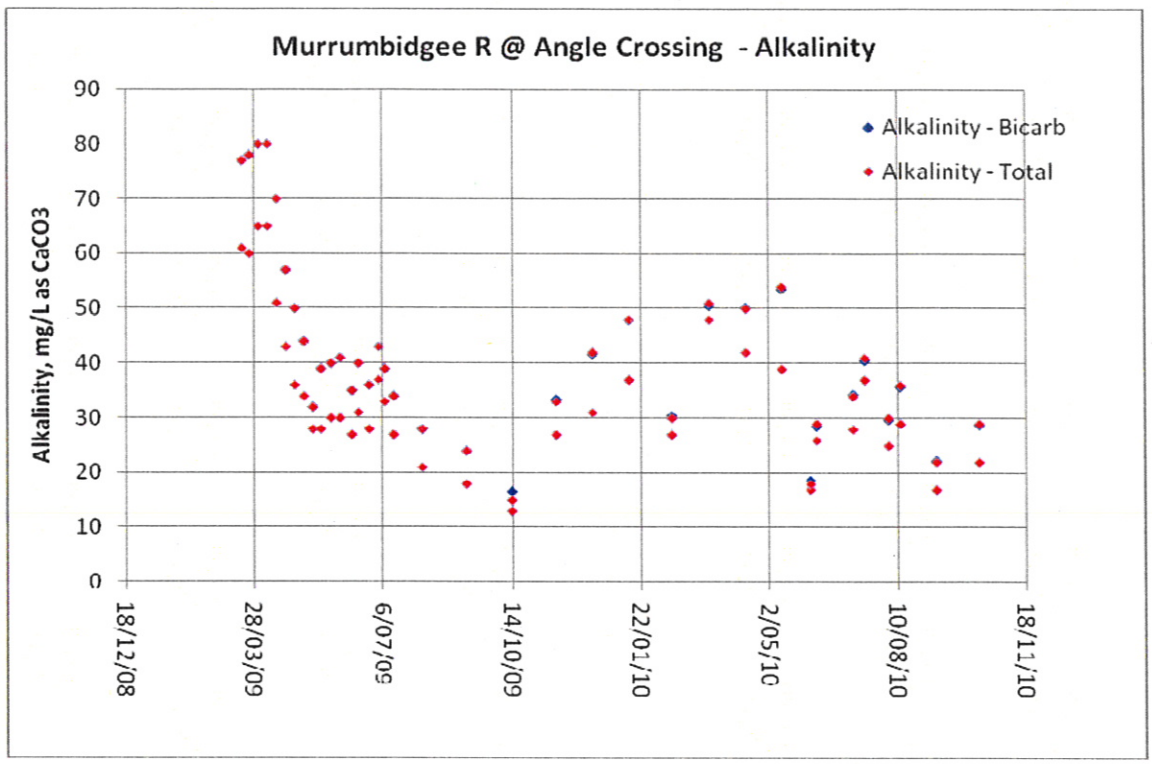


Figure 2 - Murrumbidgee R @ Angle Crossing - Alkalinity Data



The mean pH at Angle Crossing is in the order of pH 7.4) and mean total alkalinity is in the order of 42.9 mg/L as $CaCO_3$ (std. dev. of 17.6 mg/L) (data 2005-2010).

Water quality data for the Burra Creek (discharge point) is shown in Figure 3 and Figure 4 below.

Figure 3 - Burra Creek (all data) - pH

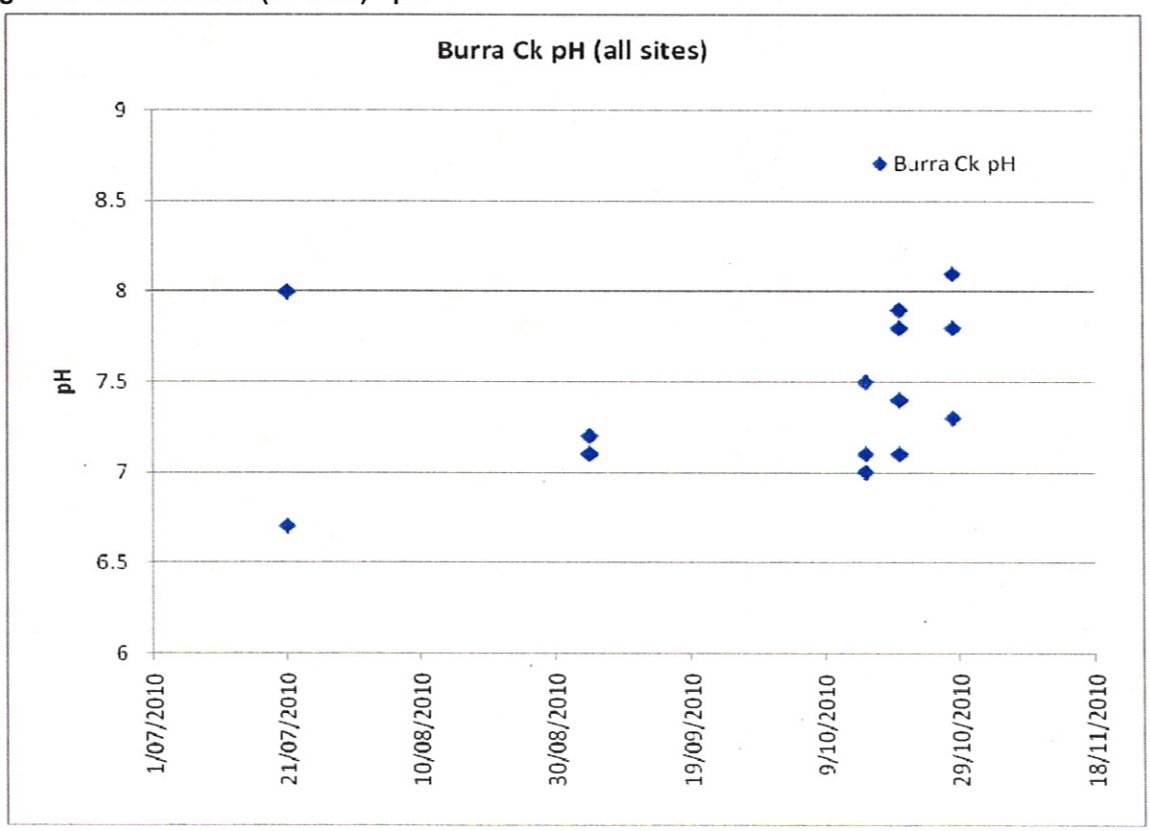
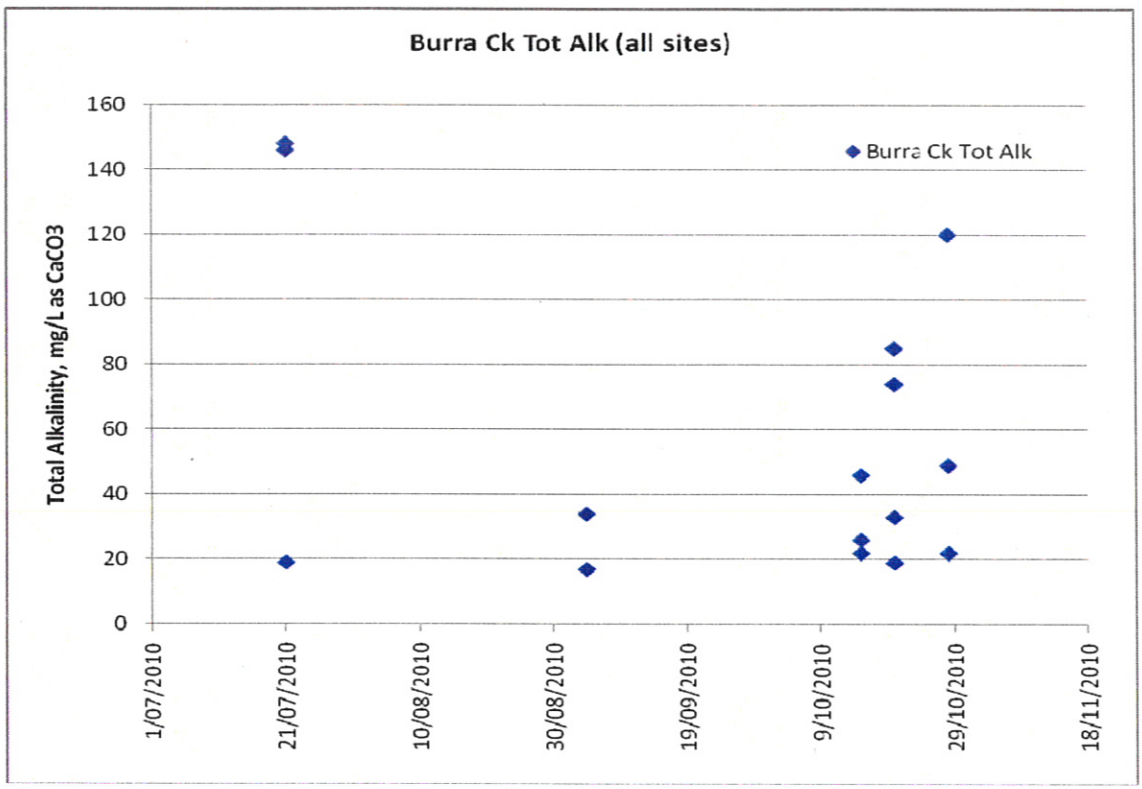


Figure 4 - Burra Creek (all data) - Alkalinity



Due to the small number of water quality samples collected from Burra Creek, all sample sites have been included, not just for the Burra Creek at Williamsdale Road.

Based on data gathered over period 2010-2011, the pH range in Burra Creek is pH 6.7 – 8.1. The total alkalinity is typically in the range 20 - 60 mg/L as $CaCO_3$, with some outliers as high as 145 mg/L as $CaCO_3$.

Discharge water quality obligations from the M2G pipeline to Burra Creek

The Operation Environment Management Plan – *Stream Flow and Water Quality Monitoring Sub Plan*[2] (SF&WQMP) – for M2G outlines key operation procedures for the monitoring and management of water quality in Burra Creek. The SF&WQMP has been submitted and approved by NSW Government as part of the conditions of approval for the M2G project.

The SF&WQMP sets default water quality trigger levels for Burra Creek. The trigger levels for pH of water discharged to Burra Ck are pH <6.5 or pH>8.0 (see Figure 5 below).

[2] ACTEW 'Murrumbidgee to Googong Water Transfer Stream Flow and Water Quality Monitoring Sub Plan', 6 Dec 2010.

Figure 5 - SF&WQMP Water Quality Triggers (Ref SF&WQMP- Figure 4.3)

Table 4.3 Burra Creek proposed water quality parameters and default trigger values

Parameter	Mean value in Burra Ck (2008-2010)*	Proposed Trigger Levels downstream of the Burra Creek discharge point during abstraction	
		Autumn / Winter	Spring / Summer
Turbidity (NTU)	<5	>80	>100
Turbidity HiLo Value		150	150
Turbidity Hi Hi value		800	800
Total Nitrogen (mg/L)	0.45	>0.5	>0.8
Total Phosphorus(mg/L)	0.015	0.10	0.10
Dissolved Oxygen (%sat)	94.5	<80 or >110	<80 or >110
pH	7.4	<6.5 or > 8.0	<6.5 or > 8.0
EC	260	> 600	> 400
Temperature ^{0}C	21(autumn)	< 5	> 24
Total Iron (mg/L)		>2.0	>2.0
Total Manganese (mg/L)		>0.15	>0.15
TDS	230	>150	>150

* limited data from the MEMP project

Clause 4.5 of the SF&WQMP states:

'Should any of the trigger levels stated above be exceeded then the following actions are to be undertaken:

- *If it is found that the exceedance parameter is due to the water abstraction and is causing an unacceptable ecological health risk or reservoir water quality impact, then the pumping of water from Murrumbidgee River shall cease until such time as the problem can be rectified or mitigation options put in place'*

Water discharged to Burra Creek must be managed to ensure does not exceed pH 8 until it can be established through ecological monitoring that no '*unacceptable ecological health risk'* is likely to result from the release of water with higher pH. This requirement will apply for pipeline commissioning, operation and particularly for test pump operation (i.e. when the pipeline is not in operation but pump testing is required on a monthly basis).

There are no documented limits on the release concentration of soluble aluminium to Burra Ck.

Anticipated quality of water to be discharged to Burra Creek from the M2G pipeline

The quality of water to be discharged to Burra Creek when the pipeline is in operation (i.e. after 24 hours of operation) is assumed to be equal to that being pumped from the Murrumbidgee River. However, following periods when no pumping is taking place, the initial water discharged from the pipeline (up to 10 ML) may be impacted by the leaching of aluminium and hydroxide ions from the HAC cement lining in the pipeline.

Two possible water quality impacts have been identified from the M2G pipeline lining materials:

- Leaching of soluble aluminium (Al) from the HAC lining of the DICL pipe; and
- pH rise in water in the pipeline due to the leaching of hydroxide (OH^-) ions from the OPC and HAC linings, particularly after extended shutdown periods (i.e. one month or longer).

These issues are discussed in greater detail below.

Leaching of aluminium from the HAC lining

The leaching of aluminium from the HAC lining of the pipeline is anticipated based on the low alkalinity of water in the Murrumbidgee River, particularly in the early years of pipeline operation. This conclusion is supported by information from the US EPA paper "*Permeation and Leaching*"[3]. This paper states "*Aggressive, soft, and poorly buffered (i.e. low alkalinity) water promote aluminium leaching from cementitious materials*".

