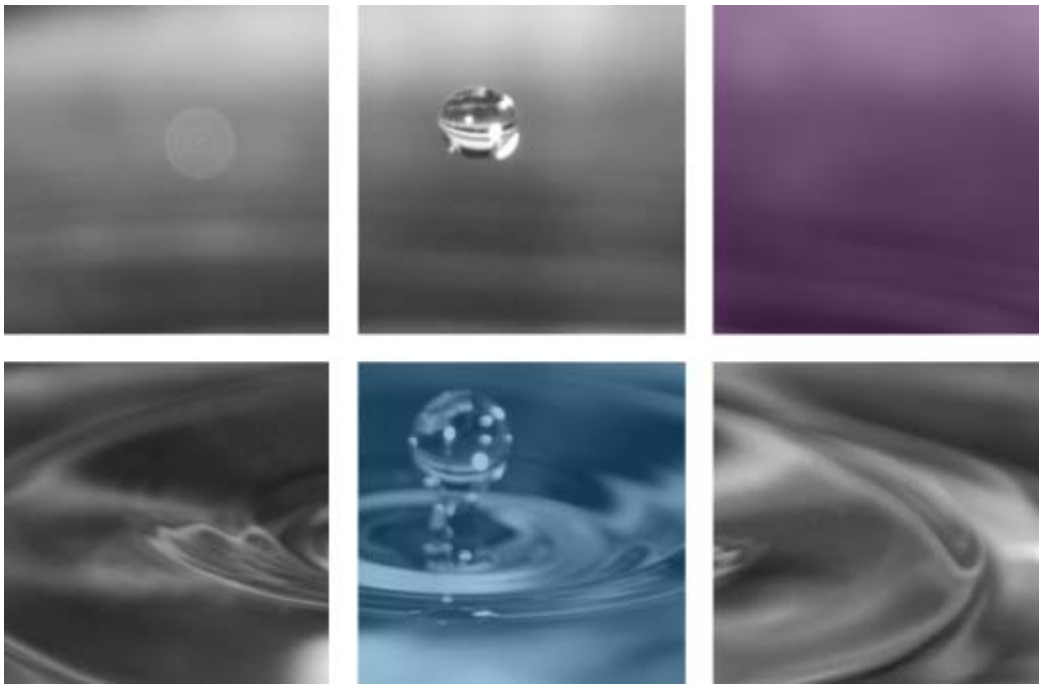
SUGARLOAF PIPELINE PROJECT

AQUATIC ECOLOGY – FISH SURVEY REPORT



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Contents

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Abbreviations

AUSRIVAS	Australian River Assessment System
CMA	Catchment Management Authority
DSE	Department of Sustainability and Environment
EES	Environment Effects Statement
EMP	Environment Management Plan
EPA	Environment Protection Authority
EPBC	Environment Protection and Biodiversity Conservation Act 1999
FFG	*Flora and Fauna Guarantee 1988*
GHD	Gutheridge Haskins and Davey Pty Ltd
ISC	Index of Stream Condition
MW	Melbourne Water
RBA	Rapid BioAssessment
SEPP	State Environmental Protection Policy
SEPP (WoV)	State Environment Protection Policy: Waters of Victoria
SIGNAL	Stream Invertebrate Grade Number Average Level
SKM	Sinclair Knight Mertz Pty Ltd

Limitations

The Aquatic Ecology assessment,

- Is for the use of the Sugarloaf Pipeline Alliance for the purpose of identifying the potential for impacts on aquatic ecology due to construction and maintenance of the Sugarloaf Pipeline Project.
- Must not be used:

  1) by anyone other than the Sugarloaf Pipeline Alliance; or

  2) for any purpose that for which it is specifically intended.
- Must not be copied without the prior written permission of the Sugarloaf Pipeline Alliance.

The Sugarloaf Pipeline Alliance has prepared this report on the basis of information provided by the sources cited in this document and Additional field investigations conducted by the Sugarloaf Pipeline Alliance.

1. Introduction

1.1 The Sugarloaf Pipeline Project

The Sugarloaf Pipeline Project aims to deliver Additional water supply to Melbourne. The Project is a key component of the Victorian Government's *Our Water, Our Future The Next Stage of the Government's Water Plan* (DSE, 2007), which aims to secure Victoria's water supplies in the face of drought, climate change and a growing population.

The pipeline will transfer a maximum of 75 GL/year of water from the Goulburn River into the Melbourne Water distribution network via Sugarloaf Reservoir in the Yarra Ranges. Water for the Sugarloaf Pipeline will be sourced from savings achieved through the Food Bowl Modernisation Project, which involves modernisation of irrigation infrastructure in the Goulburn-Murray Irrigation District.

The project involves the construction and operation of a water pipeline, approximately 70 km long, pump stations, a balancing storage and associated electrical infrastructure to deliver water to Sugarloaf Reservoir. The planning, design and construction phases of the Sugarloaf Pipeline Project will be undertaken by the Sugarloaf Pipeline Alliance, an alliance comprised of Melbourne Water Corporation, GHD Pty Ltd, SKM Pty Ltd, and John Holland Group.

1.2 Purpose and Scope of the Study

This report addresses the aquatic ecology monitoring components of the project, specifically, wetlands, instream habitat, water quality and fish within the waterways that could potentially be impacted by the construction of the Sugarloaf Pipeline.

The monitoring program is designed to meet obligations under:

- Appendix A, Table 1 of Minister for Planning's written advice, which requires reporting of compliance with an approved species specific mitigation plans for threatened fauna.
- Condition 4 of the Environmental Protection and Biodiversity Conservation (EPBC) Approval conditions, which states.

  "To protect the EPBC listed aquatic fauna species that are known to occur or could potentially occur in the action area, in particular the Macquarie Perch (*Macquaria australasica*), Trout Cod (*Maccullochella macquariensis*) and Murray Cod (*Maccullochella peelii*), the person taking the action must implement the Mitigation Plan for EPBC Act and FFG Act Listed Aquatic Fauna Species July 2008."
- Attachment 9, mitigation plan for EPBC Act and FFG Act listed aquatic species (SPA 2008), which outlines a monitoring program (this report) to meet the requirements of the above obligations.

1.3 Study Area

Yea River and tributaries

The Yea River flows from its headwaters in the hills near Toolangi in Central Victoria, to the Goulburn River, near the town of Yea. The major tributary is the Murrindindi River, which flows into the Yea River, upstream of Langs Road, South of Yea. The catchment is steep and forested in the

headwater reaches, confined in the middle reaches, and extensively cleared for agriculture in the lower reaches.

In the upper reaches, the Yea River and tributaries such as Kalatha and Katy Creeks, flow through forested hills with native vegetation and includes the North Eastern section of Kinglake National Park and Toolangi State Forest. The main land use in the lower reaches is grazing, primarily sheep and cattle. Rural development of the mid to lower reaches of the catchment has resulted in degraded water quality compared to the upper forested reaches. The Yea River and its tributaries are within the Goulburn Catchment and fall within the legislation of the State Environment Protection Policy (Waters of Victoria) (SEPP (WoV)) (SEPP, 2003) as Cleared Hills and Coastal Plains.

2. Yea River Methods

A detailed fish survey, water quality data assessment, and in stream habitat assessment were undertaken in the Yea River as part of the field investigations for this project. Sites were selected based on the final pipeline route and were determined based on the crossing of the pipeline with the waterways.