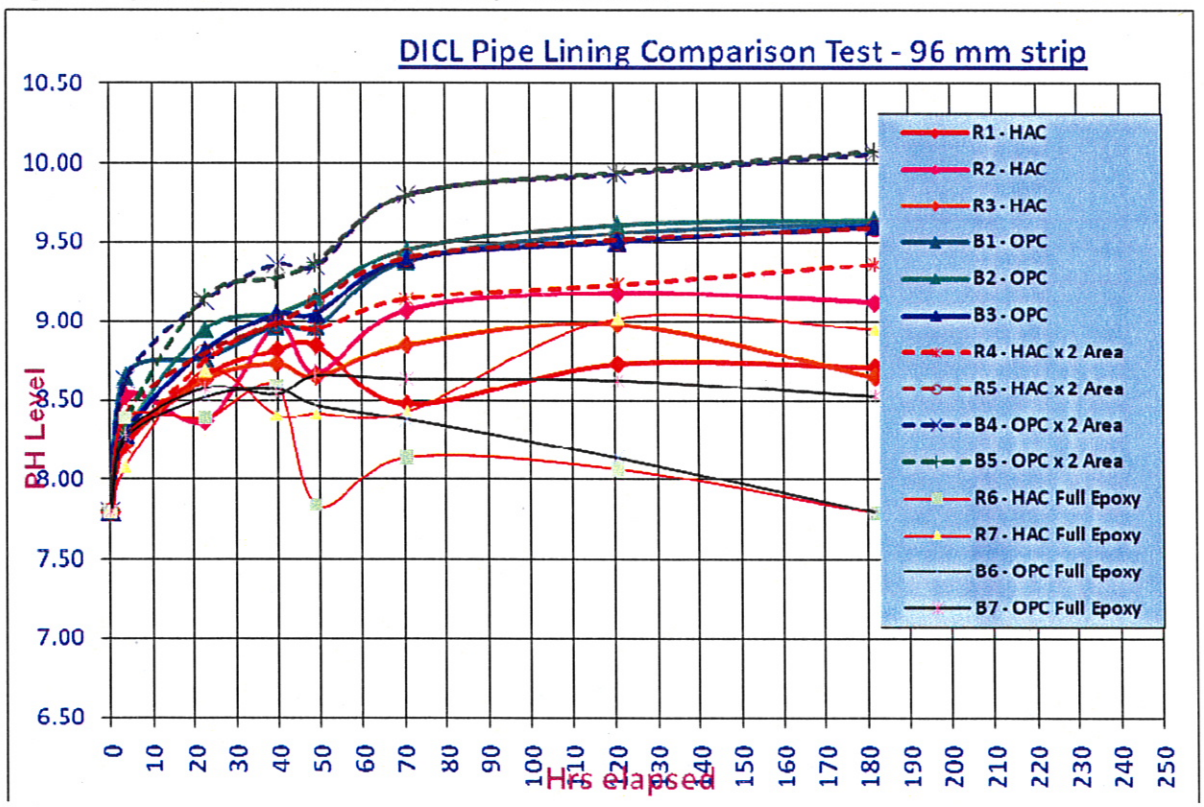
The release of soluble aluminium in the discharged water to Burra Creek has been assessed by Dr Norm Mueller[4] (ALS Global). Mueller concluded that, while the aluminium concentrations in the discharged water are likely to be similar to or lower than those experienced naturally in Burra Creek and hence pose no ecological risk to Burra Creek.

pH rise in water stored in the pipeline

The leaching of hydroxide (OH^-) ions from the OPC and HAC linings, particularly after extended shutdown periods (i.e. one month or longer) is anticipated to result in a pH rise in water stored in the pipeline for extended periods.

Testing of the potential pH increase in water in contact with uncoated HAC pipe lining has been undertaken by the BWA[5]. This testing, while limited in its extent, shows a likely pH rise of approximately 1 – 1.25 pH units for water stored in the pipeline for a period in excess of 72 hours. This study also found that the pH rise for water in contact uncoated OPC pipe lining for the same period was approximately 2 pH units.

Figure 6 - pH Rise curves from BWA experimentation



These results are in good correspondence with information provided by Mike Chapman[6] (GHD) relating to experiments conducted for Melbourne Water by Tubemakers Pipelines Research Centre. In research undertaken by Tubemakers on OPC lined pipes with very soft water, a pH rise of in

[3] United States Environment Protection Agency 'Permeation and Leaching', Aug 15, 2002 clause 2.2.2 Cement Materials, pg 12.
[4] Dr Norm Mueller, email to John Turville 'DICL Pipe Lining', 1 December 2010
[5] Bulk Water Alliance 'High Alumina Testing Report', April 2011 BWA Document BWA-M2G-CO-RPT-008.
[6] Mike Chapman, email to Mike Rodd 'pH leaching notes from mike Chapman', 14 April 2011

excess of 2 pH units was recorded on uncoated linings after 24 hours, rising to approximately 3 pH units after 96 hours. A rise of approximately 0.75-0.8 pH units was recorded for water in contact with 'seal coated' OPC lined pipe in a 24 hour period.

On the basis of the above information, if the DICL section of the M2G pipeline is not seal coated, it is expected that water in the pipeline will have an elevated pH after periods of extended shutdown (i.e. in excess of 24-72 hours), above the SF&WQMP Water Quality trigger level of pH 8. The rise in pH expected is in the order of 1 – 1.25 pH units above that of the Murrumbidgee River.

If the DICL section of the pipeline is seal coated, based on the above research, it is expected that water in the M2G pipeline will still have an elevated pH after periods of extended shutdown (i.e. in excess of 24-72 hours), above the SF&WQMP Water Quality trigger level of pH 8. The rise in pH expected is in the order of 1 pH unit above that of the Murrumbidgee River.

Seal coating risks

The BWA has been recently advised by Vinidex (pipe supplier) that St Gobain PAM (pipe manufacturer) has not previously undertaken seal coating of HAC lined DICL pipe, and hence has no experience of the performance of the seal coats on this material.

Without long term performance trial information there are risks that:

- the seal coat will not provide the expected service life as experienced on OPC lining; and
- the seal coat may delaminate from HAC mortar resulting in stranding of the coating impacting on the operation of the mini-hydro.

This issue was not brought to the attention of the BWA at the time of purchasing the pipe.

Options for management of water quality

The extent of treatment required to lower the pH of the discharge to Burra Creek to achieve the SF&WQMP Water Quality trigger of pH< 8 has not been determined at this stage and will depend on a more detailed analysis of the expected water chemistry.

The following is considered to be close to the likely final position.

The correction of the pH of water in the pipeline should be as close as possible to the discharge point to Burra Ck. This will minimise the volume of water to be treated at any time (and hence minimise operating costs) and will ensure a high level of control over the process. This optimal dosing location is downstream of the mini-hydro power station immediately prior to discharge.

Options for the correction of the pH of water discharging the pipeline to Burra Creek are as follows:

- Dose water with an acid solution;
- Dose water with gaseous carbon dioxide (CO_2).

Acid solution dosing is not considered to be viable from a safety and an environmental management perspective due to the need for specially designed dangerous goods storage facilities for acid, as well as this facility being within the floodway of Burra Creek.

Carbon dioxide (CO_2) dosing is considered to be the better solution, and one which is commonly used for pH management in water pipelines. A carbon dioxide dosing facility will require dangerous goods licensing, however, is consider being at lower risk from flooding.

CO_2 dosing rates are yet be finalised, however, are expected to be in the range of 10-25 mg/L, with a most likely dose of approximately 15 mg/L. On this basis, approximately 100-250 kg CO_2 will be required for dosing the initial 10 ML (i.e. pipeline volume) of water discharged.

On the basis of estimated usage, a one (1) tonne vacuum insulated cryogenic storage vessel and associated controls would be located at the mini-hydro power station. This vessel would be leased from the gas supplier.

Figure 7 - Photograph of 2.5 tonne refrigerated CO_2 storage vessel (courtesy BOC Gases)

Information has been provided by BOC Gases relating to CO_2 storage vessels[7]. A one (1) tonne net storage capacity vacuum insulated cryogenic vessel has dimensions in the order of 1,400 (dia) x 3,400 (h); 2.5 tonne vessel 1,700 (dia) x 3,700 (h). Concrete plinth area required is in the order of 3.0 – 3.6 m square. A 415 volt 30 amp power supply is required for the operation of liquid pump on the delivery tanker, in addition to power for refrigeration unit. Figure 7 shows a photograph of a typical refrigerated CO_2 storage vessel

Controls associated with the facility would most likely include a series of dosing control valves all linked to SCADA. [Note – pH flow-paced metering control is not considered by the author to be desirable due to increased operations and maintenance complexity and costs.]

CO_2 gas would be injected to the water immediately downstream of the hydro power station (point of high turbulence) to lower and maintain the pH in the discharged water in the range $7.5 < pH < 7.75$.

Figure 8 shows a possible dosing configuration.

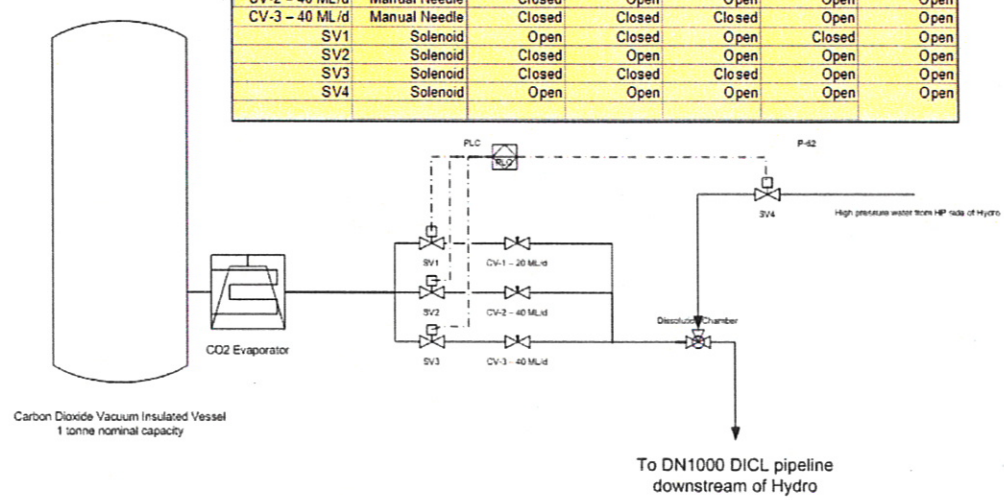
Occupational health and safety implications

Carbon dioxide is a toxic gas and one which is heavier than air. Consideration would need to be given to pipeline and discharge chamber access and ventilation as well as ventilation of the hydro power station building to ensure oxygen concentrations are adequate in the locations prior entry. Confined space access procedures for underground facilities typically cover this risk. A gas monitoring system and alarm may need to be fitted in the hydro power station building to warn of low oxygen / high CO_2 levels.

Figure 8 - Possible CO_2 dosing configuration

OPTION 2 – Pre-dissolution prior to injection of CO2 solution to pipeline

Valve List						
Valve No	Description	20 ML/d	40 ML/d	60 ML/d	80 Ml/d	100 ML/d
CV-1 – 20 ML/d	Manual Needle	Open	Closed	Open	Closed	Open
CV-2 – 40 ML/d	Manual Needle	Closed	Open	Open	Open	Open
CV-3 – 40 ML/d	Manual Needle	Closed	Closed	Closed	Open	Open
SV1	Solenoid	Open	Closed	Open	Closed	Open
SV2	Solenoid	Closed	Open	Open	Open	Open
SV3	Solenoid	Closed	Closed	Closed	Open	Open
SV4	Solenoid	Open	Open	Open	Open	Open



7 BOC - IPRM 2006 – Section 2: General Information, pg 34.

Other safety aspects relating to the handling of high pressure cryogenic liquids would also need to be considered in the design and operation of this facility.

Operating and maintenance implications

Operations and maintenance procedures for the M2G project will need to include procedures for the testing and checking of operation of the carbon dioxide dosing system prior to starting of pumping equipment, including routine calibration checking of pH metering equipment.

The CO_2 vessel sizing still needs to be finalised based on the dose rate required. Refilling of the vessel would need to occur on a regular basis, with the frequency determined by the number of start/stop operations of the M2G facility over time. For monthly pump testing, with total pump operating time less than 6 hours (i.e. 2 hours run time for each pump - pumped volume is in the order of 4 ML) CO_2 usage would be in the order of 125 kg based an a 15 mg/L dose rate. This would indicate a 1,000 kg vessel would require refilling approximately every 6 months taking into account other operational testing, gas losses, etc.

Planning approval and licensing implications

The current planning approval documentation for the M2G project did not envisage the incorporation of a CO_2 dosing facility at the mini-hydro power station.

The size of the proposed facility is relatively small – 1 tonne vessel is in the order of 3,400 high by 1,400 diameter. A security cage enclosing the vessel and evaporator unit would be required – with cage dimensions in the order of 3,000 x 5,000 by 2,400 high. The facility should not project significantly above the roof line of the planned mini-hydro power station. The vessel will be located outside of the mini hydro building and would be visible from certain angles.

The following planning review comments have been provided by Peiter Van Der Walt[8] ().

'It is important to consider the impact of the inclusion of CO_2 dosing infrastructure to the M2G project in the context of the NSW Part 3A approval.

The inclusion of CO_2 dosing infrastructure were not foreseen in the M2G Preferred Project Report (PPR) and has not been assessed in the 2009/10 project approval and is likely to require specific assessment by the NSW Dept. for Planning (DoP). Approval of the CO_2 dosing infrastructure as an amendment to the M2G proposal is likely to require the preparation of a consistency assessment for submission and consideration by DoP.

Matters that may require consideration are likely to include:

- *Extent of pH change and dosing requirements in the context of the M2G operational regime proposed;*
- *Timing during which CO_2 dosing is likely to be required;*
- *Parameters when dosing would be introduces and CO2 volumes required;*
- *Impact of CO_2 dosing on Burra Creek and the aquatic environment of the creek (flora and fauna species and communities);*
- *Visual impact of the CO_2 storage vessel and associated infrastructure at the mini-hydro facility; and*

The consistency assessment will require the above assessments to be included as supporting documentation. There may be a requirement to consult with stakeholders and NSW Government Agencies while the consistency assessment is being prepared. The assessment may further benefit form considering the likely timing during which CO_2 dosing may be required as the inclusion of this infrastructure is likely to be non-permanent, and may be able to be removed in the future.'

Dangerous goods licensing will be required for this facility, however, this should be managed through the vessel and gas supply contractor.

---

[8] Pieter Van Der Walt, CBRE, email via Chris Webb, 'M2G CO2 dosing', 6 May 2011

Annual operating costs

BOC Gases[9] have advised vessel leasing costs is likely to be in the range of $800/month for a 1,000 kg vessel to $1030/month for a 2,500 kg vessel, giving annual costs in the order of $9,600 to $12,400.

CO_2 supply unit cost is likely to be in the order of $2.10/kg[10] delivered to site. Based on an annual usage in the order of 1,800 kg (i.e. 12 monthly pump tests each pumping 10 ML dosed at 15 mg/L), the annual CO_2 supply cost is expected to be in the order of $3,800 per annum.

Total operating costs (excluding maintenance) are expected to be in the order of $13,400 per annum (based on 1 tonne vessel lease).

A worst case scenario involving the need for continuous annual treatment of 750 ML (i.e. 20 ML/d pump operation for one year) with a 15 mg/L dose of CO_2, would involve a gas cost in the order of $23,600 per annum, giving a total annual cost in the order of $24,630.

Risks

The following risks have been identified with respect to the pH of discharged water to Burra Creek:

1. There is a risk that the pH of water being pumped through the pipeline during normal operation, i.e. after initial displacement of the stagnant volume of water in the pipe, will rise above the trigger level of pH 8 and this may result in the need for ongoing operation of the pH correction system, rather than planned intermittent operation on start-up of pumping. This risk is more likely to crystallise when there is sustained operation of the facility at low flows, i.e. 20 ML/d, when the water retention time in the pipe is in the order of 12 hours.
2. There is a risk that the calibration of the pH control system instrumentation at the mini hydro is out of calibration with respect to the in-stream continuous monitoring system established to meet the requirements of the SF&WQMP, and reported pH values exceed the SF&WQMP trigger level due to differences in calibration and calibration drift due to fouling of pH probes.