2.1 Methods

2.1.1 Fish Sampling Procedures

All surveys were undertaken under Victorian Fisheries Permit RP11732. All fish species were identified, counted, measured and weighed in the field and returned to the water at the point of release. No noxious fish species were returned to the water. Noxious fish species were euthanized using AQUI-S solution as per requirements set under the Victorian Fisheries Permit.

The following methods were employed to ensure a rigorous and accurate assessment of community assemblages.

2.1.1.1 Passive Sampling Techniques

Fyke Nets and Bait Traps

Single wing fyke nets, dual wing fyke nets and bait traps were deployed as a method of passive sampling for this project. All nets were set to ensure a diversity of structural habitat available to fish was sampled in each waterway (open water, amongst or against vegetation and woody material). The variety of these passive sampling methodologies was designed to increase the probability of sampling a wider range of species and size classes. A description of each of the net/trap types employed is provided below:

- Single wing fyke (large mesh) nets have a central wing (8m x 1.2m) attached to the first supporting hoop (diameter = 0.65m) with a stretched mesh size of 20 mm.
- Single wing fyke (small mesh) nets have a central wing (8m x 1.2m) attached to the first supporting hoop (diameter = 0.65m) with a stretched mesh size of 5 mm.
- Dual wing fyke nets have 2 wings (each 2.5m x 1.2m) attached to the first supporting (diameter = 0.64m) with a stretched mesh size of 20mm.
- Bait traps that have a funnelled opening at each end (0.22m x 0.22m x 0.4m, with 2mm stretched mesh) and are set baited in the littoral zone close to emergent vegetation, submerged macrophytes and woody debris.

The fyke nets were set with the cod-end on one bank with the wing attached to the opposite bank. Nets were set in series so that they funnelled fish moving both upstream and downstream.

The cod-end of each fyke was always suspended out of the water to avoid the mortality of captured air breathing vertebrates.

2.1.1.2 Active Sampling Techniques

Backpack Electrofishing

All electrofishing activities were undertaken using a NIWA Electric Fishing Machine (EFM300).

Backpack electrofishing enables a two-person crew to operate in shallow, wadable pools and riffles (to a maximum depth of operator hip height). Electricity is provided from batteries and is transferred into the water, as a pulsed DC waveform, via a back-pack unit which is carried by the operator, with portable electrodes. Immobilised fish are dip-netted from the water by an assistant, and placed in a bucket of water for recovery.

The purpose of electrofishing is to apply a suitable electrical field to a given body of freshwater in order to attract and induce a temporary state of narcosis in fish within the immediate area. This enables aquatic ecologist's to carry out tasks such as detailed population studies, live capture and tagging. The most effective output for fish capture is within a voltage range adjustable from 100V to 600V DC.

All electrofishing was undertaken at an electrical frequency of 100 hertz and pulse width of 4 milliseconds. The voltage used while electrofishing ranged between 100V to 600V DC.

At each site, one electrofishing transect was conducted. Each transect was standardised to 850 seconds. All electrofishing was halted within 50m of any animals standing in, or about to enter the water. While undertaking electrofishing, all care was taken to avoid shocking non-target species including platypus, birds, snakes and other aquatic animals. All stunned specimens were immediately dip netted and transferred to a holding tank for recovery.

All noxious species were euthanized with AQUI-S Aquatic aesthetic. AQUI-S is a commercially based aquatic aesthetic originally developed by the New Zealand Institute for Crop & Food Research for the aquaculture market. The active constituent of AQUI-S is 540g/L Isoeugenol (2-Methoxy-4 – propenylphenol) and is a colourless liquid that needs to be diluted into water at a ratio of 1:10.

The sites surveyed are presented below in a table encompassing the entire list of sites visited and the years that they were surveyed Table 2-1. The 2007-08 survey met the requirements for pre-construction survey, the 2008-09 survey met the requirements for survey during construction and the 2009-10 and 2010-11 surveys met the requirements for two years of post construction survey as specified in the approved threatened species monitoring and mitigation plan (SPA 2008).

- **Table 2-1 Summary of fish survey sites**

Site Name	GPS	Date Surveyed			
		2007-08	2008-09	2009-10	2010-11
		Pre-construction	During construction	Post-construction yr 1	Post-construction yr 2
Yea River Crossing at Yea					
Yea River – U/S Yea Crossing at Yea	E 55361043; N 5880035	-	X	X	*
Yea River- Downstream of Yea crossing at Yea	E 55361124; N 5879988	-	X	X	*
Yea Wetlands	E 55360559; N 5880788	X	X	X	X
Yea River- Webster Road	E 55359472; N 5880494	-	X	X	*
Devlins Bridge Crossing					
Yea River – U/S Devlins Bridge	E 55364841; N 5861554	X	X	X	*
Yea River – D/S Devlins Bridge	E 55364961; N 5861598	-	-	X	*
Yea River – Property 59 Glendaloch	E 55364797; N 5866996	-	X	X	*
Yea River – Murrindindi Road	E 55361066; N 5847065	-	X	X	*
Castella Road Crossing					
Yea River – U/S Castella Road	E 55361066; N 5847065	X	X	X	X
Yea River – Opposite Northern Portal	E 55360205; N 5851207	-	X	X	X
Yea River- U/S Gordon's Road Bridge	E 55359707; N 5848832	-	X	X	X
Yea River- Kinglake/ Glenburn Road	E 55360327; N 5852723	-	X	X	X
Additional Sites					
Yea River – Property 34	E 55397250; N 4159360	-	X	-	-
Kalatha Creek	E 55363464; N 5859299	X	X	X	X
Katy's Creek	E 550362482; N 5858339	-	-	X	X

** Water levels too high for sampling* *X= Sampled* *- = Access Issues*

2.2 Macroinvertebrates

Macroinvertebrate sampling was completed from 2007-08 through to 2009-10. Macroinvertebrate sampling was not possible during the 2010-11 survey because series of high flow events restricted access during the designated survey period of spring and/or autumn.

2.2.1 Inconsistent Sampling Regime

Since 2007 a number of catchment scale events have interrupted the sampling regime for this project and are likely to have influenced the data.

In 2009-2010 bushfires completely destroyed the upper Yea River catchment, resulting in a large amount of ash being deposited into the River and its tributaries.

In 2010-2011 an unusually wet summer significantly impacted on the sampling effort. Attempts were made to conduct surveys in November 2011, January and February 2011 however due to the high river flows the sampling was postponed. Sampling was finally completed in June 2011 in spite of the high flows and poor sampling conditions where possible. Due to the conditions some sites were not surveyed and at many sites the deployment of fyke nets and bait traps was not possible.

3. Yea River Results

The results for surveys in the Yea River are presented below in the form of tables which encompass all the results collected for each site throughout the pre and post pipeline construction monitoring period.

3.1 Yea River Crossing at Yea

3.1.1 Summary

Water quality trends appear to be consistent across sampling periods for sites above and below the Yea River pipeline crossing. EC, turbidity and temperature increased in 2009-10 at the sites immediately upstream and downstream of the crossing in the first year post construction (2009-10) but then were shown to decrease in the 2010-11 sampling period, two years port construction, to levels consistent with that pre construction.

There was no marked difference in fish population results between upstream and downstream sites. Mountain Galaxias were only found at Yea Wetlands and Webster's Road. Southern Pygmy perch were only found upstream of the crossing and Murray Jollytails were found both upstream and downstream. Brown Trout and Mosquito Fish were found at most sites. A Platypus was recorded in the Yea Wetlands in 2009-10 and Murray Spiny Crayfish were observed at the same site across all sampling periods. Macroinvertebrate sampling was only undertaken at the Yea Wetlands. The number of both individuals and taxa decreased across sampling periods for edge habitat however SIGNAL scores indicated that the habitat was in good condition.