   [It is currently a recognised problem that in-stream continuous water quality data loggers can have calibration drift which is heavily influenced by prevailing stream flow conditions – silting and algal growths on probe, etc. Calibration management of the water quality monitoring systems at the Upstream Angle Crossing and Burra Creek gauging stations need to be reviewed by ACTEW and ALS Global.]
3. Rate of draw off of CO_2 from the storage vessel (i.e. evaporator sizing) needs to be considered as part of the facility design, particularly if dosing required at high flow rates, due to low winter temperatures.

Conclusions

The following conclusions are made with respect to seal coating of the M2G DICL high alumina cement lined pipe:

1. With or without seal coating of the DICL HAC lined pipe, there is an anticipated pH rise in water stored within the pipeline for extended periods. It is expected that this pH rise will exceed the Burra Creek discharge trigger level of pH >8, resulting in a need to adjust the pH of water prior to release.
2. Seal coating may reduce the extent of this pH rise, however, will not eliminate it.
3. Seal coating has not been applied to HAC piping manufactured by St Gobain and there is a risk of this costing not performing in the same manner at the costing applied to OPC linings.
4. The most appropriate manner to adjust pH to within the discharge range of $6.5 < pH < 8.0$ is considered to be by the dosing of carbon dioxide dosing at the downstream side of the mini hydro in an area of high turbulence.
5. Annual costs of CO_2 supply and vessel leasing are likely to be in the order of $13,400, based on a leased 1 tonne vessel.

---

[9] BOC Gases –Ralph Lloyd-Smith email 'CO2 dosing for Murrumbidgee to Googong pipeline', 20 April 2011

[10] BOC Gases –Ralph Lloyd-Smith email 'CO2 dosing for Murrumbidgee to Googong pipeline', 20 April 2011

6. There is a risk that continuous dosing of pH correction may be required during low flow pumping periods due to the high retention time of water within the pipeline during these periods. It is expected however that the need for dosing will diminish with operating time of the pipeline.

Recommendations

The following recommendations are made with respect to seal coating and pH adjustment:

1. That the DN1000 DICL pipe on the M2G pipeline is not seal coated, resulting in a project cost saving in the order of $540,000.
2. That the BWA give consideration to whether the decision not to seal coat constitutes a 'Change' or a 'Scope Change' under the PAA, and consequently review the application of the saving achieved by not proceeding with seal coating;
3. That ACTEW review the planning approval implications of a locating a CO_2 storage vessel at the mini hydro site and actions needed to achieve approval for design changes at the mini-hydro station;
4. That detailed consideration be given by the BWA to the design of a carbon dioxide dosing system for pH control in water discharged from the pipeline;
5. That the BWA communicate with Vinidex over the issue of there being no experience in use of seal coating on HAC lined pipe, when there was a clear expectation by the BWA and ACTEW that this was a 'no risk' decision if needed to be taken following the BWA's assessment of this need.

24/5/11

John Dymke
Owner's Chief Engineer

Attachments

- Email from Dr Norm Mueller re Burra Creek Aluminium Concentrations and DICL Pipe lining, 1 December 2010.
- BOC Gases –Ralph Lloyd-Smith email 'CO2 dosing for Murrumbidgee to Googong pipeline', 20 April 2011
- BOC Documents

Email from Dr Norm Mueller re Burra Creek Aluminium Concentrations and DICL Pipe lining, 1 December 2010.

"Mueller, Norm"
<Norm.Mueller@als
global.com> To
"'John.Turville@bwa.actew.com.au'"
01/12/2010 03:03 <John.Turville@bwa.actew.com.au>,
PM "Linda.Garlick@jhg.com.au"
<Linda.Garlick@jhg.com.au>,
"Peter.Sheehan@jhg.com.au"
<Peter.Sheehan@jhg.com.au>
cc
"Gavin.Morrison@bwa.actew.com.au"
<Gavin.Morrison@bwa.actew.com.au>,
"Jason.Julius@bwa.actew.com.au"
<Jason.Julius@bwa.actew.com.au>,
"Mike.Rodd@bwa.actew.com.au"
<Mike.Rodd@bwa.actew.com.au>
Subject
RE: DICL Pipe Lining.

John,
I have had a look at some of the water sample results taken as part of the Murrumbidgee Ecological Monitoring Program.

My view is that temporary aluminium levels from the pipeline of between 300-400 ug/L are unlikely to affect the water quality in Burra Ck. The natural levels within the creek are already quite high due to the geology of the system. Natural baseflow values also appear to be near this range.

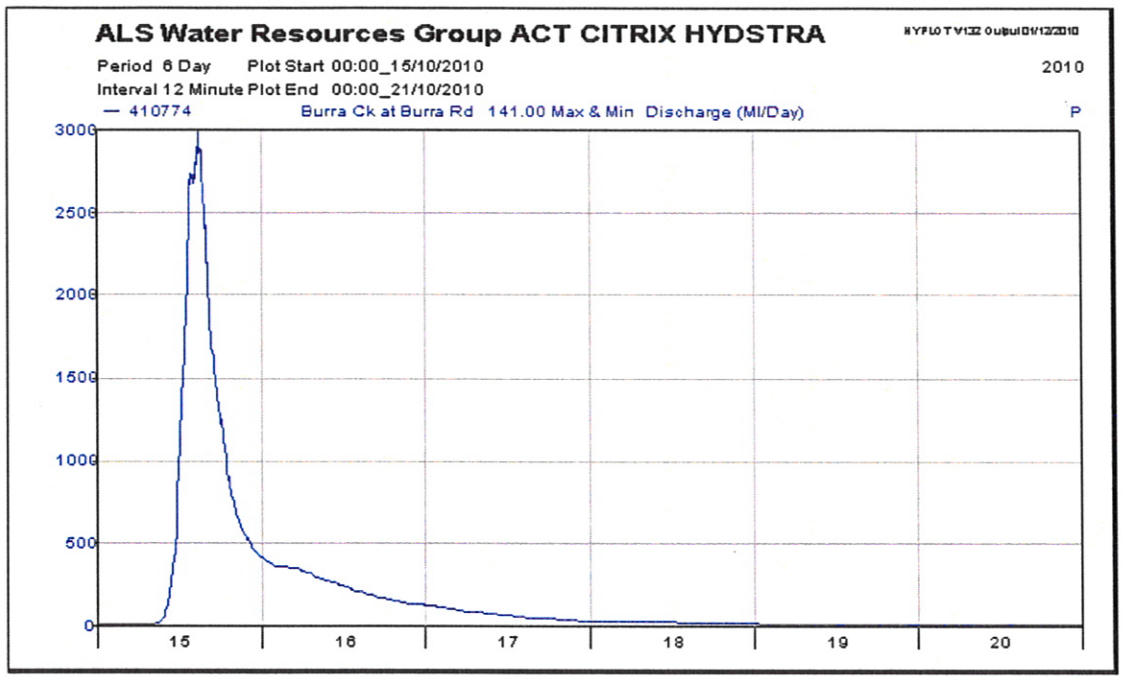
For the protection of freshwater ecosystems, ANZECC (2000) Table 3.4.1. does not specify a limiting value for Aluminium.

Some of the results for grab samples taken in Burra Ck at Williamsdale Rd (the M2G discharge location) are given below:

Date Al (ug/L)
21/07/10 250 (during low flow; 3000 ug/L recorded upstream at Cassidy's Ck confluence - the Tinderry Nature Reserve inflow)
11/08/10 980 (after a small rainfall event)
04/09/10 3100 (large rainfall event)
15/10/10 2000 (large rainfall event)
16/10/10 1300 (1 day after event)
17/10/10 2000 (2 days after event)
20/10/10 1300 (5 days after event)

All the event samples are well above the expected DICL pipe values except for the low baseflow value at 250 ug/L.
Note that aluminium levels in the Murrumbidgee are also naturally high and would be increased by the DICL pipe during transfer.

Plot indicating flow at Burra gauging station from 15 to 20 October below:



Regards
Norm

Norm Mueller
Manager Water Sciences, ACT

ALS Water Resources Group (Environmental Division) ALS Laboratory Group Canberra, AUSTRALIA
P.O. Box 1834, Fyshwick, ACT 2609

Tel: +61 2 6202 5421
Mob: +61 418 225 666
Fax: +61 2 6202 5455

www.ecowise.com.au
www.alsglobal.com

Appendix C - **Technical Memorandum: Mini-Hydro CO_2 Dosing – Fate of Carbonate Byproducts**

- Memorandum: Mini-Hydro CO_2 Dosing – Fate of Carbonate By-products
- Norm Mueller Advice re Carbonate By-products

Memorandum

DATE: 1 SEPTEMBER 2011

SUBJECT	Mini-Hydro CO2 Dosing – Fate of Carbonate Byproducts
TO	
FROM	B Smith

It is proposed to install carbon dioxide dosing at the M2G Mini Hydro to allow correction of pH prior to discharge to Burra Creek. The nature and fate of carbonate byproducts introduced by carbon dioxide dosing has been assessed by Norm Mueller[1] (ALS Global). Mueller states that;

"The CO_2 dosing rate of 25mg/L for 15ML is unlikely to produce any by-products that would affect Burra Creek environmentally or the Googong Reservoir receiving water.

CO_2 dosing changes carbonate ions to bicarbonate ions driving the pH down. The calcium in the raw water will not reach a saturation point at the expected discharge pH levels and therefore will remain in solution and not precipitate out.

Note that if the ~50m length of pipe downstream of the CO_2 dosing point is the same DICL pipe as the pipe main, then the carbonic acid produced by the dosing does drive the carbonate leaching reaction from the lining more quickly. However, given that the dosing is only for the initial pipe flushing on approximately a monthly basis, this may not be an issue for erosion of the lining."

On the above advice, it is not expected that carbon dioxide dosing at the proposed rates will have a significant impact on the ecology of Burra Creek or Googong reservoir.

[1] Dr Norm Mueller, email to Benjamin Smith 'RE: Fate of CO2 products from Mini Hydro dosing", 25 August 2011

----- Forwarded by Benjamin Smith/JHG on 25/08/2011 12:06 PM -----

"Mueller, Norm" <Norm.Mueller@alsglobal.com>

25/08/2011 12:03 PM

To "Benjamin.Smith@bwa.actew.com.au" <Benjamin.Smith@bwa.actew.com.au>

cc

Subject RE: Fate of CO2 products from Mini Hydro dosing

Hi Ben,
We have had a look at the document, water quality sample data, and the dosing rate indicated below.

The CO_2 dosing rate of 25mg/L for 15ML is unlikely to produce any by-products that would affect Burra Creek environmentally or the Googong Reservoir receiving water.
CO_2 dosing changes carbonate ions to bicarbonate ions driving the pH down. The calcium in the raw water will not reach a saturation point at the expected discharge pH levels and therefore will remain in solution and not precipitate out.

Note that if the ~50m length of pipe downstream of the CO_2 dosing point is the same DICL pipe as the pipe main, then the carbonic acid produced by the dosing does drive the carbonate leaching reaction from the lining more quickly. However, given that the dosing is only for the initial pipe flushing on approximately a monthly basis, this may not be an issue for erosion of the lining.

Regards
Norm

Norm Mueller

MANAGER WATER SCIENCES, ACT

ALS | Environmental

Address
16B Lithgow St, (PO Box 1834)
Fyshwick ACT 2609 Australia
PHONE +61 2 6202 5421
MOBILE +61 418 225 666
FAX +61 2 62025435
www.alsglobal.com

From: Benjamin.Smith@bwa.actew.com.au [mailto:Benjamin.Smith@bwa.actew.com.au]
Sent: Wednesday, 17 August 2011 4:36 PM
To: Mueller, Norm
Cc: Gavin.Morrison@bwa.actew.com.au
Subject: RE: Fate of CO2 products from Mini Hydro dosing

Hi Norm,

The attached document contains some relevant information regarding CO2 dosing. Note the meeting minutes summarise the discussion held in June however most should still be relevant. For the purposes of the advice we require from you, a CO2 dosing rate of 25 mg/L into a 15 ML/d transfer will give the highest concentration of carbonate products. If we consider Burra Creek to be in drought conditions then we should get an idea of the maximum effect on the creek.

I have checked with Shafin and the WQ samples from the HAC pipe testing have been disposed of already.

Let me know if you require further info.

Cheers,
Ben

Benjamin Smith
Project Engineer - M2G
Bulk Water Alliance
p 02 6242 2101 **f** 02 6175 2302 **m** 0407 287 953
www.actew.com.au

securing water for life

"Mueller, Norm" <Norm.Mueller@alsglobal.com>

10/08/2011 04:18 PM

To "Benjamin.Smith@bwa.actew.com.au" <Benjamin.Smith@bwa.actew.com.au>

cc

Subject RE: Fate of CO2 products from Mini Hydro dosing

Hi Ben,
Are you able to provide me with some information on the proposed CO2 dosing unit rates and operation criteria?
I thought someone else looked at this during the design phase, did a report get produced?

Cheers
Norm

Norm Mueller
MANAGER WATER SCIENCES, ACT
ALS | Environmental

Address
16B Lithgow St, (PO Box 1834)
Fyshwick ACT 2609 Australia
PHONE +61 2 6202 5421
MOBILE +61 418 225 666
FAX +61 2 62025435
www.alsglobal.com

From: Benjamin.Smith@bwa.actew.com.au [mailto:Benjamin.Smith@bwa.actew.com.au]
Sent: Wednesday, 10 August 2011 1:01 PM
To: Mueller, Norm
Cc: Gavin.Morrison@bwa.actew.com.au
Subject: Fate of CO2 products from Mini Hydro dosing

Hi Norm,

Some time ago you provided advice on the impact of soluble aluminium on Burra Creek WQ as a result of using HAC lined pipe. Can you also please advise on the nature and fate of CO2 products on Burra Creek as a result of the proposed CO2 dosing system to be installed at the Mini hydro. Happy to discuss further when you get the chance.