3.1.2 Yea River – upstream Yea Crossing at Yea

Fish and water quality sampling were undertaken at this site for the 2008-09 and 2009-10 sampling periods. EC, turbidity and temperature increased during 2009-10, however this was likely related to the time of sampling (i.e. late spring). Three introduced species of fish were recorded post construction and Southern Pygmy Perch was recorded pre construction. Murray Jollytail was recorded during both sampling periods (Table 3-1).

- **Table 3-1 Aquatic ecology sampling results for Yea River – upstream Yea Crossing at Yea**

Parameter	**Site Name: Yea River upstream of GVW pump site GPS** E 55361043; N 5880035			
Year	**2007-08 Pre-construction**	**2008- 09 During construction**	**2009-10 Post construction yr 1**	**2010-11 Post construction yr 2**
Date of sample collection		13/5/09	3/11/09	21/6/11
Electrofishing Time		8 x 150	8 x 150	NA
No Fyke Nets		4	4	NA
No Bait Traps		10	10	NA
Water Quality				
DO (mg/l)		8.47	7.09	9.36
pH		6.85	6.32	7.68
EC (µs/cm)		67	180	79.2
Turbidity (NTU)		12	41	20.7
Temperature (˚C)		12.5	19.6	10.3
Fish Species and Number				
Southern Pygmy Perch (*Nannoperca australis)*		1		
Brown Trout (*Salmo trutta)*			1	
Mosquito Fish *(Gambusia holbrooki)*			1	
Murray Jollytail (*Galaxias rostratus*)		1	1	
Redfin Perch *(Perca fluviatilis)*			1	

3.1.3 Yea River- Downstream of Yea Crossing at Yea

Fish and water quality sampling were undertaken at this site for the 2008-09 and 2009-10 sampling periods. EC increased during 2009-10 and pH slightly decreased, while in 2010 -2011 the EC decreased. The salinity fluctuations were likely due to the timing of the 2009-10 sampling event (i.e. late spring) and the 2011 period where flows were high. All other water quality parameters remained

consistent across sampling events. Three introduced fish species were recorded at this site in low numbers (Table 3-2).

- **Table 3-2 Aquatic ecology sampling results for Yea River – downstream of Yea Crossing at Yea**

Parameter	**Site Name: Downstream of Yea Crossing at Yea GPS** E 55361124; N 5879988			
Year	**2007-08 Pre-construction**	**2008- 09 During construction**	**2009-10 Post construction yr 1**	**2010-11 Post construction yr 2**
Date of sample collection		20/7/09	4/11/09	21/6/11
Electrofishing Time		8 x 150	8 x 150	NA
No Fyke Nets		4	4	NA
No Bait Traps		10	10	NA
Water Quality				
DO (mg/l)		7.9	7.09	9.36
pH		7.09	6.37	7.68
EC (µs/cm)		114.2	180	79.2
Turbidity (NTU)		45.7	41	20.7
Temperature (˚C)		16.6	19.6	10.3
Fish Species and Number				
Brown Trout (*Salmo trutta)*		1		
Mosquitofish (*Gambusia Holbrooki)*		1		
Carp *(Cyprinus carpio)*			1	

3.1.4 Yea River-Yea Wetlands

Sampling was undertaken during all four sampling periods at this site. Water quality and fish sampling were undertaken on each occasion with macroinvertebrate sampling occurring on three occasions. Water quality parameters slightly increased during construction in the 2008-09 sampling period but most decreased again in 2009-10 and 2010-11 (except temperature). Presence and number

of introduced fish species remained consistent between pre and post sampling periods. Murray Jollytail was recorded post construction and Mountain Galaxias was recorded pre construction, both in low numbers. Murray Spiny Crayfish were observed at the site during all sampling periods and Platypus was recorded at the site in 2009-10. Both the number of individuals and taxa decreased across subsequent sampling periods for edge habitat. EPA SIGNAL scores remained steady (5-6) and indicate very good habitat quality (Table 3-3).

- **Table 3-3 Aquatic ecology sampling results for Yea River – Yea Wetlands**

Parameter		**Site Name: Yea Wetlands** **GPS** E 55360559; N 5880788			
Year		**2007-08 Pre-construction**	**2008- 09 During construction**	**2009-10 Post construction yr 1**	**2010-11* Post construction yr 2**
Date of sample collection		08/11/08	13/5/09	4/11/09	16/6/11
Electrofishing Time		8 x 150	8 x 150	8x150	8x150
No Fyke Nets		4	4	4	0
No Bait Traps		10	10	10	10
Water Quality					
DO (mg/l)		6.8	8.6	6.05	9.92
pH		6.38	7.44	6.39	6.93
EC (µs/cm)		77	119.0	92.9	60.9
Turbidity (NTU)		38	46.9	28.5	15
Temperature (˚C)		17.6	16	20.4	7.3
Fish Species and Number					
Redfin Perch *(Perca fluviatilis)*		1	1	1	
Brown Trout (*Salmo trutta)*		7	5		
Mosquito fish *(Gambusia holbrooki)*			1		24
Common Goldfish (*Carassius auratus*)					3
Murray Jollytail (*Galaxias rostratus*)			1		
Mountain Galaxias *(Galaxias olidus)*		2			1
Southern Pygmy Perch (*Nannoperca australis*)					2
Additional species					
Platypus				1	
Murray Spiny Crayfish		observed	observed	observed	
Macroinvertebrates					
Number of individuals	**edge**	220	117	57	
	riffle	547			
Number of families	**edge**	30	29	19	
	riffle	29			
EPA SIGNAL	**edge**	5.71	5.68	5.89	
	riffle	6.02			

*sampling was conducted in 2011 in the wetlands as well as the Yea River due to the lack of suitable wadable habitat in main channel.

3.1.5 Yea River-Webster's Road

Three surveys were undertaken at this site and included water quality and fish sampling. Turbidity was elevated in the first year post construction (2009-10), but decreased to acceptable leves in the second year post construction. Most other water quality parameter remained consistent between sampling periods. Mountain Galaxias were recorded at this site during and in the first year post construction (Table 3-4).

- **Table 3-4 Aquatic ecology sampling results for Yea River – Webster's Road**

Parameter	**Site Name: Yea River - Webster's road GPS** E 359472; N 5880494			
Year	**2007-08 Pre-construction**	**2008- 09 During construction**	**2009-10 Post construction yr 1**	**2010-11 Post construction yr 2**
Date of sample collection		13/5/09	3/11/09	16/5/11
Electrofishing Time		4 x150	NA	NA
No Fyke Nets		4	4	NA
No Bait Traps		10	10	NA
Water Quality				
DO (mg/l)		9.6	7.69	10.08
pH		6.82	6.63	6.62
EC (µs/cm)		118.6	100.4	64.9
Turbidity (NTU)		9.8	74.2	12.5
Temperature (˚C)		16	21.6	7.2
Fish Species and Number				
Mountain Galaxias *(Galaxias olidus)*		2	1	

3.2 Devlins Bridge Crossing

3.2.1 Summary

Water quality parameters at all sites show consistent data results. Turbidity slightly increased at all sites in the latter sampling periods most likely due to time of assessment (late spring as opposed to mid-winter). Brown Trout and Two-spined Blackfish were recorded both above and below the Devlins Bridge crossing. Mountain Galaxias was only recorded above the crossing and the threatened Macquarie Perch only below (in the 2009-10 sampling period). Platypus were recorded upstream of the crossing both pre and post construction. Murray Spiny Crayfish were recorded at this site in the 2007-08 sampling period, and Eastern Long Neck Turtles were recorded only at Yea River – Murrindindi Road for the same period.