Thanks,
Ben

Benjamin Smith
Project Engineer - M2G
Bulk Water Alliance
p 02 6242 2101 **f** 02 6175 2302 **m** 0407 287 953
www.actew.com.au

securing water for life

Appendix 3 M2G Mini Hydro, Consistency Check for Raised Floor Level, August 2011

Bulk Water Alliance

M2G Mini Hydro

Consistency Check for Raised Floor Level

October 2011

securing **water** for life

Certificate of approval for issue of documents

Document number	GHD-M2G-MHY-HD-RPT-0001
DM5 number	P:\Arenium_Projects\23-12615 ACTEW Bulk Water Aliance\M2G\TECHNICAL\HD - Hydrology\Burra Ck
Title	M2G Mini Hydro Consistency Check
Revision	0
Document status	Final
Date of issue	October 2011

	Position	Name	Signature	Date
Prepared by	M2G Design Manager	G Morrison	*GM	13/10/2011
Reviewed by	Design Engineer	A Campbell	*AC	13/10/2011
Approved by	Program Design Manager	R Frost	*RF	14/10/2011

Document revision control

Version	Author	Date	Description	Approval
A	G Morrison	9/8/2011	Preliminary Draft for review and comment	*GM
B	G Morrison	16/8/2011	Draft for formal review	*RF
0	G Morrison	13/10/2011	Final	*RF 14/10/11

Contents

1	**INTRODUCTION**	**1**
2	**HYDROLOGIC INVESTIGATION**	**2**
2.1	Investigation	2
2.2	Evaluation of gauged discharges	2
2.3	Evaluation of rainfall data from 9 December 2010	3
2.4	HEC-RAS model analysis	4
2.5	Hydraulics of adopted HEC-RAS model analysis of existing site	4
3	**MINI HYDRO AMENDMENTS**	**9**
4	**EFFECT OF BUND ON HYDRAULIC PARAMETERS**	**12**
5	**CONCLUSION**	**15**

1 Introduction

The mini hydro TOC design was based upon flood data obtained from the Burra Creek gauging station (Site 410774) for the period from 1985 to 2008. Using this data, a flood frequency analysis was undertaken to determine the flood discharge for the 1 in 100 year Annual Exceedance Probability (AEP) flood (equivalent to 100 year Average Recurrence Interval (ARI)). This discharge was input to a validated HEC-RAS model of Burra Creek in this location and hence a floor level was determined.

During bulk excavation for the mini hydro, debris was noted in the trees along the adjacent section of Burra Creek that was up to nearly 2 metres above the proposed floor level. The level of the debris was surveyed and this information used to investigate the flood levels.

This indicated that a substantially greater flood had occurred in Burra Creek on 9 December 2010 than had occurred previously during the period of records since mid 1985.

Subsequently the assessed Q100 (1 in 100 year AEP) flood level has been increased. This has necessitated a change to the mini hydro general arrangement combining raising the mini hydro floor level by 0.91 m to RL 750.8 and an earth mound separating the mini hydro from the creek for a distance downstream of approximately 50 metres.

This report presents a summary of the hydrologic investigation and outcomes, in addition to a consistency check of the revised arrangement against the assessment presented in the Environmental Impact Statement.

2 Hydrologic Investigation

2.1 Investigation

The investigation involved the following tasks:

- obtained levels of flood debris remaining in trees as a result of the December 2010 event in the vicinity of the mini hydro power station;
- back calculation of the flow in Burra Creek to match those flood levels;
- liaison with ALS Global regarding their information and interpretation of the flow that occurred at the Burra Creek gauging station located downstream of the Burra Road bridge;
- review of rainfall gauge readings;
- site visit to view upstream creek conditions for evidence of large flows and possible farm dam breaches that may have contributed;
- Calculation of hydraulic values for Burra Creek for design of mini hydro facility.

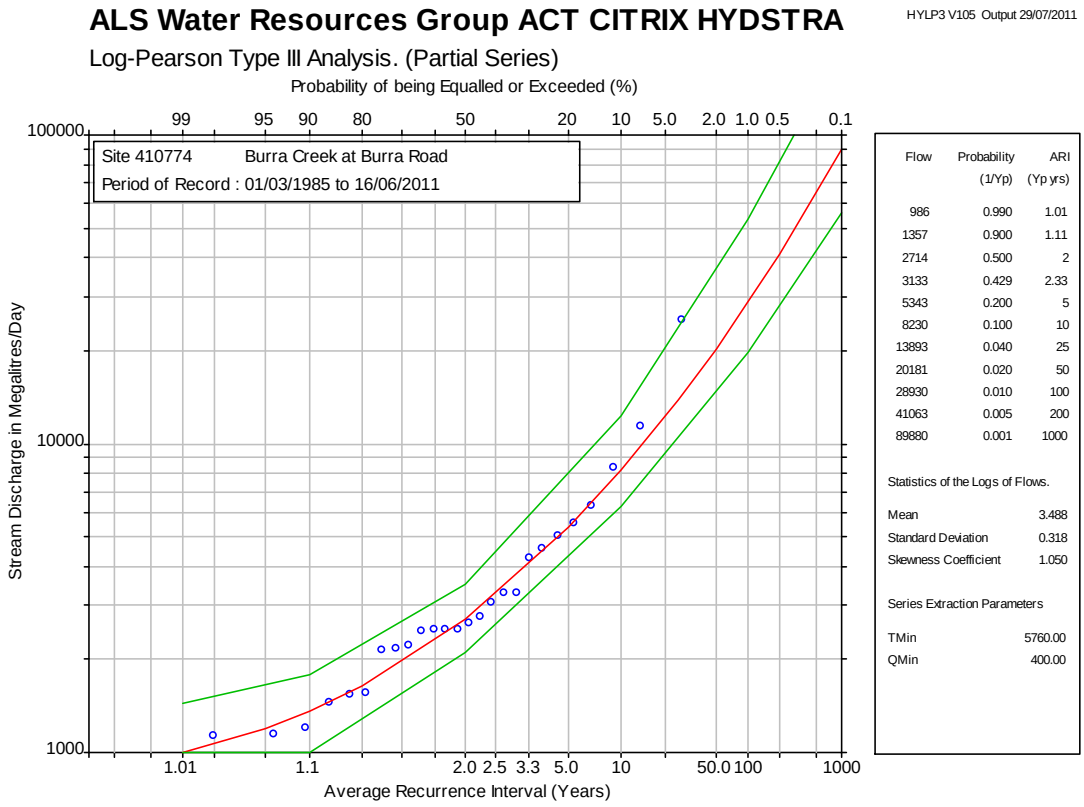
2.2 Evaluation of gauged discharges

ALS Water Resources Group (ACT) (formerly Ecowise Environmental) maintains the Burra Creek Stream Gauging Station (1985 – present). Mr Norm Mueller of ALS Water Resources has advised that the significant large floods in the 1960s and 1970s have a strong effect on flood frequency analyses for ACT streams. The Burra Creek record, which only commenced from 1985 therefore misses the "typical" large floods included in the data for most ACT catchments and misses the 9 December 2010 flood because ALS "disqualified" the data (peak water level well above maximum level of site rating curve). The Burra Creek record also includes the drought period from 1997-2010. For example, the 100 year flood peak for the Queanbeyan River including the 1960s data is 50% higher than a flood frequency calculation using the data from 1985.

Norm Mueller (ALS Global) checked debris marks at the Gauging Station to get a flow profile and compared the debris marks with the recorded maximum at the gauge. Agreement was within 10 cm. They have undertaken a slope-area calculation at the gauge and computed a flow at the gauging station of 294 m^3/s. ALS then extrapolated the existing rating curve at the gauge station based on this calculation.

The figure below shows the output of a Log-Pearson Type III analysis carried out taking into account the full period of record (1985 – first half 2011) and including the 9 December 2010 flood.

Figure 2.1 Recent Flood Frequency Analysis by ALS Water Resources Group



The Log-Pearson III frequency analysis indicates the 9 December 2010 flood was approximately a 1 in 100 year AEP event.

The ALS determined catchment area at the gauge is 70.3 km^2. Based on this, the Log-Pearson III result is consistent with the ACT Regional Flood Frequency procedure in Australian Rainfall and Runoff 1987 and 2001 (originally developed by Ross Knee).

2.3 Evaluation of rainfall data from 9 December 2010

A review was also made of 15 minute rainfall data provided by ALS Water Resources. The closest rainfall station to the Burra Creek gauging station is 570 970 (approximately 15 km west of the Burra Creek gauge). The total rainfall recorded by this gauge was 86 mm for the storm on the 8th/9th of December. The highest event total was recorded by rainfall gauge 570 916 (102 mm) and is the only site to exceed the 570 970 gauge. The event totals for the other four gauges range between 71 to 84mm (excluding station 570 903 which has a total of 47mm and seems very low).

In terms of rainfall intensities it appears that the highest rates were recorded at station 570 970. The peak 6 hour burst was 72 mm (12.0 mm/h) and this is only 0.7 mm/h lower than the 1 in 50 year AEP rainfall for the station. The 1 in 100 year AEP 6 hour intensity at Burra Creek is approximately 14.1mm/h or 85mm total, (some 13mm more than recorded at station 57090). Based on this information it is concluded that the December 2010 event was a large event. It is plausible that a localised storm may well have occurred and possibly delivered rainfall similar to a 1 in 100 year AEP event at least.

2.4 HEC-RAS model analysis

A HEC-RAS model of this section of Burra Creek was previously developed and validated based on a photograph of a large flood which occurred on the morning of 11 July 1991. We have reviewed this model based on topographical survey of flood debris marks that can be clearly attributed to the 9 December 2010 flood. The work has included a sensitivity test of n values and extending-completing some of the existing surveyed cross sections (which were “overtopped” by this big flood). By fitting a flood line that goes through the middle of the surveyed debris marks, a "best estimate" fit was obtained with a discharge of 260 m^3/s, which is consistent with ALS’s estimated flow at the gauging station where the catchment area is larger.

The effect of including the 9 December flood in this analysis is illustrated by the table below.

Table 2.1 Maximum Flood Discharges at Gauge Station and at Mini-hydro site

Item	Based on flood data - 1985 up to 8 December 2010	Including 9 December 2010 event (best fit flood profile at mini-hydro site)
Burra Creek Gauging Station maximum flow	132 m3/s	294 m3/s
Burra Creek Gauging Station gauge height		5.6 m
Burra Creek design flow at mini hydro site	111 m3/s	260 m3/s

On the basis of the above three analyses, the December 2010 peak water levels at the site and best-fit discharge estimate have been adopted as the 1 in 100 year AEP design flood for the mini-hydro station.

2.5 Hydraulics of adopted HEC-RAS model analysis of existing site

Figures 2.2 to 2.4 and Table 2.2 provide a summary of the HEC-RAS computed hydraulics of the creek at the site.

The following are included below:

- Figure 2.2 - model layout schematic showing the model cross section locations. Grey solid section represents the culvert where Williamsdale Road crosses Burra Creek – immediately downstream of the M2G discharge structure location and MHY building.
- Figure 2.3 - Plotted flow profiles with discharges of 230, 260 (heavier line) and 300 m3/s. The middle line (260 m3/s) has been adopted as having the best fit with the surveyed flood marks (see small open diamond shapes), and this computed flood profile has been adopted for selection of the mini hydro floor level and bund. The red line and red diamonds plotted on the middle line shows the XS (409 downstream to 379) where the model has computed the flow as approximately critical and this short reach is also a zone of very high computed channel flow velocities
- Figure 2.4 – plotted average channel velocities along the channel

- Table 2.2 - Tabulated hydraulic values at the model XS for the adopted middle discharge of 260 m3/s. Our interpretation is that the computed flood level at the upstream side of the mini hydro building is 751.68 (XS 429.666*) and immediately upstream of the discharge structure is 750.55 (XS 379).

Figure 2.2 HEC-RAS Model Layout Schematic

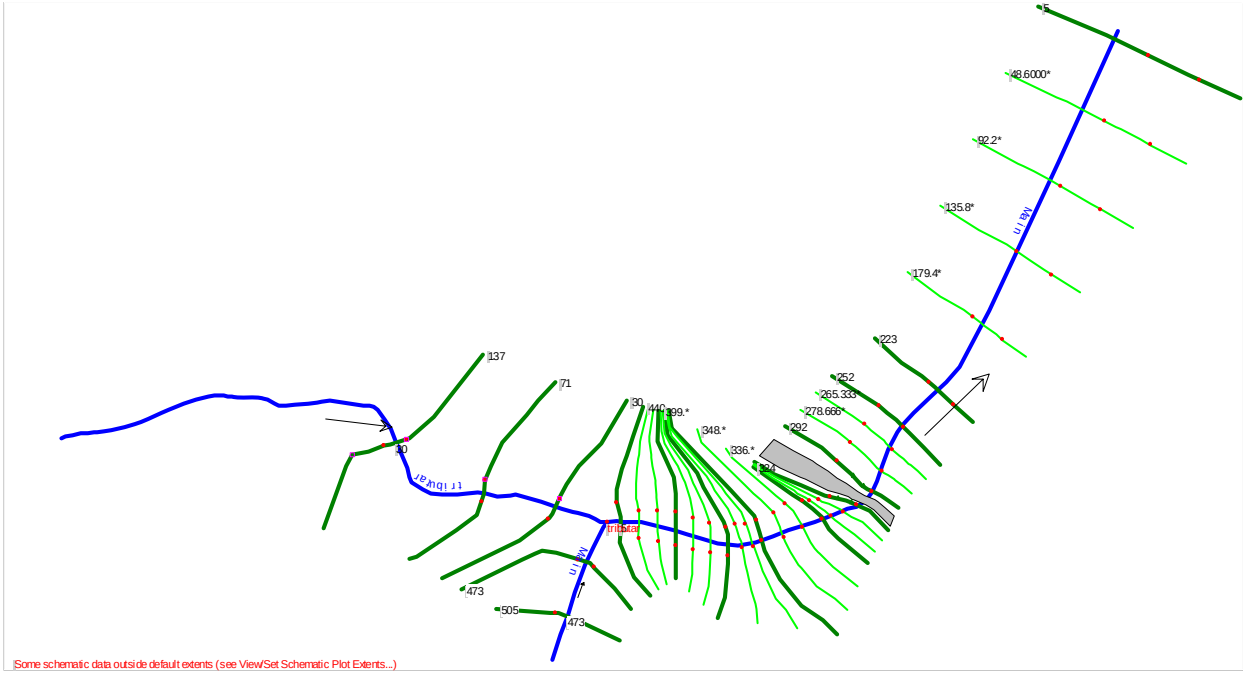


Figure 2.3 Plotted Flow Profiles (9 December 2010 flood)

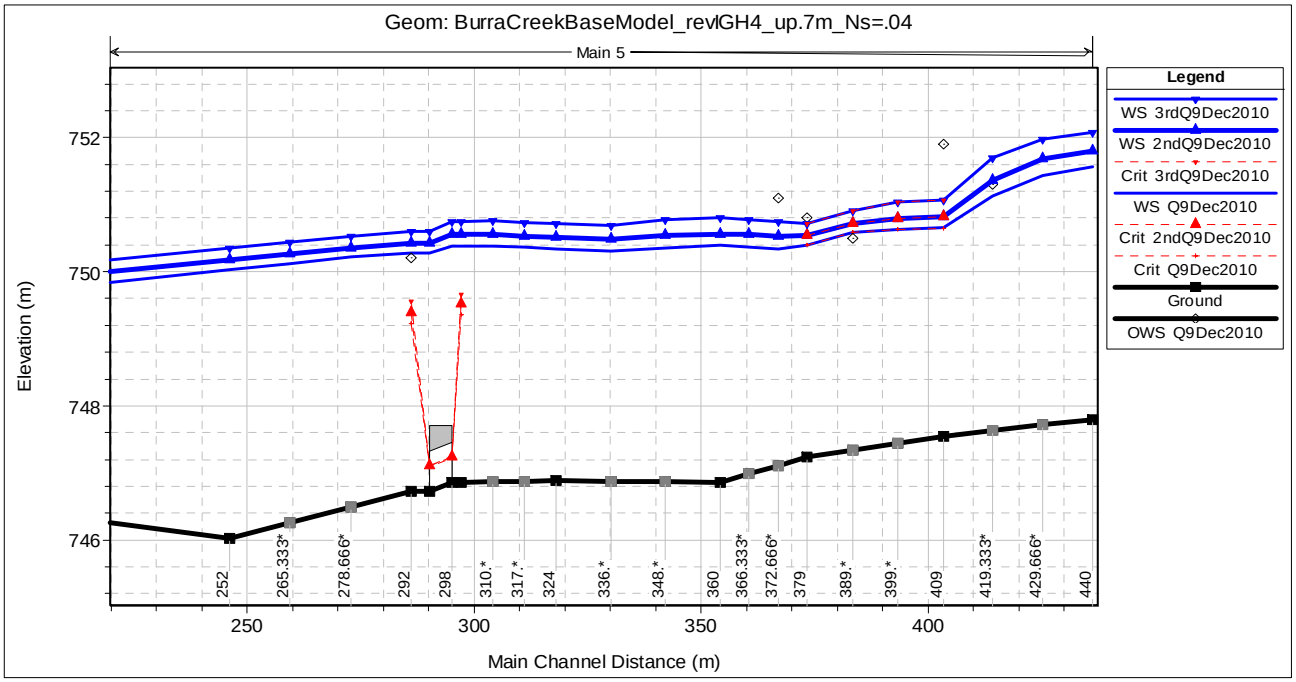


Figure 2.4 Velocity Profile (9 December 2010 flood)

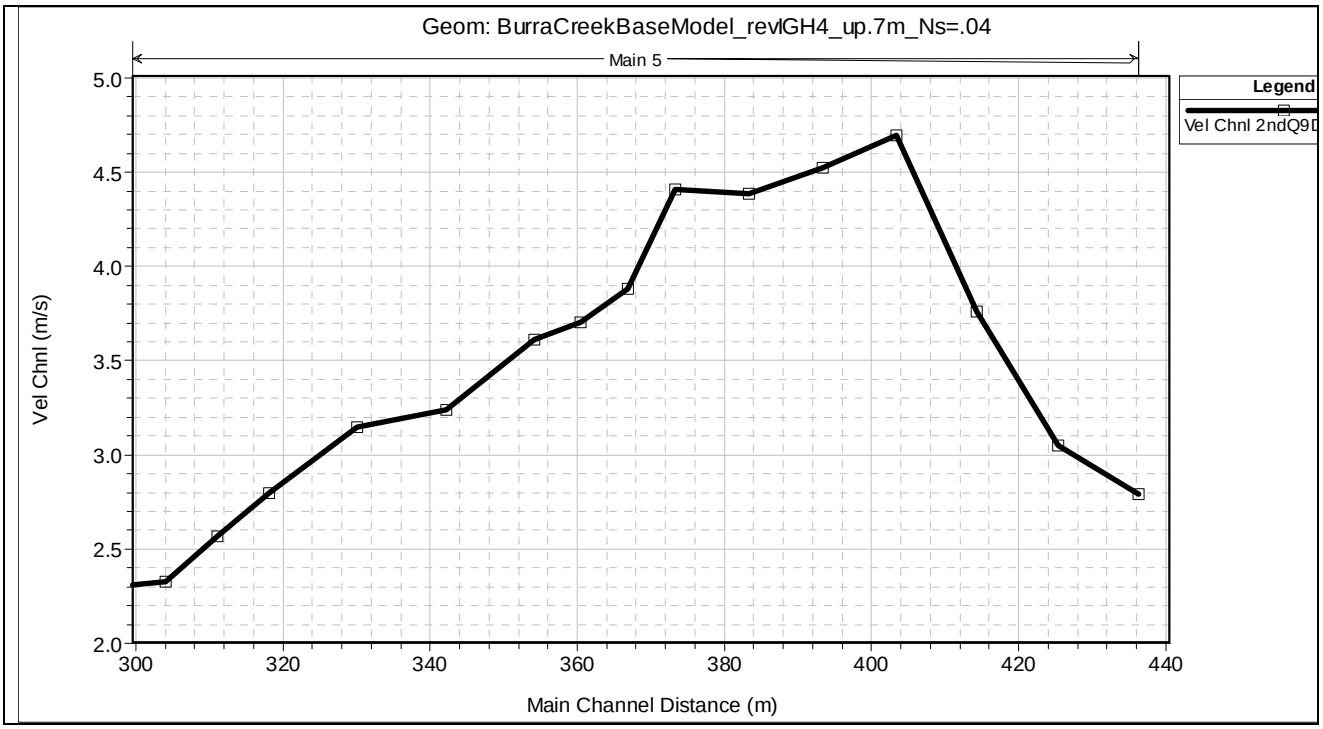


Table 2.2 Computed hydraulic values at model cross sections

XS (River Sta)	Q Total	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
	(m3/s)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
440	260	751.8		752.05	0.002279	2.79	160.54	77.45	0.47
429.666*	260	751.68		752.01	0.002888	3.05	134.52	68.25	0.52
419.333*	260	751.36		751.95	0.005007	3.76	100.22	57.54	0.67
409	260	750.82	750.82	751.84	0.009926	4.7	69.94	40.03	0.92
399.*	260	750.79	750.79	751.68	0.008952	4.52	77.32	48.07	0.88
389.*	260	750.73	750.73	751.51	0.008199	4.39	86.79	57.55	0.84
379	260	750.55	750.55	751.31	0.00833	4.41	93.19	63.37	0.84
372.666*	260	750.52		751.06	0.006194	3.88	103.06	72	0.73
366.333*	260	750.56		751	0.005238	3.71	119.68	83.44	0.68
360	260	750.56		750.95	0.00461	3.61	138.12	99.53	0.64
348.*	260	750.54		750.89	0.003747	3.24	135.93	95.62	0.58
336.*	260	750.48		750.86	0.00352	3.15	133.12	91.16	0.57
324	260	750.51		750.8	0.002617	2.8	149.41	94.74	0.49
317.*	260	750.53		750.76	0.002149	2.57	159.82	93.13	0.45
310.*	260	750.56		750.74	0.001717	2.33	170.26	91.23	0.4
303	260	750.55	749.52	750.72	0.001262	2.3	178.64	88.19	0.39
298	Culvert								
292	260	750.43	749.39	750.69	0.001599	2.4	133.66	70.15	0.44
278.666*	260	750.36		750.66	0.002473	2.62	126.78	75.81	0.47
265.333*	260	750.26		750.62	0.003104	2.9	120.82	80.91	0.53
252	260	750.17		750.57	0.003859	3.15	115.92	78.14	0.58
223	260	749.98		750.44	0.00462	3.35	106.51	72.33	0.63
179.4*	260	749.79		750.24	0.004513	3.32	106.99	72.49	0.63
135.8*	260	749.6		750.04	0.004463	3.31	107.42	72.64	0.62
92.2*	260	749.41		749.85	0.004408	3.29	107.99	72.83	0.62
48.6000*	260	749.2		749.65	0.004548	3.34	107.3	72.59	0.63
5	260	748.94	748.66	749.44	0.005001	3.46	103.63	71.35	0.66

3 Mini Hydro Amendments

Based upon the amended flood levels for the 1 in 100 year AEP flood, there are three options for providing flood immunity. These are:

- Maintain the existing floor level of RL 749.89 and flood proof the building. This would eliminate the side access, require through the roof access for maintenance, add considerable cost and significantly vary the concept of the proposed building. Nonetheless back flooding through the pipeline to the discharge structure is still possible and a flap valve could not be relied upon to secure the electrical equipment from inundation.
- Raise the floor level to RL 750.8. This eliminates the risk of back flooding from the discharge structure pipeline. Side access is maintained and the concept is maintained. An earth mound is required alongside the southern side of the access being the old Williamsdale Road. The earth mound will add cost, but is more cost effective than a retaining wall.
- Raise the floor level to RL 751.8. This eliminates the need for the earth mound and maintains the side access. However it raises the roof of the building to one metre above the top of the hill into which the mini hydro is being incorporated. It results in an excessively deep tank under the mini hydro building and significantly increases the earthworks immediately around the building.

Of the three options, the second has been adopted for the purposes of progressing the design.

A consistency check has been undertaken against the proposal in the EIS for the proposed amendments to the mini hydro to accommodate the increase in design flood level.

Table 3.1 Consistency Check

EIS Description	Proposal
EIS Volume 1	
Sect 3.2.5 Mini-hydro power generator	
The mini-hydro power generator will be located near the outlet structure within the pipeline construction corridor away from the immediate environs of the Burra Creek bank to minimise local impacts and to protect the infrastructure from flooding.	No change. Consistent
Sect 6.7 Mini-hydro power facility	
A mini-hydro power generator is proposed to be incorporated into the preferred project to reduce the overall energy requirements of the preferred project during its operation. The electricity generated will be used to power the high lift pump station. The electricity generated will be transmitted via an underground transmission cable located within the pipeline trench that will terminate at the high lift pump station.	No change. Consistent.
The mini-hydro power generator will be substantially underground and located near the outlet structure within the pipeline construction corridor away from the	No change. Consistent.

EIS Description	Proposal
immediate environs of the Burra Creek bank … The facility will comprise of a turbine, generator and substation, with some minor above ground auxiliary components such as air vents and access portals.	
The mini-hydro power generator will generate approximately 1 mega watt of electricity…	No change. Consistent.
The above ground dimensions (footprint area) of the mini-hydro power generator are approximately 75 m2. The facility will include a buried valve pit with an exposed top and enclosing structure designed to reduce the potential for any noise emissions.	Dimensions of the building floorplan are 12 m by 10 m resulting in a floor area of 120 m2. This has increased from the 75 m2 stated in the EIS. However this is due largely to the previously separate valve pit being deleted and the valves located inside the mini hydro building with the mini hydro equipment. Note that the footprint of the mini hydro remains less than that stated in the EIS (30 m x 25 m). Consistent.
Key features of the facility will include: • A purpose designed generating plant comprising a hydro generating unit; • Plant rooms with required air venting and power supply infrastructure; • A 11 kV substation; • A main water control inlet valve to the turbines; • Fire detection and fire fighting facilities; • Drainage structures for stormwater collection; and • Oil spill collection and separation units	Consistent.
Sect 18.3.4 Mini-hydro power generator	
The mini-hydro power generator will have a footprint of approximately 30 m x 25 m, however the majority of this facility will be located underground and will not be visible. Earth mounds will be constructed against the structure to assist in the mitigation of visual impacts. Visual elements will include one side of the facility with access doors, an access road (existing) and car parking area, air vents and a hand rail around the roof of the structure.	Consistent. Note Figure 1.6 - Simulation of the mini-hydro power generator shows the earth mound along the left hand (southern) side of the access road.
Sect 18.6.3 Site Specific Recommendations	
Mini hydro power generator There are opportunities for mitigation measures to the mini-hydro power generator including the following: • Earthworks mounding as high as possible around structure walls to assist in screening; • Screening vegetation to be planted on batters and around the site; • Vegetation planted on batters to be tied in with	Consistent

EIS Description	Proposal
surrounding vegetation in order to 'blend' the structure into the landscape as best as possible; • Colour and materials of structure to be sensitive to the surrounding environment and any built elements; and • Parking area to be surfaced with crushed rock / gravel similar to existing surface of Williamsdale road to reduce visual impact.	
EIS Volume 4 Landscape and Visual Impact Assessment Addendum	
2.2 Assessment of Impacts – Project Elements	Consistent.
2.2 Assessment of Impacts – Mini Hydro Power Facility	Consistent
2.3 Mitigation Measures	Consistent. As per 18.6.3

4 Effect of bund on hydraulic parameters

The geometry of the proposed bund was included in the HEC-RAS model. The bund would have the effect of constricting flow in large flood events which has resulted in higher velocities in the creek channel and overbank areas and some modification of the flood profile which is illustrated by Figures 4.2 and 4.3 and Table 4.2.

For example:

- Figure 4.2 (in comparison with Figure 2.3) shows that the flow profile is modified from XS 372.666 to XS 366.633 with critical flow occurring at XS 366.633.
- Figure 4.3 in comparison with Figure 2.4 shows that the computed channel flow velocity at XS 366.633 is higher than without the bund and lower at XS 372.666. Otherwise the channel velocities are not much changed.
- Table 4.2 in comparison with Table 2.2 shows that the computed flood level at XS 366.333 has been lowered (because of the higher channel velocity), while the flood levels from XS 419,333 (approximately at the downstream side of the mini-hydro power station) to XS 372.666 are higher.
- A conservative interpretation of Table 4.2 is that the most applicable flood level (with respect to the power station floor level) is that computed at XS 360 (downstream of the proposed bund) of EL 750.56 (0.24 m below the proposed floor level).

The following table summarises the change in water levels due to the bund. The water level increase is only up to 40 mm higher which is not significant.