Macroinvertebrates were recorded upstream of Devlins Bridge and downstream at Yea River – Murrindindi Road. The number of individuals and taxa richness showed similar trends across the sampling periods at both sites and were consistent between sites. SIGNAL scores downstream were actually slightly higher overall.

3.2.2 Yea River- Upstream of Devlins Bridge

This site was sampled during all four sampling periods and included water quality, fish and macroinvertebrate sampling. DO slightly increased across sampling periods, whilst turbidity increased, peaking during the construction period (2008-09) –although note that this site is upstream of the construction impact so the increase is likely due to other factors. Turbidity decreased in the two post construction sampling periods. Three fish species were recorded pre-construction during 2007-08 but were not recorded in post construction sampling. Platypus were recorded at this site pre and post construction, however Murray Spiny Crayfish were recorded in large numbers (> 100) pre construction but were not recorded post construction – note again that this site is above the construction zone, so the absence of fish is likely due to factors other than construction, including sampling variation. Platypus were recorded pre and during the construction period.

For macroinvertebrates, the number of individuals and taxa slightly increased post construction, as well as overall EPA SIGNAL scores (Table 3-5). SIGNAL scores indicate good quality habitat.

- **Table 3-5 Aquatic ecology sampling results for Yea River – upstream of Devlins Bridge**

Parameter		**Site Name: Yea River at Devlins Bridge GPS** E 55364841; N 5861554			
Year		**2007-08 Pre-construction**	**2008- 09 During construction**	**2009-10 Post construction yr 1**	**2010-11 Post construction yr 2**
Date of sample collection		09/11/2008	15/10/09	6/11/09	16/6/11
Electrofishing Time		8 x 150	8 x 150	NA	NA
No Fyke Nets		4	4	4	NA
No Bait Traps		10	10	10	NA
Water Quality					
DO (mg/l)		8.7	8.6	10	9.28
pH		7.05	6.46	7.0	7.03
EC (µs/cm)		106	92	82.0	55.3
Turbidity (NTU)		6	33	16.9	13
Temperature (˚C)		16.1	17.3	12.9	7
Fish Species and Number					
Brown Trout (*Salmo trutta)*		6			
Two-spined Blackfish (*Gadopsis bispinosus)*		5			
Mountain Galaxias (*Galaxias olidus*)		1			
Additional Species					
Platypus		1	1		
Murray Spiny crayfish		>100			
Macroinvertebrates					
Number of individuals	**edge**	116	125	134	
	riffle	181			
Number of families	**edge**	12	21	14	
	riffle	18			
EPA SIGNAL	**edge**	5.2	5.88	6.55	
	riffle	5.6			

3.2.3 Yea River- Downstream of Devlins Bridge

The Yea River site downstream of Devlins Bridge is also downstream of the construction zone for the pipe bridge crossing. There was a slight increase in turbidity during and post construction, but this increase was also observed upstream of the construction zone, so the construction impact cannot be exclusively attributed to the change in turbidity.

Brown Trout, Two-spined Blackfish and Mountain Galaxias were all recorded prior to construction but not during or after. However, these species were also not recorded at the monitoring site upstream of the construction zone, so as with water quality, construction impacts cannot be exclusively attributed to the absence of these species.

- **Table 3-6 Aquatic ecology sampling results for Yea River – downstream of Devlins Bridge**

Parameter	**Site Name: Yea River at Devlins Bridge GPS** E 55364841; N 5861554			
Year	**2007-08 Pre-construction**	**2008- 09 During construction**	**2009-10 Post construction yr 1**	**2010-11 Post construction yr 2**
Date of sample collection		15/10/09	6/11/09	16/6/11
Electrofishing Time	8 x 150	8 x 150	NA	NA
No Fyke Nets	4	4	4	NA
No Bait Traps	10	10	10	NA
Water Quality				
DO (mg/l)	8.7	8.6	10	9.28
pH	7.05	6.46	7.0	7.03
EC (µs/cm)	106	92	82.0	55.3
Turbidity (NTU)	6	33	16.9	13
Temperature (˚C)	16.1	17.3	12.9	7
Fish Species and Number				
Brown Trout (*Salmo trutta)*	6			
Two-spined Blackfish (*Gadopsis bispinosus)*	5			
Mountain Galaxias (*Galaxias olidus*)	1			
Additional Species				
Platypus	1	1	0	
Murray Spiny crayfish	>100	>100		

Macroinvertebrates					
Number of individuals	**edge**	116	125	134	
	riffle	181			
Number of families	**edge**	12	21	14	
	riffle	18			
EPA SIGNAL	**edge**	5.2	5.88	6.55	
	riffle	5.6			

3.2.4 Yea River- Property 59 Glendaloch (downstream Devlins Bridge)

Sampling at this site was undertaken in 2008-09, 2009-10 and 2010-11. Fish sampling was undertaken during all sampling periods however water quality sampling was only undertaken in 2009-10 and 2010-11. Water quality appears good from the 2009-10 sampling event, however turbdity was highly elevated during the 2010-11 sample. This is likely a reult of sampling error or a very localised impact because upstream sites did not exhibit such high turbidity during the same period. Goldfish were recorded in 2008-09 and one Macquarie Perch was recorded in 2009-10, post-construction (Table 3-7, Figure 1). This species is listed as Endangered in Victoria under the *Flora and Fauna Guarantee Act 1988* and Endangered under the Commonwealth *Environment Conservation and Biodiveristy Protection Act 1999.*

- **Figure 1 Macquarie Perch sampled using fyke nets**

- **Table 3-7 Aquatic ecology sampling results for Yea River - Property 59**

Parameter	**Site Name: Property 59** **GPS** E 55364797; N 5866996			
Year	**2007-08 Pre-construction**	**2008- 09 During construction**	**2009-10 Post construction yr 1**	**2010-11 Post construction yr 2**
Date of sample collection		15/10/08	4/11/09	21/6/11
Electrofishing Time		6 x 150	8 x 150	NA
No Fyke Nets		4	4	NA
No Bait Traps		10	10	NA
Water Quality				
DO (mg/l)			9.54	10.3
pH			6.65	7.47
EC (µs/cm)			89.2	97.8
Turbidity (NTU)			19	222
Temperature (˚C)			15.7	9.9
Fish Species and Number				
Brown Trout (*Salmo trutta)*				
Two-spined Blackfish (*Gadopsis bispinosus)*				
Goldfish *(Carassius auratus)*		3		
Macquarie Perch *(Macquaria australasica)*			1	
Additional Species				
Platypus				
Murray Spiny crayfish				

3.2.5 Yea River – Murrindindi Road

This site was sampled during all four sampling periods, however macroinvertebrates were not sampled for 2009-10 or 2010-11 due to high flows which restricted access to suitable habitat. DO, EC and Turbidity slightly increased post construction. Turbidity returned to pre construction levels during the second year post construction.

Four species of fish were recorded at this site over the sampling periods however Brown Trout was the only species recorded on more than one occasion. Eastern Long Neck Turtle was only recorded in 2007-08. Macroinvertebrate results for edge habitat are consistent for periods 2007-08 and 2008-09 and indicate good habitat with an EPA SIGNAL score of 6-7 and taxa richness of 17-24 (Table 3-8).