Table 4.1 Water Level Changes due to Bund

Chainage of Cross Section	Existing	With bund
440	751.80	751.82
409	750.82	750.84
379 u/s side of discharge structure	750.55	750.59
360 d/s side of discharge structure	750.56	750.56

Figure 4.2 Flood profile - 9 December Flood with Bund

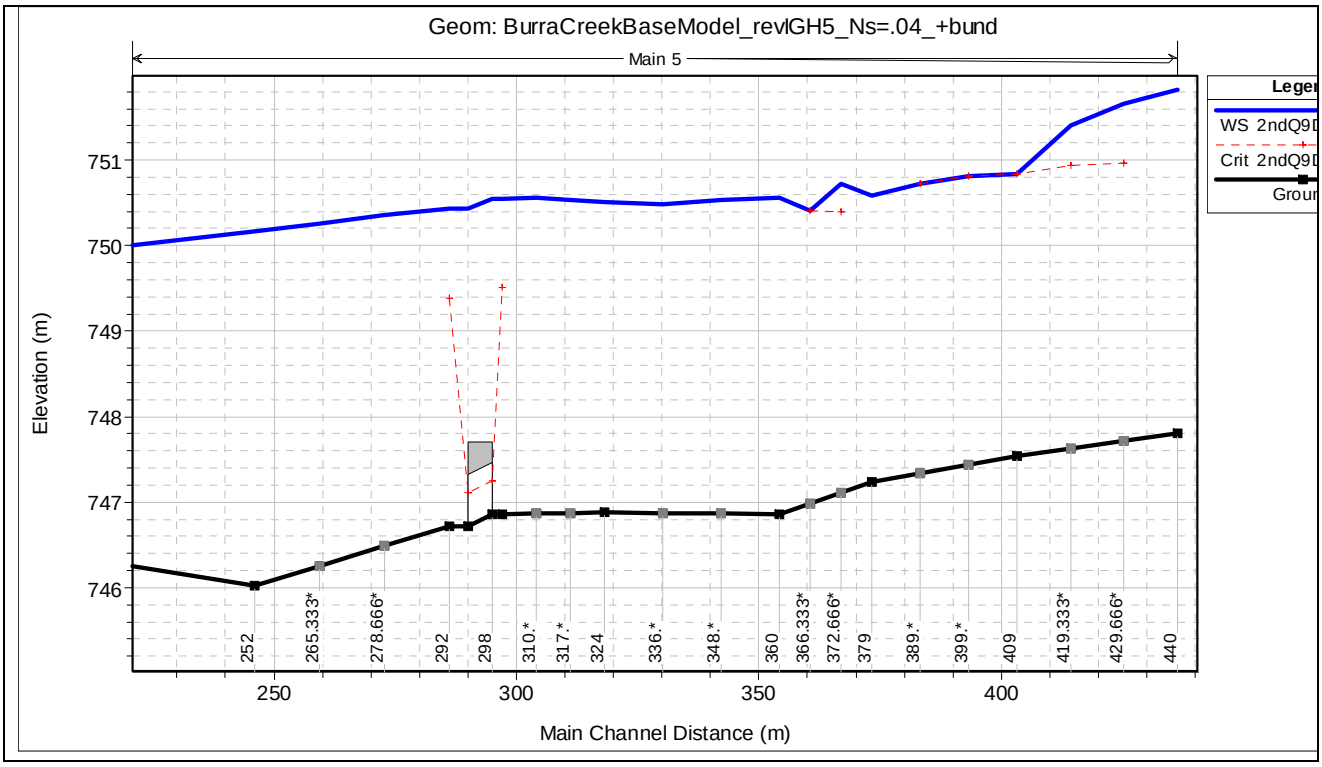


Figure 4.3 Velocity profile - 9 December Flood with Bund

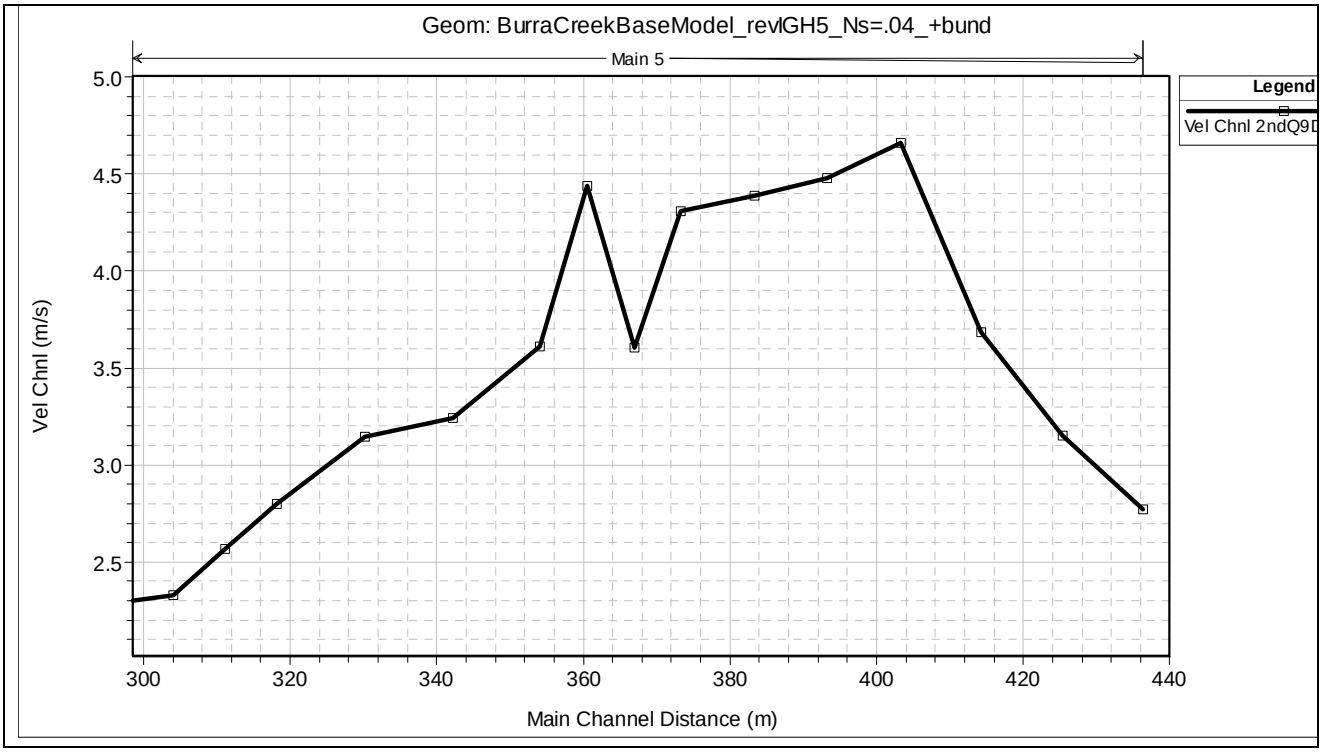


Table 4.2 9 Dec 2010 flood -computed hydraulic values at model cross sections (with Bund)

XS (River Sta)	Q Total	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
	(m3/s)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
440	260	751.82		752.07	0.002225	2.77	162.05	77.78	0.46
429.666*	260	751.66	750.96	752.02	0.003111	3.15	125.76	60.16	0.54
419.333*	260	751.4	750.93	751.96	0.004722	3.68	100.09	48.67	0.66
409	260	750.84	750.84	751.84	0.009678	4.66	69.92	38.33	0.91
399.*	260	750.81	750.81	751.68	0.008693	4.48	78.09	47.15	0.87
389.*	260	750.73	750.73	751.51	0.008199	4.39	86.79	57.55	0.84
379	260	750.59		751.31	0.00779	4.31	95.82	63.91	0.82
372.666*	260	750.73	750.4	751.19	0.00488	3.61	111.1	68.41	0.66
366.333*	260	750.41	750.41	751.13	0.008014	4.44	90.84	63.23	0.84
360	260	750.56		750.95	0.00461	3.61	138.12	99.53	0.64
348.*	260	750.54		750.89	0.003747	3.24	135.93	95.62	0.58
336.*	260	750.48		750.86	0.00352	3.15	133.12	91.16	0.57
324	260	750.51		750.8	0.002617	2.8	149.41	94.74	0.49
317.*	260	750.53		750.76	0.002149	2.57	159.82	93.13	0.45
310.*	260	750.56		750.74	0.001717	2.33	170.26	91.23	0.4
303	260	750.55	749.52	750.72	0.001262	2.3	178.64	88.19	0.39
298	Culvert								
292	260	750.43	749.39	750.69	0.001599	2.4	133.66	70.15	0.44
278.666*	260	750.36		750.66	0.002473	2.62	126.78	75.81	0.47
265.333*	260	750.26		750.62	0.003104	2.9	120.82	80.91	0.53
252	260	750.17		750.57	0.003859	3.15	115.92	78.14	0.58
223	260	749.98		750.44	0.00462	3.35	106.51	72.33	0.63
179.4*	260	749.79		750.24	0.004513	3.32	106.99	72.49	0.63
135.8*	260	749.6		750.04	0.004463	3.31	107.42	72.64	0.62
92.2*	260	749.41		749.85	0.004408	3.29	107.99	72.83	0.62
48.6000*	260	749.2		749.65	0.004548	3.34	107.3	72.59	0.63
5	260	748.94	748.66	749.44	0.005001	3.46	103.63	71.35	0.66

5 Conclusion

Based upon the comparison of the proposed revisions to the general arrangement of the mini-hydro with the commitments made in the EIS, it is considered that these are consistent. The mini hydro building remains substantially in-ground and the treatment provided to mitigate the aesthetic and noise impacts remain applicable. The floor level is selected to provide immunity to flooding as per the EIS document.

Appendix 4 Community Information Details

Mt Stromlo Road, Mt Stromlo
GPO Box 366 Canberra ACT 2601
Tel (02) 6175 2400
Fax (02) 6175 2322

ACTEW CORPORATION | ActewAGL Always.

ACTEW working with ActewAGL

4 August 2011

Enter name and address **here**
Address line 2
Address line 3
State and postcode

Subject: Murrumbidgee to Googong Water Pipeline – temporary carbon dioxide dosing

Dear Name

I am writing to provide you with some information on the construction of the Murrumbidgee to Googong Water Transfer project, particularly the inclusion of equipment to ensure pH levels of water discharged into Burra Creek do not impact the environment.

Earthworks for the discharge structure and mini-hydro have commenced near Burra Creek. We are now planning to include carbon dioxide dosing equipment to lower the pH of water entering the creek from the pipeline. Minimal amounts of carbon dioxide will be bubbled through the water, and it will not have an adverse impact on water quality in Burra Creek. We will conceal the equipment at the site using earth batters and plantings.

The increase in pH from water in the pipeline is only associated with the commissioning and initial operation of the pipeline. It is expected that the equipment will be removed within two to four years of operation of the pipeline commencing.

ACTEW is working with technical specialists and an independent environmental representative to ensure the equipment meets all safety and environmental standards, and ensures the water quality in Burra Creek is protected.

If you would like to meet with us to discuss, please feel free to contact me on the details provided below.

Yours faithfully,

Rachel Clarke
Manager – Community and Stakeholder Engagement
Murrumbidgee to Googong Water Transfer

p: 02 6175 2409 | **f:** 02 6175 2495 | **m:** 0406 378 146
rachel.clarke@bwa.actew.com.au

www.actew.com.au

4 August 2011

Gordon Cunningham
Palerang Council
PO Box 348
Bungendore
NSW 2621

Subject: Murrumbidgee to Googong Water Pipeline – temporary carbon dioxide dosing

Dear Gordon

I am writing to provide you with some information on the construction of the Murrumbidgee to Googong Water Transfer project, particularly the inclusion of equipment to ensure pH levels of water discharged into Burra Creek do not impact the environment.

Earthworks for the discharge structure and mini-hydro have commenced near Burra Creek. We are now planning to include carbon dioxide dosing equipment to lower the pH of water entering the creek from the pipeline. Minimal amounts of carbon dioxide will be bubbled through the water, and it will not have an adverse impact on water quality in Burra Creek. We will conceal the equipment at the site using earth batters and plantings.

The increase in pH from water in the pipeline is only associated with the commissioning and initial operation of the pipeline. It is expected that the equipment will be removed within two to four years of operation of the pipeline commencing.

ACTEW is working with technical specialists and an independent environmental representative to ensure the equipment meets all safety and environmental standards, and ensures the water quality in Burra Creek is protected.

If you would like to meet with us to discuss, please feel free to contact me on the details provided below.

Yours faithfully,

Rachel Clarke
Manager – Community and Stakeholder Engagement
Murrumbidgee to Googong Water Transfer

p: 02 6175 2409 | **f:** 02 6175 2495 | **m:** 0406 378 146
rachel.clarke@bwa.actew.com.au

www.actew.com.au

PALERANG COUNCIL

Contact: Gordon Cunningham (02 6238 8111)

8 August 2011

Ms Rachel Clarke
Manager – Community & Stakeholder Engagement
Murrumbidgee to Googong Water Transfer
GPO Box 366
CANBERRA ACT 2601

Dear Ms Clarke,

RE: M2G WATER PIPELINE – TEMPORARY CARBON DIOXIDE DOSING

Thank you for your letter of 4 August regarding the above matter.

Council appreciates your advice and offer to meet to discuss this interesting aspect of the project and I confirm my earlier discussions on the matter with Messers Webber and Richardson at Council's offices on 14 June.

Accordingly, I do not anticipate a need for any additional briefings at this stage although I commit to contacting you directly in the event that circumstances change.

Yours faithfully,

G T Cunningham
Director of Works

DOW 250_2011

POSTAL: PO Box 348 Bungendore NSW 2621
OFFICES: 10 Majara Street, Bungendore; 144 Wallace Street, Braidwood
P: 02 6238 8111
F: 02 6238 1290
All hours: 1300 735 025
E: records@palerang.nsw.gov.au
W: www.palerang.nsw.gov.au
ABN: 70 605 876 877

Carbon dioxide dosing consultation to 29092011

Report Parameters:
Event Keyword Contains carbon
Event Keyword Contains dioxide

Ms Kath Boyd	
Call in 08 Jul 2011	**Summary:** Kath Boyd called re concerns about the realignment of the road near Blinksells, the CO2 dosing and the Williamsdale Road closure. She requested a meeting with staff to discuss. **Stakeholder Comments:** Concerned about these issues, would like us to meet with herself and Sandy Lloyd. She will confirm Wednesday 13 July for an appointment. **Team Response:** 11 July Called kath to see if the meeting time could be moved until 12:30 on Wednesday to accommodate Simon. 8 July Rachel returned call to kath Boyd. Happy to make a time to meet to discuss these issues, hopefully next Wednesday. 8 July - email from Simon Webber Hi Rachel, I just took a call from Kath Boyd who requested you call her. She spoke of having concerns with several issues: - road realignment leading to a pipeline realignment - Carbon dioxide dosing - road closure for five weeks. She asked you call her this afternoon, before 4:45pm, of Monday morning. I advised her that we were in preliminary discussions about the above topics, and that we would seek to discuss and resolve any concerns she may have. Her number is 6236 3442. If you get a chance, could you please call her this afternoon. Cheers Simon
Meeting 27 Jul 2011	**Summary:** Meeting to discuss carbon dioxide treatment facility, Williamsdale Rd closure, and road realignement near Devitt's. **Stakeholder Comments:** Concerned about changes from the EIS, feeling that the community is being inadequately recompensed for changes to the landscape and disruptions. Suggested mailouts with a self-addresed envelope are the way to get people to respond to options. Also feel concerned that there won't be emergency access available. Worried that there has been an increase in rubbish on Williamsdale road and asked if we could turn off our flasing lights on Williamsdale road. **Team Response:** We will: * Check the EIS for inconsistencies with the draft * Provide more informaiton on the procedure for the monthly operation (in the case that the transfer isn't fully operational immediately) and check if it is possible not to operate the pipe monthly/decomission it for 6 month periods * Check if the yellow box near Keewong Lane is a tree of cultural significance * Provide an update on the pipe route *Toolbox where people need to turn off their ligths and mention rubbish on Williamsdale Rd * Check when we will get the paper that would go to Erwin on the C02 facility and provide it

Ms Wendy Christian Burra NSW 2620 Australia	
Meeting 03 Aug 2011	**Summary:** Chance meeting with quilting/knitting club at Burra Hall. Following issues were raised: * CO2 dosing - community need to know what is happening * Open gardens are on in the last weekend in October. Williamsdale Road closure needs to be over by then * Our workmen are using the ladies toilets at Burra Hall and using up the toilet paper. * Debbie Fraser has been walking in fenced off area near Burra creek * Worried about changes from EIS - Co2, road closure etc *Some people, including a lady on Williamsdale Road didn't get the notice about the closure/meeting * Are the charman trucks ours? **Stakeholder Comments:** Had heard about the carbon dioxide dosing via Murrumbidgee CMA, worried that thinks are being kept from them, want to know more about it. Worried that it might be noisy. Debbie Fraser was also concerned about the noise form the air valves. Debbie Fraser admitted to going through the fence at Burra Creek into the construction site. The workmen have moved a boulder to cut off the road where the Fraser were trying to get some wattles and things going - requested this of workmen at the site. Syliva mentioned that the pipe was always going up the road and that people did know about it. **Team Response:** Explaiend that the carbon dioxide dosing is only temporary as the lining leaches and that we didn't know about it at the time of the EIS - could not have predicted extraordinary rain event last year. Asked if it was good to have a community meeting about issues with the project, or better to have drop ins at meetings like theirs - considered that a community meeting would be better.

Mr. Gordon Cunningham Bungendore NSW 2621 Australia	
Correspondence out 05 Aug 2011	**Summary:** Attached letters sent providing Paleran Council and nearby ladnholders about the plan to install carbon dioxide dosing equipment at the min-hydro sute.
Correspondence in 16 Aug 2011	**Summary:** Letter from Council adivising that they are currently comfortable with our plan for carbon dioxide dosing at the mini-hydro.

Mr and Ms Peter and Kath Duffy and Boyd Burra NSW 2620 Australia	
Meeting 27 Jul 2011	**Summary:** Meeting to discuss carbon dioxide treatment facility, Williamsdale Rd closure, and road realignement near Devitt's. **Stakeholder Comments:** Concerned about changes from the EIS, feeling that the community is being inadequately recompensed for changes to the landscape and disruptions. Suggested mailouts with a self-addresed envelope are the way to get people to respond to options. Also feel concerned that there won't be emergency access available. Worried that there has been an increase in rubbish on Williamsdale road and asked if we could turn off our flasing lights on Williamsdale road. **Team Response:** We will: * Check the EIS for inconsistencies with the draft * Provide more informaiton on the procedure for the monthly operation (in the case that the transfer isn't fully operational immediately) and check if it is possible not to operate the pipe monthly/decomission it for 6 month periods * Check if the yellow box near Keewong Lane is a tree of cultural significance * Provide an update on the pipe route *Toolbox where people need to turn off their ligths and mention rubbish on Williamsdale Rd * Check when we will get the paper that would go to Erwin on the C02 facility and provide it

Mr and Mrs Donald and Alison Fraser Burra NSW 2620 Australia	
Meeting 03 Aug 2011	**Summary:** Chance meeting with quilting/knitting club at Burra Hall. Following issues were raised: * CO2 dosing - community need to know what is happening * Open gardens are on in the last weekend in October. Williamsdale Road closure needs to be over by then * Our workmen are using the ladies toilets at Burra Hall and using up the toilet paper. * Debbie Fraser has been walking in fenced off area near Burra creek * Worried about changes from EIS - Co2, road closure etc *Some people, including a lady on Williamsdale Road didn't get the notice about the closure/meeting * Are the charman trucks ours? **Stakeholder Comments:** Had heard about the carbon dioxide dosing via Murrumbidgee CMA, worried that thinks are being kept from them, want to know more about it. Worried that it might be noisy. Debbie Fraser was also concerned about the noise form the air valves. Debbie Fraser admitted to going through the fence at Burra Creek into the construction site. The workmen have moved a boulder to cut off the road where the Fraser were trying to get some wattles and things going - requested this of workmen at the site. Syliva mentioned that the pipe was always going up the road and that people did know about it. **Team Response:** Explaiend that the carbon dioxide dosing is only temporary as the lining leaches and that we didn't know about it at the time of the EIS - could not have predicted extraordinary rain event last year. Asked if it was good to have a community meeting about issues with the project, or better to have drop ins at meetings like theirs - considered that a community meeting would be better.

Mr John Harris and Ms Barbara Pearson Burra NSW 2620 Australia	
Correspondence out 05 Aug 2011	**Summary:** Attached letters sent providing Paleran Council and nearby ladnholders about the plan to install carbon dioxide dosing equipment at the min-hydro sute.

Mr and Mrs Mark and Bridget Hehir Burra NSW 2620 Australia	
Meeting 14 Jul 2011	**Summary:** Chance meeting with Mark Hehir near the mini-hydro site. He needs to get access from the road to a paddock on this side of the creek. **Stakeholder Comments:** Needs access so he can get into both sides of the creek. He is trying to remove and old fence in that area, but our new fence has restricted his access. He is happy to meet with us sometime to discuss the carbon dioxide dosing - suggested tomorrow. **Team Response:** We will look into it. We are also keen to meet to discuss the carbon dioxide dosing cylinder which will be installed near the mini-hydro.

Mr and Ms Mervyn and Sandy Lloyd Tinderry NSW 2620 Australia	
Meeting 27 Jul 2011	**Summary:** Meeting to discuss carbon dioxide treatment facility, Williamsdale Rd closure, and road realignement near Devitt's. **Stakeholder Comments:** Concerned about changes from the EIS, feeling that the community is being inadequately recompensed for changes to the landscape and disruptions. Suggested mailouts with a self-addresed envelope are the way to get people to respond to options. Also feel concerned that there won't be emergency access available. Worried that there has been an increase in rubbish on Williamsdale road and asked if we could turn off our flasing lights on Williamsdale road. **Team Response:** We will: * Check the EIS for inconsistencies with the draft

Mr and Ms Mervyn and Sandy Lloyd Tinderry NSW 2620 Australia	
	* Provide more informaiton on the procedure for the monthly operation (in the case that the transfer isn't fully operational immediately) and check if it is possible not to operate the pipe monthly/decomission it for 6 month periods * Check if the yellow box near Keewong Lane is a tree of cultural significance * Provide an update on the pipe route *Toolbox where people need to turn off their ligths and mention rubbish on Williamsdale Rd * Check when we will get the paper that would go to Erwin on the C02 facility and provide it

Ms Sandy Lloyd	
Call in 08 Jul 2011	**Summary:** Kath Boyd called re concerns about the realignment of the road near Blinksells, the CO2 dosing and the Williamsdale Road closure. She requested a meeting with staff to discuss. **Stakeholder Comments:** Concerned about these issues, would like us to meet with herself and Sandy Lloyd. She will confirm Wednesday 13 July for an appointment. **Team Response:** 11 July Called kath to see if the meeting time could be moved until 12:30 on Wednesday to accommodate Simon. 8 July Rachel returned call to kath Boyd. Happy to make a time to meet to discuss these issues, hopefully next Wednesday. 8 July - email from Simon Webber Hi Rachel, I just took a call from Kath Boyd who requested you call her. She spoke of having concerns with several issues: - road realignment leading to a pipeline realignment - Carbon dioxide dosing - road closure for five weeks. She asked you call her this afternoon, before 4:45pm, of Monday morning. I advised her that we were in preliminary discussions about the above topics, and that we would seek to discuss and resolve any concerns she may have. Her number is 6236 3442. If you get a chance, could you please call her this afternoon. Cheers Simon
Meeting 27 Jul 2011	**Summary:** Meeting to discuss carbon dioxide treatment facility, Williamsdale Rd closure, and road realignement near Devitt's. **Stakeholder Comments:** Concerned about changes from the EIS, feeling that the community is being inadequately recompensed for changes to the landscape and disruptions. Suggested mailouts with a self-addresed envelope are the way to get people to respond to options. Also feel concerned that there won't be emergency access available. Worried that there has been an increase in rubbish on Williamsdale road and asked if we could turn off our flasing lights on Williamsdale road. **Team Response:** We will: * Check the EIS for inconsistencies with the draft * Provide more informaiton on the procedure for the monthly operation (in the case that the transfer isn't fully operational immediately) and check if it is possible not to operate the pipe monthly/decomission it for 6 month periods * Check if the yellow box near Keewong Lane is a tree of cultural significance

Ms Sandy Lloyd	
	* Provide an update on the pipe route *Toolbox where people need to turn off their ligths and mention rubbish on Williamsdale Rd * Check when we will get the paper that would go to Erwin on the C02 facility and provide it

Mr and Mrs Christopher and Janene Lumley Burra NSW 2620 Australia	
Correspondence out 05 Aug 2011	**Summary:** Attached letters sent providing Paleran Council and nearby ladnholders about the plan to install carbon dioxide dosing equipment at the min-hydro sute.

Ms Carol Mackay Burra NSW 2620 Australia	
Meeting 03 Aug 2011	**Summary:** Chance meeting with quilting/knitting club at Burra Hall. Following issues were raised: * CO2 dosing - community need to know what is happening * Open gardens are on in the last weekend in October. Williamsdale Road closure needs to be over by then * Our workmen are using the ladies toilets at Burra Hall and using up the toilet paper. * Debbie Fraser has been walking in fenced off area near Burra creek * Worried about changes from EIS - Co2, road closure etc *Some people, including a lady on Williamsdale Road didn't get the notice about the closure/meeting * Are the charman trucks ours? **Stakeholder Comments:** Had heard about the carbon dioxide dosing via Murrumbidgee CMA, worried that thinks are being kept from them, want to know more about it. Worried that it might be noisy. Debbie Fraser was also concerned about the noise form the air valves. Debbie Fraser admitted to going through the fence at Burra Creek into the construction site. The workmen have moved a boulder to cut off the road where the Fraser were trying to get some wattles and things going - requested this of workmen at the site. Syliva mentioned that the pipe was always going up the road and that people did know about it. **Team Response:** Explaiend that the carbon dioxide dosing is only temporary as the lining leaches and that we didn't know about it at the time of the EIS - could not have predicted extraordinary rain event last year. Asked if it was good to have a community meeting about issues with the project, or better to have drop ins at meetings like theirs - considered that a community meeting would be better.

Fern Maclachlan Burra NSW 2620 AUSTRALIA	
Meeting 03 Aug 2011	**Summary:** Chance meeting with quilting/knitting club at Burra Hall. Following issues were raised: * CO2 dosing - community need to know what is happening * Open gardens are on in the last weekend in October. Williamsdale Road closure needs to be over by then * Our workmen are using the ladies toilets at Burra Hall and using up the toilet paper. * Debbie Fraser has been walking in fenced off area near Burra creek * Worried about changes from EIS - Co2, road closure etc *Some people, including a lady on Williamsdale Road didn't get the notice about the closure/meeting * Are the charman trucks ours? **Stakeholder Comments:** Had heard about the carbon dioxide dosing via Murrumbidgee CMA, worried that thinks are being kept from them, want to know more about it. Worried that it might be noisy. Debbie Fraser was also concerned about the noise form the air valves. Debbie Fraser admitted to going through the fence at Burra Creek into the construction site. The workmen have moved a boulder to cut off the

Fern Maclachlan Burra NSW 2620 AUSTRALIA	
	road where the Fraser were trying to get some wattles and things going - requested this of workmen at the site. Syliva mentioned that the pipe was always going up the road and that people did know about it. **Team Response:** Explaiend that the carbon dioxide dosing is only temporary as the lining leaches and that we didn't know about it at the time of the EIS - could not have predicted extraordinary rain event last year. Asked if it was good to have a community meeting about issues with the project, or better to have drop ins at meetings like theirs - considered that a community meeting would be better.

Mr and Mrs Leonard and Shirley Pain Burra NSW 2620 Australia	
Meeting 03 Aug 2011	**Summary:** Chance meeting with quilting/knitting club at Burra Hall. Following issues were raised: * CO2 dosing - community need to know what is happening * Open gardens are on in the last weekend in October. Williamsdale Road closure needs to be over by then * Our workmen are using the ladies toilets at Burra Hall and using up the toilet paper. * Debbie Fraser has been walking in fenced off area near Burra creek * Worried about changes from EIS - Co2, road closure etc *Some people, including a lady on Williamsdale Road didn't get the notice about the closure/meeting * Are the charman trucks ours? **Stakeholder Comments:** Had heard about the carbon dioxide dosing via Murrumbidgee CMA, worried that thinks are being kept from them, want to know more about it. Worried that it might be noisy. Debbie Fraser was also concerned about the noise form the air valves. Debbie Fraser admitted to going through the fence at Burra Creek into the construction site. The workmen have moved a boulder to cut off the road where the Fraser were trying to get some wattles and things going - requested this of workmen at the site. Syliva mentioned that the pipe was always going up the road and that people did know about it. **Team Response:** Explaiend that the carbon dioxide dosing is only temporary as the lining leaches and that we didn't know about it at the time of the EIS - could not have predicted extraordinary rain event last year. Asked if it was good to have a community meeting about issues with the project, or better to have drop ins at meetings like theirs - considered that a community meeting would be better.

Mr and Ms George and Dianne Podmore Burra NSW 2620 Australia	
Correspondence out 05 Aug 2011	**Summary:** Attached letters sent providing Paleran Council and nearby ladnholders about the plan to install carbon dioxide dosing equipment at the min-hydro sute.

Ronald, Annett and Maureen Scattergood Burra NSW 2620 Australia	
Correspondence out 05 Aug 2011	**Summary:** Attached letters sent providing Paleran Council and nearby ladnholders about the plan to install carbon dioxide dosing equipment at the min-hydro sute.