- **Table 3-8 Aquatic ecology sampling results for Yea River – Murrindindi Road**

Parameter	**Site Name: Yea River – Murrindindi Road GPS** E 55279368; N 5761058			
Year	**2007-08 Pre-construction**	**2008- 09 During construction**	**2009-10 Post construction yr 1**	**2010-11 Post construction yr 2**
Date of sample collection	11/07	20/11/08	5/11/09	16/6/11
Electrofishing Time (sec)	8x 150	8 x150	8x150	NA
No Fyke Nets	4	4	4	NA
No Bait Traps	10	10	NA	NA
Water Quality				
DO (mg/l)	7.6	8.57	9.05	9.28
pH	6.97	6.12	6.52	7.03
EC (µs/cm)	63	55	74.6	55.3
Turbidity (NTU)	9		24	13
Temperature ˚C	16.6	17.9	14.8	7
Fish Species and Number				
Brown Trout (*Salmo trutta)*	1		1	
Two-spined Blackfish (*Gadopsis bispinosus)*	2			
Redfin Perch(*Perca fluviatilis)*		1		

Goldfish *(Carassius auratus)*				1	
Additional Species					
Eastern Long Neck Turtle		5			
Macroinvertebrates					
Number of individuals	**Edge**	123	134		
	Riffle	47			
Number of families	**Edge**	17	24		
	Riffle	20			
EPA SIGNAL	**Edge**	6.6	6.30		
	Riffle	6.7			

3.3 Castella Road Crossing

3.3.1 Summary

Water quality parameter results were relatively consistent across all sites and across sampling periods. Brown Trout and Two-spined Blackfish were recorded at locations above and below the crossing during pre and post construction monitoring. Murray Spiny Crayfish were only found downstream at Yea River – upstream of Gordon's Bridge. Macroinvertebrate sampling was only conducted at the upstream site and indicated good habitat condition. Overall, the 2009-10 survey in the first year post construction returned the lowest density of fish of the three survey locations and is likely a reflection of recent bushfire that impacted the area in early 2009, rather than specific pipeline impacts.

3.3.2 Yea River Upstream Castella Road

This site is located upstream of the Yea River construction. Sampling was undertaken for all four sampling periods, however water quality data was not obtained for the 2009-10 period. Water quality parameters remained consistent pre and pst construction. Brown Trout and Two-spined Blackfish were recorded at this site in consistent numbers across sampling events (Brown Trout were not recorded during 2009-10). Number of individuals and families increased for edge habitat during the 2008-09 sampling event, however EPA SIGNAL scores remained constant at 6-7 (Table 3-9). This indicates good habitat quality.

Table 3-9 Aquatic ecology sampling results for Yea River – upstream Castella Road

Parameter		**Site Name: Castella Road GPS** E 55361066; N 5847065			
Year		**2007-08 Pre-construction**	**2008- 09 During construction**	**2009-10 Post construction yr 1**	**2010-11 Post construction yr 2**
Date of sample collection		11/07	20/11/08	2/11/09	15/6/11
Electrofishing Time		8 x 150	8 x 150	8x150	8x150
No Fyke Nets		No Fyke nets set – unsuitable habitat			
No Bait Traps		10	10	10	NA
Water Quality					
DO (mg/l)		9.3	9.67		8.9
pH		7.06	6.05		7.03
EC (µs/cm)		50	58		41.2
Turbidity (NTU)		13	7		10
Temperature (˚C)		12.3	16.4		8.9
Fish Species and Number					
Brown Trout (*Salmo trutta)*		5	3		5
Two-spined Blackfish (*Gadopsis bispinosus)*		9	5	3	7
Macroinvertebrates					
Number of individuals	**Edge**	34	88	20	
	Riffle	78			
Number of families	**Edge**	9	19	8	
	Riffle	10			
EPA SIGNAL	**Edge**	6.2	6.81	6.88	
	Riffle	6.7			

3.3.3 Yea River- Opposite Northern Portal

Three sampling events were undertaken at this site for fish and water quality; once during construction and twice post-construction. Water quality parameters were consistent across all sampling periods and indicate good water quality. Brown Trout were recorded during and in the first year post construction. Two-spined Blackfish were recorded in all sampling events and Redfin Perch recorded in the second year post construction (Table 3-10).

- **Table 3-10 Aquatic ecology sampling results for Yea River – opposite Northern Portal**

Parameter	**Site Name: Yea River Opposite Northern Portal GPS** E 55360205; N 5851207			
Year	**2007-08 Pre-construction**	**2008- 09 During construction**	**2009-10 Post construction yr 1**	**2010-11 Post construction yr 2**
Date of sample collection		20/7/09	2/11/09	21/1/11
Electrofishing Time (sec)		8 x150	8x150	8x150
No Fyke Nets		4	4	NA
No Bait Traps		10	10	NA
Water Quality				
DO (mg/l)		11.5	10.05	9.72
pH		6.94	6.62	6.62
EC (µs/cm)		70.8	52.9	40.3
Turbidity (NTU)		19	12.8	21.9
Temperature (˚C)			13.1	15.2
Fish Species and Number				
Brown Trout *(Salmo trutta)*		7	2	
Two-spined Blackfish *(Gadopsis bispinosus)*		19	5	4
Redfin Perch *(Perca fluviatilis)*				3

3.3.4 Yea River- Upstream of Gordon's Road Bridge

Three sampling events were undertaken at this site for fish and water quality. Turbidity was slightly lower during the two post construction sampling events compared with the during construction observations; other water quality parameters remained consistent. Brown Trout were recorded during construction and in the first year after construction. Two-spined Blackfish were recorded on all sampling occasions. Redfin Perch and Murray Spiny Crayfish were recorded in the 2009-10 sampling event, in the first year after construction (Table 3-11).

- **Table 3-11 Aquatic ecology sampling results for Yea River – upstream of Gordon's Road Bridge**

Parameter	**Site Name: Yea River Gordon's Road Bridge GPS** E 55360435; N 5848308			
Year	**2007-08 Pre-construction**	**2008- 09 During construction**	**2009-10 Post construction yr 1**	**2010-11 Post construction yr 2**
Date of sample collection		20/7/09	2/11/09	16/6/11
Electrofishing Time (sec)		8x150	8 x 150	8x150
No Fyke Nets		4	4	NA
No Bait Traps		8	8	NA
Water Quality				
DO (mg/l)		10.4	8.84	10.23
pH		8.02	6.08	7.03
EC (µs/cm)		65.2	65	41.2
Turbidity (NTU)		24	15	10
Temperature ˚C		15.8	14.1	8.9
Fish Species and Number				
Brown Trout (*Salmo trutta)*		10	1	
Two-spined Blackfish (*Gadopsis bispinosus)*		4	5	5
Redfin Perch *(Perca fluviatilis)*			1	
Additional Species				
Murray Spiny Crayfish			2	

3.3.5 Yea River- Kinglake/ Glenburn Road

Three sampling events were undertaken at this site (2008-09, 2009-10 and 2010-11) for fish and water quality. Turbidity was slightly raised during the 2009-10 sampling event however was still at fairly low levels (20 NTU) and had reduced to low levels in the second year post construction.

Brown t\Trout and Two-spined Blackfish were recorded during and post construction, although there did appear to be a large drop in blackfish numbers in the second year post construction. This site is located well away from direct construction impacts so the drop in numbers is most likely to be related to bushfire impacts or sampling variation. Redfin Perch were only recorded in the second year post construction. Murray Crayfish were recorded at this during and post construction (Table 3-12).

- **Table 3-12 Aquatic ecology sampling results for Yea River – Kinglake/ Glenburn Road (Westbridge Rd)**

Parameter	**Site Name: Yea River Kinglake/Glenburn road** **GPS** E 553603227; N 5852723			
Year	**2007-08 Pre-construction**	**2008- 09 During construction**	**2009-10 Post construction yr 1**	**2010-11 Post construction yr 2**
Date of sample collection		20/7/09	2/11/09	17/6/11
Electrofishing Time (sec)		8 x150	8x150	8x150
No Fyke Nets		4	4	NA
No Bait Traps		10	10	NA
Water Quality				
DO (mg/l)		10.68	NA	10.99
pH		7.5	6.4	6.74
EC (µs/cm)		59.7	71.3	52.2
Turbidity (NTU)		11	20	12.5
Temperature ˚C			15.3	9.3
Fish Species and Number				

Brown Trout *(Salmo trutta)*		3	3	
Two-spined Blackfish *(Gadopsis bispinosus)*		9	10	1
Redfin Perch *(Perca fluviatilis)*				1
Additional Species				
Murray Crayfish		1	2	

3.4 Additional Sites

3.4.1 Yea River-Property 34 (downstream Devlins Bridge)

This site was only sampled pre and during construction; access was not available post construction. The water quality and fish population data collected at this site were consistent with that captured from sites downstream of Devlins Bridge, presented in Section 3.2. Brown Trout and Two-spined Blackfish were recorded in both the 2007-08 and 2008-09 survey periods in similar numbers (Table 3-13).

- **Table 3-13 Aquatic ecology sampling results for Yea River Property 34**

Parameter	**Site Name: Property 34**		**GPS**
Year	**2007-08**	**2008-09**	
Date of sample collection		15/10/08	NA
Electrofishing Time	8 x 150	8 x 150	
No Fyke Nets	4	4	
No Bait Traps	10	10	
Water Quality			
DO (mg/l)		8.04	
pH		7.13	
EC (µs/cm)		68	
Turbidity (NTU)		34	
Temperature (˚C)		14.1	
Fish Species and Number			
Brown Trout (*Salmo trutta)*	6	4	
Two-spined Blackfish (*Gadopsis bispinosus)*	5	3	

3.4.2 Kalatha Creek

Aquatic ecology sampling was undertaken at this site for all four sampling periods. Water quality parameters remained consistent throughout the pre and post pipeline construction phases and turbidity was low (7 – 9 NTU).

Brown trout were recorded on all four sampling occasions. Two-spined Blackfish and Mountain Galaxias where also recorded pre and post construction, although not neccessarily on every sampling occassion. Murray Spiny Crayfish were observed pre, during and post construction.

Macroinvertebrate species richness and abundance remained consistent across sampling periods. The EPA SIGNAL score of 6-7 indicates good habitat and low pollution levels at this site (Table 3-14).

- **Table 3-14 Aquatic ecology sampling results for Kalatha Creek**

Parameter	**Site Name: Kalatha Creek** **GPS** E 55363464; N 5859299			
Year	**2007-08 Pre-construction**	**2008- 09 During construction**	**2009-10 Post construction yr 1**	**2010-11 Post construction yr 2**
Date of sample collection	11/07	20/11/08	2/11/09	16/6/11
Electrofishing Time (sec)	8x 150	8 x150	6 x150	4x150
No Fyke Nets	4	4	NA	NA
No Bait Traps	10	10	10	10
Water Quality				
DO (mg/l)	8.8	9.45	9.38	10.59
pH	7.06	6.28	6.14	6.88
EC (µs/cm)	40	38	56.2	38.4
Turbidity (NTU)	9	9	7.1	5.50
Temperature (˚C)	14	15.8	15.6	8.0
Fish Species and Number				
Brown Trout (*Salmo trutta)*	4	5	3	2
Two-spined Blackfish (*Gadopsis bispinosus)*	2	2		5
Mountain Galaxias *(Galaxias olidus)*	1			1
Additional Species				

Murray Spiny crayfish		5	observed	observed	
Macroinvertebrates					
Number of individuals	**Edge**	99	80	65	
	Riffle	70			
Number of families	**Edge**	13	19	14	
	Riffle	10			
EPA SIGNAL	**Edge**	6.3	6.52	6.69	
	Riffle	5.4			

3.4.3 Katy's Creek

Sampling was only undertaken post construction during 2009-2010 and 2010-2011 for water quality. Macroinvertebrates were surveyed in 2009-10 but not 2010-11 and fish were only sampled in 2010-11. Turbidity was slightly elevated in 2009-10 but had reduced to acceptable levels in 2010-11.

Brown Trout, Two-spined Blackfish and Mountain Galaxias were all recorded in the 2010-11 survey.

Macroinvertebrate species richness and EPA SIGNAL score indicate poor habitat and a disturbed environment (Table 3-15).

- **Table 3-15 Aquatic ecology sampling results for Katy's Creek**

Parameter	**Site Name: Katy Creek** **GPS** 55 0362482; 5858339			
Year	**2007-08 Pre-construction**	**2008- 09 During construction**	**2009-10 Post construction yr 1**	**2010-11 Post construction yr 2**
Date of sample collection			2/11/09	16/6/11
Electrofishing Time (sec)			6x150	4x150
No Fyke Nets			NA	NA
No Bait Traps			NA	5
Water Quality				
DO (mg/l)			8.4	10.5
pH			6.07	6.98
EC (µs/cm)			100.2	46.6

Turbidity (NTU)				32	5.4
Temperature (˚C)				16.6	9.1
Fish Species and Number					
Red fin *(Perca fluviatilis)*					1
Two-spined Blackfish (*Gadopsis bispinosus)*					9
Mountain Galaxias *(Galaxias olidus)*					1
Macroinvertebrates					
Number of individuals	**Edge**			17	
	Riffle				
Number of families	**Edge**			7	
	Riffle				
EPA SIGNAL	**Edge**			5.7	
	Riffle				

4. Goulburn River

The Goulburn River is the offtake point for the pipeline. Adult and larval sampling was undertaken downstream, upstream and adjacent to the offtake location.

4.1 Method

Boat mounted electrofishing was conducted by employing single pass shots in within the Goulburn River channel habitats using a Smith-Root 7.5 GPP boat mount electrofisher running at 500-1000 Volts with a pulse frequency of 40 Hz at 120 pulses per second.

At each site, boat electrofishing was conducted in one 10 minute shot, followed by another 10 minute 'shot'.

4.1.1 Adult fish sampling

Electrofishing transects were conducted at three sites on the Goulburn River, one at the offtake site, one downstream of the offtake site and on one upstream of the offtake site.

4.1.2 Larval Sampling Design Rationale

The design and methods for the targeted study to assess the spawning of native fish in relation to the extraction for the pipeline were developed by the alliance in consultation with DSE. This component was added to the program to examine the relationship between the predicated pumping volumes and the density/composition of larval drift within the Goulburn River. In particular, increased baseflows and high flow freshes during spring/summer have been identified as a key flow event to stimulate spawning of migratory fish species, particularly Murray Cod (*Maccullochella peelii peelii*), Trout Cod (*Maccullochella macquariensis*) and Macquarie Perch (*Macquaria australasica*).