Minutes

16 JUNE 2011

SUBJECT	Murrumbidgee to Googong Water Transfer Environment Reference Group Meeting
LOCATION	Monaro Room, M2G site office at Williamsdale
PREPARED BY	Rachel Clarke
ATTENDEES	ACTEW - Simon Webber, Chris Pulkkinen, Rachel Clarke, John Turville, Mathew Richardson ActewAGL – Bronwen Butterfield ALS Laboratory Group - Norm Mueller Burra Landcare - Sandra Lloyd Friends of Grasslands (FOG) – Tony Lawson Upper Murrumbidgee Catchment Coordination Committee (UMCCC) – Kelly Behrens Burra Community Association – David Lloyd Molonglo Catchment Group – Lynton Bond Murrumbidgee Catchment Management Authority – Heather Mason NGH Environmental – Erwin Budde Eco Logical Australia Pty Ltd – Tom Kaveney and Mathew Dowle Conservation, Planning and Research ACT Government – Mathew Beitzel Parks and Conservation Service – Michael Maconachie Smith's Road Community – Peter Henry
APOLOGIES	ACTEW – Tsuey Cham Burra Community Association – Kath Boyd Friends of Grasslands – Naarilla Hirsh Upper Murrumbidgee Catchment Coordination Committee (UMCCC) – Peter Duffy

MINUTES ITEMS	**ACTION**
1 Welcome	
1.1 Simon welcomed everyone and thanked them for coming. He emphasised the importance of the group as part of ACTEW's commitment to delivering the water transfer project in a way that protects the environment. This meeting is the last informal meeting before the inaugural meeting which will formalise the Environment Reference Group and ensure that recognition is given to all the groups/individuals.	
1.2 It was agreed that a list of all members of the ERG should be sent out to all members.	**1.1 ACTEW** to send out list

2 Actions from past meetings

2.1 Rachel discussed actions from the last meeting in September 2010 that required further discussion. These were:

- Mini-hydro discharge plan – the group was provided with an opportunity to comment on the species that will be used in the rehabilitation of Burra Creek below the discharge outlet. These recommendations have been incorporated into the Landscape Rehabilitation Management Plan.
- Tree removal – individual landholders have been consulted on which trees will be removed to allow access for the pipeline and have had their desires accommodated wherever possible within individual Property Interaction Plans. Community groups will be consulted on the removal of any trees, including poplars and willows, in the Burra Creek area as construction progresses.
- Landscape Rehabilitation Management Plan for Murrumbidgee to Googong Water Transfer Construction Project – comments from the ERG were considered in the plan. The plan has also been updated to reflect a new, revised weed management strategy.
- Induction process– all staff and contractors on the Water Transfer project undertake a site induction. This induction includes advice on the rubbish policy, which is that staff pick up any rubbish in their immediate work area irrespective of if they left it there.

2.1 ACTEW to consult groups on the removal of any trees, including poplars and willows, in the Burra Creek area as construction progresses.

3 Project Outline

3.1 Simon provided a brief overview of the project. The Murrumbidgee to Googong Water Transfer Project was identified as a viable option to deliver security of water supply to Canberra and region. Simon also provided an overview of the pipeline location and some information on the construction of the project.

3.2 The group also discussed the offset for the project. Simon said that the group will be consulted about the offset. Eco Logical has been involved in establishing the offset and Naarilla Hirsh and others had also been to see the offset site and provided positive feedback.

4 Statutory approvals update

4.1 Simon provided an update on the approvals as for Commonwealth, ACT and NSW as follows:

- The Commonwealth approved the project in October 2010. There was a condition about the sustainable diversion limit due to Commonwealth's concerns about its impact on Murray Cod in the Murrumbidgee. This issue was reviewed by an expert panel commissioned by the Commonwealth and included Dr Fiona Dyer, Professor Wayne Erskine, Mark Lintermans and Dr Keith Bishop. The condition was that if it is too dry for 3 years in a row, then ACTEW will have to limit use of the water transfer. The Sustainable Limit Plan was approved in April 2011 and can be found at http://www.actew.com.au/publications/Sustainable-Diversion-Limit-Plan.pdf.
- The ACT approval process is proceeding well, with only approval for the research and monitoring plan needed.
- ACTEW has discussed the offset plan with the Office of Environment and Sustainability, and it has been approved by the ACT and Commonwealth governments. Talks with NSW are progressing well and it is anticipated

that NSW will sign off on the plan soon.

4.2 The group discussed commissioning of the pipeline. Simon confirmed that the Water Transfer will only operate when the dam is at less than 80% full – the EIS prohibits it from being operated if the water level is higher. One variation to this is for commissioning and routine maintenance. Although the dam is currently 100% full the pipeline may need to be turned on for commissioning and routine maintenance to ensure it operates correctly.

4.3 The group discussed the role of the Murrumbidgee CMA as the administrators of the Native Vegetation Act in NSW. As the offset is on ACT leasehold land and is held in perpetuity, the Murrumbidgee CMA is not directly involved with the offset. However, the EIS included offset requirements based on the level of impact, and this was negotiated with all jurisdictions. The offset needed to have a 6-1 ration and also needs enhancement works. If the impact of the project increases, the offset value will need to go up, but it doesn't go down if the impact is less than expected.

5 Construction update

5.1 Construction Manager Matthew Richardson delivered a Power Point presentation on the progress at the high lift and low lift pump stations and the pipeline. A PDF of the slides is attached.

The group discussed the details for the pipe including depth and revegetation. The pipeline will be installed at a minimum depth of 600mm with current designs showing it at around 700mm. Trees will not be allowed to grow within a 15m easement around the pipe, but grasses and other ground cover species will be reinstated in these areas. The pipeline will be laid below ground but there will be some aboveground structures. These will be air valves and scour valves for relieving pressure and cleaning the pipe.

The construction team is aiming to minimise the amount of trenching ahead of the pipe laying at any time.

Topsoil removal has started and the goal will be to have it reinstated as soon as possible. Tenders are currently out for the planting and seeding jobs and grassland specialists have been consulted on the best ways to successfully restore the area. Contracts for the work are pending and rehabilitation will follow as soon as possible after the pipe is installed, hopefully from early August. There might be a break in Summer depending on the weather.

5.2 John delivered a presentation on the updated weed strategy (see attached). The weed strategy was reviewed and revised based on a complaint from a landholder. Following construction rapidly with rehabilitation will limit the amount of weeds growing in the construction corridor, and a weed contractor will be used to control any weeds. ACTEW and ActewAGL will carry out ongoing management over at least two years following construction and as necessary thereafter. The Environmental Representative will give advice on where improvements need to be and will stay involved in the project until recovery is deemed complete.

5.2 ACTEW will send out a copy of the weeds fact sheet to ERG members.

5.3 Sandy commented that the silt fencing that has been done by Palerang Council at Burra Creek is inappropriate for the site. **Note:** Sandy and John visited the site after the ERG inspection in order for John to visualise where Sandy was referring to and to propose a more appropriate erosion measure at the site. John actioned the agreed erosion controls (mulch and coir log) with the M2G foreman that afternoon.

6 ERG establishment

6.1 The group, including secondary representatives, all need to have access to the terms of reference and the terms of reference need to reflect all the groups that are involved.

6.1 ACTEW to send out terms of reference to all ERG members.

6.2 The chair will be nominated by ACTEW and selected in consultation with the group. ACTEW has identified three potential chairs – Darro Stinson, Ken Horsham and Fiona Howarth. Darro Stinson and Ken Horsham were both interested in the role, but Fiona Howarth has declined. CVs of the potential chairs and their availabilities will be distributed to the group. A request for no objections will be sought from the group prior to the chair being appointed by ACTEW.

6.2 ACTEW to circulate CVs and other background detail on potential chairs in the next two weeks.

7 General Business

7.1 Simon raised the possibility that the pipeline won't be fully operational for a few years after commissioning due to the high flow event experienced late in 2010. After commissioning, water may sit in the pipeline for up to a month at a time and is likely to react with the cement lining of the pipes, causing a rise in pH. Treating the water with carbon dioxide at the outlet into Burra Creek will reduce the pH to acceptable levels. A consistency review will be undertaken to assess the proposal. A planner will be involved in assessing the impacts such as noise, air pollution, traffic impacts and impacts on the community.

7.1 ACTEW will keep the group up to date on the planning of the CO_2 dosing facility.

Some concerns about the impact of the de-oxygenated water and carbon dioxide on fish were raised by the group. Norm said that the carbon dioxide wouldn't be excessive and that the water was likely to re-oxygenate as it passes through the outlet structure. There may be some salt precipitated into Burra Creek but EC is already pretty high in Burra Creek so the system is fairly well adapted to it.

The group asked if it was possible for the pipe to be lined with something to prevent the reaction. The pipe is already lined with cement which is important to prevent rust, and this form of pipe was the best option for the project. It is otherwise impractical to reline the pipe. Other linings, such as epoxies were discussed and they would potentially have more significant environmental issues.

8 Timing for next meeting

The timing for the next meeting will depend on the engagement and availability of the chair, but is likely to be in July or August. Wednesday, Thursday and Friday are better for some group members.

Meeting ENDS.

ACTEW CORPORATION | ActewAGL Always.

ACTEW working with ActewAGL

Minutes

20 SEPTEMBER 2011

SUBJECT	Murrumbidgee to Googong Water Transfer Inaugural Environment Reference Group Meeting
LOCATION	Monaro Room, M2G site office at Williamsdale
PREPARED BY	Rachel Clarke
ATTENDEES	Independent Chair – Darro Stinson ACTEW - Simon Webber, Chris Pulkkinen, Rachel Clarke Burra Landcare - Sandra Lloyd Burra Community Association – David Lloyd Molonglo Catchment Group – Lynton Bond Murrumbidgee Catchment Management Authority – Heather Mason Eco Logical Australia Pty Ltd –Mathew Dowle Conservation, Planning and Research ACT Government – Mathew Beitzel Parks and Conservation Service – Michael Maconachie Smith's Road Community – Peter Henry Burra Community Association – Kath Boyd Friends of Grasslands – Naarilla Hirsch Upper Murrumbidgee Catchment Coordination Committee (UMCCC) – Peter Duffy ACT Department of Territory and Municipal Services – Heath Chester
	NGH Environmental – Erwin Budde ActewAGL – Bronwen Butterfield ALS Laboratory Group - Norm Mueller ACTEW – John Turville
APOLOGIES	Palerang Council – Simon Holloway

MINUTES ITEMS	**ACTION**

1 Information and induction on the role of the Environment Reference Group (ERG)

1.1 Introduction and welcome by ERG Chair Darro Stinson

Darro outlined his role, including ground rules for the group. Key points included:

- The role of the independent chair is to facilitate the group meetings and ensure everyone gets a chance to speak. Once everyone has had a chance to speak on any one issue, then members may be given the floor

a second time.

- The role of the ERG is to give advice and provide recommendations to ACTEW. The expectation is that ACTEW will explain their decisions and how they may have, or why they may have not followed the advice of the ERG
- Draft minutes will be circulated within seven business days after the meeting.
- There probably won't always be agreement between the ERG what ACTEW decides to do, but it will be incumbent upon ACTEW to explain why decisions are made.
- The ERG may attract some media attention and while individual members have the prerogative to publicly express their individual views or those of the organizations they represent, members agreed not to publicly discuss the deliberations of the ERG, including the views expressed my other members during the meetings.
- Items not on the agenda should be deferred to the next meeting, or included under general business.
- Minutes will be ratified at each meeting.

1.1 ACTEW to update website to reflect Rachel Clarke as media contact.

1.2 ACTEW to update contact details and redistribute.

2 Full briefing on the transfer

2.1 Simon provided a project update and indicated that the construction project will finish by late June/early July 2012. As mentioned at an earlier meeting, as Googong dam is still above 80 percent, water will probably sit in the pipeline for up to a month at a time. Simon explained that it will be necessary to periodically drain the pipeline into Burra Creek – the pumps at Angle Crossing cannot run backwards, although some of the water could be drained backwards from Gibraltar Pass if there was a critical failure.CO2 dosing will only occur at Burra Creek.

2.2 Flow in Burra Creek will mimic natural flow as far as possible, by slowly increasing flow rates, i.e. 20 ML per day, although this is dependent on the need to exercise the pumps.

2.3 There were also a few questions about monitoring of noise, and whether the pump stations will be noisy, operate at night, and how much longer jack-hammering will occur at Burra Creek.

2.3 ACTEW to provide advice on how noise monitoring and noisy activities, including information on how noisy the pumps will be, and the time-frames for jack-hammering at Burra Creek.

3 Review to agree on the ERG Terms of Reference

3.1 The group discussed representation and whether all groups were represented in the Terms of Reference (ToR). Palerang Council, ACT Government and the Murrumbidgee Catchment Management Authority are not reflected in the ToR.

3.1 ACTEW to update ToR to reflect group composition.

3.2 The group discussed the membership of the ERG as being for a term of two years from the date of the inaugural meeting. Minutes need to reflect that this is the inaugural meeting. Membership of the ERG may change after the two years.

3.3 Conflicts of interest should be declared at the meetings.

3.4 Sitting fees need to be resolved, and will be resolved out of session. Payment will be to organisations, rather than individuals.

3.4 ACTEW will send out a proposed fee schedule in line with the ACT Remuneration Tribunal.

3.5 The OEMP – Operations Environment Management Plan needs to be spelled out in the T of R, as do any other acronyms.

3.6 The Terms of Reference are accepted subject to addition of partners not currently reflected being included.

3.6. ACTEW will make necessary edits and issue the ToR to the group.

4 Discussion to develop a draft annual work program

4.1 The group discussed the need to have a better understanding of the data ACTEW has available and associated timeframes to help in planning a schedule of works.

4.1 ACTEW to provide an indication of timing/release of relevant reports i.e. water monitoring.

4.2 ACTEW needs to provide reports to the ERG in a timely manner.

4.2 ACTEW to provide any relevant reports, such as the Landscape Rehabilitation Plan.

4.3 The group also discussed the need to be kept up to date on construction progress in order to plan the work program. It was acknowledged that regular field visits to the site will help keep the group up to date on progress, and it was suggested that every second meeting should be a field visit. The first site visit will be scheduled by the end of October, 2011. It was suggested that secondary members also be invited to attend, and there will be a short meeting after the site visit to discuss the program of works.

4.3 ACTEW to organise dates for site visit.

4.5 The group discussed the three priority areas for the group as being:

- Burra Creek
- Rehabilitation of the pipeline
- The offset site for the project.

4.5 ACTEW will provide a draft program of works that can be linked to the ERG work program before the next meeting.

The ERG will assist in reviewing data and advising on what works have been done/are being done as they relate to the priority areas.

5 Consideration of ERG performance indicators

5.1 Performance indicators for the group relate to how the group is fulfilling the terms of reference and will focus on the process of engagement. An effective process for the group would include:

5.1 ERG Chair to check in with the group in a few meetings time to ensure the group feels they are achieving their aims.

- Two way communications and professional courtesy should be exhibited by group members.
- Reading the relevant material provided.
- Offering advice and recommendations as per the T of R.
- Having the advice forwarded to ACTEW and receiving feedback about their consideration of the advice.
- Consideration of the need/potential for the development of working groups

6 Group administration

6.1 Members will be asked for input to develop the meeting agenda.

6.1 ACTEW to email group requesting agenda items prior to distribution of agenda.

6.2 The Chair would appreciate email feedback from group members on issues that impact the group or ideas that could improve effectiveness.

6.2 ERG Members to email ERG Chair with any issues/ideas to help the ERG.

6.3 It was agreed that an inspection of Burra Creek downstream of the discharge structure also would be beneficial. – It was suggested that it could be linked to next quarterly meeting to be held in December.

6.3 ACTEW to provide 3 dates for the site visit and see which one suits the group best.

7. Meeting was adjourned at 1300 hrs.

6.4 ACTEW to invite group to the next quarterly meeting in early December and include Burra Creek site visit.