There are several morphological stages associated with larval development, a Murray-Darling Freshwater Research Centre publication (Serafini *et al.* 2004) was used in this study for larval stage identification and nomenclature purposes. The publication includes the following larval life stages:

- **Yolk-sac larva** – Free-swimming larva showing yolk material as a ventral sac, including oil globules.
- **Protolarva** – Absence of median fin rays or spines (dorsal, al, and caudal); prominent fin fold present on dorsal and ventral surface; top of notochord predominately straight. Body length measured to end of notochord
- **Flexion larva** – Appearance of distinct, but incomplete, complement of principle median fin rays; tip of the notochord flexes upward; fin fold is still predominate. Body length measured to end of notochord.
- **Postflexion larva** – Adult complement of principle median fin rays; fin fold greatly reduced; notochord flexion complete with hypural plates evident within caudal fin. Body length measured to end of hypural plates.

- **Metalarva** – Adult compliment of principle and soft rays in median fins; presence of pelvic fin buds for species with pelvic fins in adults; residual fin fold may be present. Body length measured to end of hypural plates.

- **Juvenile** – Full complement and position of adult characters, including scales, fin rays and spines, with evidence of segmentation of soft rays; fin folds not visible. Body length measured to end of hypural plates.

The classification of larvae sampled from this study is included in the Results section of this report.

4.1.3 Drift Sampling

Samples of fish larvae were collected at three sites on the Goulburn River, downstream, at and upstream of the Sugarloaf Pipeline offtake site. The sampling procedure was conducted on the week November 2009. This period was chosen to coincide with the predicted main spawning time of migratory fish species of this river.

The drift nets consisted of 250 μm mesh, were 500 mm in diameter and had flow meters fitted to the mouth of the net to measure the volume of water filtered. The nets were tied to "snags" in areas with relatively high water velocity. The samples of drifting larvae and associated debris were collected and preserved in 100% ethanol and taken to the laboratory for sorting.

Fish were removed from the samples by sorting through the debris under a dissecting microscope.

4.1.4 Hand Trawls

Hand trawls utilised the same nets used in the drift trawls mentioned above. The nets were thrown a distance from the boat with ropes attached to the mouths of the nets; the ropes were then used to trawl the net back towards the boat in order to capture a sample.

4.1.5 Light Trap Sampling

Light traps are constructed of perspex and steel and are 300 mm deep and 220 mm square with a sieve of 200μm mesh, 200 mm in diameter. Larvae are attracted using a light stick and attain entry via 5 mm gaps that exclude the entry of larger bodied fish. Traps are set in areas that are hard to access such as vegetated and heavily snagged riverine environs.

4.2 Results

4.2.1 Adult Fish Sampling

The downstream site was located approximate 10 km downstream of the pump offtake. Four species were recorded in 2009-10, including two native and two introduced (Table 4-1). The native species sampled included Two-spined Blackfish (*Gadopsis bispinosus)* and Flat Headed Gudgeon (*Philypnodon grandiceps*). However, Carp were the most dominant species sampled with 15 individuals sampled. In the 2010-11 sampling an additional native species, Smelt, and two exotic species, Gambusia and Gold Fish, were recorded. This site is located well downstream of the offtake and the differences in species composition between the two sampling occasions is likely due to sampling variation and timing rather than any specific impact associated with the offtake.

At the offtake site, surveys in 2008 did not record any fish. However, in 2009/10 and 2010/11 surveys Flat Headed Gudgeon and Two-spined Blackfish were recorded, as were the introduced Brown Trout, Carp and Redfin Perch (Table 4-2). Similar to the downstream site, Carp were the dominant species sampled. Water quality was not sampled in 2009-10 but sampling in 2010-11 indicates slightly elevated turbidity and low dissolved oxygen. Neither of these impacts is likely to be a result of the offtake operation, which would be very unlikely to affect water quality specifically.

At the site upstream of the offtake, two native species, Flat Headed Gudgeon and Smelt, and four exotic species, Carp, Brown Trout, Gambusia and Redfin Perch, were recorded. No fish were recorded in 2008-09 but relatively high numbers were recorded in 2010-11. Carp were again the most dominant species sampled.

- **Table 4-1 Aquatic ecology sampling results for Goulburn River downstream of offtake site**

Parameter	**Site Name: Goulburn River @ Ghin Ghin Bridge** **GPS** E 55355468; N 5883883	
Year	**2009-10** **Post construction yr 1**	**2010-11** **Post construction yr 2**
Date of sample collection	6/11/09	23/1/09
Electrofishing Time (sec)	12x90	12x90
No Fyke Nets	NA	NA
No Bait Traps	NA	NA
Water Quality		
DO (mg/l)	9.24	6.79
pH	6.87	7.47
EC (µs/cm)	42.9	38.4
Turbidity (NTU)	15.4	15.9
Temperature (˚C)	16.8	24.1
Fish Species & Number		
Brown Trout (*Salmo trutta)*	1	
Two-spined Blackfish (*Gadopsis bispinosus)*	1 (observed)	1
Carp (*Cyprinus carpio***)**	15	19
Flat Headed gudgeon (*Philypnodon grandiceps***)**	1	
Smelt (*Retropin semoni***)**		1
Gold Fish (*Carassius auratus***)**		3
Gambusia (*Gambusia holbrookii)*		2

- **Table 4-2 Aquatic ecology sampling results for Goulburn River at the offtake site**

Parameter	**Site Name: Goulburn River** **GPS** E 55359811; N 5885819	
Year	**2009-10** **Post construction yr 1**	**2010-11** **Post construction yr 2**
Date of sample collection	4/11/09	23/1/11
Electrofishing Time (sec)	12x90	12x90
No Fyke Nets	NA	NA
No Bait Traps	NA	10

Water Quality		
DO (mg/l)		5.1
pH		7.15
EC (µs/cm)		37.1
Turbidity (NTU)		12.4
Temperature (˚C)		21.1
Fish Species & Number		
Brown Trout (*Salmo trutta)*	3	
Carp (*Cyprinus carpio***)**	6	8
Redfin Perch (*Perca fluviatilis***)**	2	4
Flat Headed Gudgeon (*Philygnodon grandiceps***)**	3	
Two-spined Blackfish (*Gadopsis bispinosus)*		1

- **Table 4-3 Aquatic ecology sampling results for Goulburn River upstream of offtake site**

Parameter	**Site Name: Goulburn River** **GPS** E 55360602; N 5885953	
Year	**2009-10** **Post construction yr 1**	**2010-11** **Post construction yr 2**
Date of sample collection	4/11/09	23/1/11
Electrofishing Time (sec)	4x90	12x90
No Fyke Nets	NA	NA
No Bait Traps	NA	10
Water Quality		
DO (mg/l)	8.59	5.1
pH	7.18	7.15
EC (µs/cm)	41.7	37.1
Turbidity (NTU)	10.4	12.4
Temperature (˚C)	18.3	21.1
Fish Species & Number		
Carp (*Cyprinus carpio***)**	9	15
Redfin Perch (*Perca fluviatilis***)**	1	1
Flat Headed Gudgeon (*Philygnodon grandiceps***)**	2	3
Smelt (*Retropin semoni***)**		5
Brown Trout (*Salmo trutta)*		1
Gold Fish (*Carassius auratus***)**		4

4.3 Larval Sampling

Overall, few larval fish were collected from the sites during the sampling period. Flat Headed Gudgeon larvae were the most abundant native species recorded at all sites (Table 4-4 to Table 4-6). Smelt and Mountain Galaxias and were also recorded at and upstream of the offtake site respectively. Mountain Galaxias were not recorded as adults in other surveys.

Redfin Perch were the most abundant species sampled during the larval survey. This was also the only introduced larvae sampled during this assessment. This species was found with the immediate vicinity of the pipeline offtake, with 10 larvae sampled from two life stages.

Off the three larval sampling methods employed, light traps were the most effective. Overall, 18 of the 19 individual larvae sampled during this project were sampled by light traps. Only one larva was capture through the use of hand trawl. No fish were caught within the drift sample.

- **Table 4-4 Larval sampling results for Goulburn River downstream of offtake site**

Trapping Method	Species	Life Stage	Number of Larvae	Mean Larval Length (*Max, Min*)
Light trap 2009-2010	*Flat Headed Gudgeon*	Protolarva	2	4.35 *(4.5, 4.2)*
Light trap 2009-2010	*No fish*			
Hand trawl 2009-2010	*No Fish*			
Hand trawl 2010-2009	*No Fish*			
Drift Net 2009-2010	*No Fish*			
Drift Net 2009-2010	*No Fish*			

- **Table 4-5 Larval sampling results for Goulburn River at the offtake site**

Trapping Method	Species	Life Stage	Number of Larvae	Mean Larval Length (*Max, Min*)
Light trap 2009-2010	*Flat Headed Gudgeon*	Protolarva	2	4.35 *(4.4, 4.3)*
Light trap 2010-2011	*No Fish, Traps Stolen*			
Handtrawl 2009-2010	*Smelt*	Protolarva	1	6.10
Handtrawl 2010-2011	*No Fish*			
Drift Net 2009-2010	*No Fish*			
Drift Net 2010-2011	*No Fish, Nets Stolen*			

- **Table 4-6 Larval sampling results for Goulburn River upstream of offtake site**

Trapping Method	Species	Life Stage	Number of Larvae (*n*)	Mean Larval Length (*Max, Min*)
Light trap 2009-2010	*Redfin Perch*	Post-flexion	4	11.68 *(11.9, 11.5)*
		Metalarva	6	12.92 *(14, 12.1)*
	Mountain Galaxias	Protolarva	3	7.67 *(8.6, 7.1)*
	Flat Headed Gudgeon	Protolarva	1	5.30
Light trap 2010-2011	*No Fish*			
Hand Trawl 2009 -2010	*No Fish*			
Hand Trawl 2010 -2011	*No Fish*			
Drift Net 2009-2010	*No Fish*			
Drift Net 2010-2011	*Flat Headed Gudgeon*	Protolarva	2	4.1

4.4 Summary

Overall, the data indicates that the river within the vicinity of the offtake is dominated by exotic species, namely Carp, Redfin Perch and Trout. Species historically present included Murray Cod, Trout Cod and Macquarie Perch, however these species have not been recorded in the reach below

Lake Eildon for more than 30 years (DSE fish database, MAFRI unpublished data). The absence of large native fish from the current survey is of little surprise.

The larval survey has identified that Mountain Galaxias, Flat Headed Gudgeon and Australian Smelt actively spawn within the vicinity of the offtake. None of these species is listed on the *FFG Act* or the *EPBC Act,* and all three species are classified as "Main Channel Generalist" under the Murray Flows Assessment Tool (MFAT) that has been developed as part of the MDBC's Living Murray Initiative.

The limited data sampled between 2009 and 2011 indicates that large protected native species such as Murray Cod, Trout Cod and Macquarie Perch are not actively breeding within the vicinity of the offtake. As such, the risk of larvae of these species being entrained in the pump offtake is minimal.

5. Discussion

The aquatic monitoring program was designed to assesses local impacts of pipeline construction on fish and water quality around and downstream of crossing points in accordance with the Threatened Species Mitigation Plan (SPA 2008) by comparing results for sites upstream and downstream of construction points prior to, during and after construction.

Sampling was undertaken pre-during and for two years post construction. This satisfies the obligations as set out in:

- Appendix A, Table 1 of the Minister for Planning's written advice, which requires reporting of compliance with an approved species specific mitigation plans for threatened fauna.
- Condition 4 of the Environmental Protection and Biodiversity Conservation (EPBC) Approval conditions, which states.

  "To protect the EPBC listed aquatic fauna species that are known to occur or could potentially occur in the action area, in particular the Macquarie Perch (*Macquaria australasica*), Trout Cod (*Maccullochella macquariensis*) and Murray Cod (*Maccullochella peelii*), the person taking the action must implement the Mitigation Plan for EPBC Act and FFG Act Listed Aquatic Fauna Species July 2008."
- Attachment 9, mitigation plan for EPBC Act and FFG Act listed aquatic species (SPA 2008), which outlines a monitoring program (this report) to meet the requirements of the above obligations.

Specifically, this report provides evidence to show that two years of post construction has been undertaken as detailed in the Threatened Species Mitigation Plan (SPA 2008).

In general, at individual sites on individual sampling occasions there was little difference in survey results upstream and downstream of construction areas, which indicates there was little effect of construction on fish or water quality at individual sites. However, there were differences detected over time pre and post construction. These differences are related to impacts associated with the February 2009 bushfires that impacted the upper Yea River catchment. The fires resulted in large amounts of ash and sediment being washed into the river. This increased turbidity and smothered in-stream habitat. This particularly impacted the sites high in the Yea River catchment, including Gordons Bridge Road, Castella Road and Yea-Glenburn Road and as far down as Devlins Bridge.

During the pre-construction assessment, Two-spined blackfish dominated the community structure at Castella Road and Devlins Bridge, however after the 2009 fires the relative abundance of this species appeared to decline at sites both upstream and downstream of construction activities. Because species abundance declined both **upstream and downstream** of construction zones it is unlikely that construction impacts were the main driver of this change and suggests the impact of the fires, or some other factor (such as high flow / flood events in 2010/11) was greater than any impacts associated with pipeline construction.

Sampling from the Goulburn River within the vicinity of the pump offtake identified that the adult fish fauna was dominated by exotic species Carp, Redfin and Trout. Flat Headed Gudgeon and one Two-spined Blackfish were the only adult native fish sampled form the Goulburn River during the

assessment period, although larvae of Australian Smelt and Mountain Galaxias were also detected. Given the absence of Murray cod, Trout cod and Macquarie perch records within the reach downstream of Lake Eildon and the absence of larvae from these species during the larval assessment, the likelihood of larvae of these species being entrained in the pump offtake is unlikely. It is anticipated that any adult fish, should they occur, would avoid the offtake with a number of mitigation measures employed in the design of the structure, including the installation of a fish screen at the offtake inlet.

Macquarie perch were confirmed to be present within the Yea River during the post-construction 2009-2010 sampling event at Property 59 Glendaloch, downstream of Devlins Bridge; however efforts to monitor this population thereafter were hindered with property access issues. Sampling in 2011 was restricted by high flow events which prevented the access to a number of sites, particularly within the Yea River.

Although sampling in 2010-11 (the second year post construction) was difficult or impossible at some sites due to property access issues and also high flows associated with major flooding, the results are still applicable and do not suggest that any adverse impacts of the pipeline construction exist. In fact, for sites that were sampled in 2010-11, many water quality variables are similar to those measured pre-construction and most sites exhibited the same fish species across all sampling occasions. This suggests that mitigation actions were effective at minimising long term impacts to threatened aquatic species associated with pipeline construction.

Overall the monitoring has identified that the construction of the pipeline is unlikely to have had an on-going impact on the intersected waterways, and any impact that may have occurred is minor compared to the catchment scale impacts caused by the 2009 fires and 2010-11 floods. On this basis further monitoring is unlikely to provide any more information on the impacts of the pipeline construction on aquatic species and is therefore not recommended.

6. References

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