Icon Water

MEMP

Fish Survey: March 2014

Executive summary

Icon Water has completed construction of a pipeline from the Murrumbidgee River to the Googong Reservoir catchment (M2G) in order to supplement ACT and Queanbeyan water supplies. The pipeline will pump up to 100 ML per day from Angle Crossing on the southern border of the ACT to Burra Creek which then flows into Googong Reservoir.

To complement the existing ACT Government fish monitoring program GHD undertook a survey of five sites in Burra Creek, one site at Angle Crossing and one reference site (Gelignite Crossing) in the Queanbeyan River. Backpack electrofishing was used to sample fish according to the Sustainable Rivers Audit methodology.

Four species of fish were captured with a total of 144 individuals from all sampling sites. The majority of these fish were redfin perch (86%) and galaxids (9%; only caught in the Queanbeyan River). Two juvenile Murray Cod were caught around the abstraction infrastructure at Angle Crossing and five carp were also caught. Observations of eastern gambusia in very high numbers in many of the Burra Creek sites were made. An additional note is that on at least two separate occasions, rainbow trout have been observed inhabiting pools downstream of the discharge weir on Burra Creek. The first of these observations was made not long after an M2G maintenance release.

Key findings from the autumn 2014 survey are:

- *The capture of juvenile Murray Cod at Angle Crossing;*
- *No native fish species in Burra Creek;*
- *No Carp or Oriental Weather Loach detected in the catchment upstream of Googong Reservoir.*

The results of this survey are consistent with previous survey efforts in Burra Creek, which indicate that all fish captured or observed have been exotic species within the Creek.

There are several likely reasons for this including the natural flow regime, exposed habitat through land clearing, poor riparian habitat, and the banks being moderate to heavily erodible for much of the length of the creek. Temperature thresholds for some upland native species are also probably exceeded regularly. Despite having low thermal tolerances relative to other exotic species, we have observed (but not captured) rainbow trout on multiple occasions in Burra Creek since the commissioning of M2G, suggesting that increasing flows for at least short periods may allow improved passage for trout, but potentially may also do so for other species in Googong reservoir.

We can also confirm that during this survey there were zero Carp and zero Oriental Weather loach captured or observed in Burra Creek and the Queanbeyan River at Gelignite Crossing.

Targeted surveys should continue following the operation of M2G and periodically following the ongoing maintenance releases.

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1. Introduction

During the 2000-2010 drought in the Australian Capital Territory (ACT) and surrounding regions of New South Wales (NSW), the ACT's dam storage volumes declined to unprecedented levels. ACTEW Corporation, the major water utility company in the ACT, developed a water security programme that involved building additional; and upgrading existing, infrastructure to improve the future water supply security for the residents of the Canberra and Queanbeyan region.

The Murrumbidgee Ecological Monitoring Programme (MEMP) was set up by Icon Water to evaluate the potential impacts of water abstraction from the Murrumbidgee River. It was designed to address concerns raised by both Government and non-Government stakeholders; and to provide Icon Water with relevant information regarding any beneficial and/or detrimental ecological effects of the project. The MEMP was implemented prior to the commencement of the M2G project, allowing Icon Water to collect pre-abstraction baseline data to compare against the post-abstraction data once the M2G project was in operation. Macroinvertebrate sampling has been conducted in spring and autumn each year since 2009 and fish surveys have been conducted as part of the project since 2010.

The M2G ecological monitoring component is consistent with the Operation Environmental Management Plan (ACTEW Corporation, 2012) and associated Ecological Monitoring Sub Plan (ACTEW Corporation, 2010), which responds to commitments made during the EIS and subsequent environmental approvals process.

Despite having one of the most degraded fish communities in the Murray Darling Basin, the Upper Murrumbidgee River does provide habitat for a number of threatened fish species (Table 1) (Beitzel et al., 2013).

Table 1 Threatened fish species in the upper Murrumbidgee River

Species	NC Act	FM Act	EPBC Act
Trout Cod *Maccullochella macquariensis*	E	E	E
Macquarie Perch *Macquaria australasica*	E	E	E
Silver Perch *Bidyanus bidyanus*	E	P	
Murray River Crayfish *Euastacus armatus*	V		
Murray Cod *Maccullochella peelii peelii*			V
Two-spined Blackfish *Gadopsis bispinosus*	V		

Key: E- Endangered V- Vulnerable and P- Protected

Several potential impacts to the Murrumbidgee River (specifically around the abstraction point at Angle Crossing) and the discharge into Burra Creek have been identified in previous reports and the purpose of the ongoing fish monitoring component of the MEMP is to monitor for any changes which may be related to M2G operations such as:

- Loss of natural flow regime;
- Loss of instream and riparian habitat complexity (reduced amounts of large woody debris, and increased base load sediment, exotic/cleared riparian plant communities).
- Competition, predation and disease from alien fish.
- Poor water quality and barriers to fish passage (Beitzel et al., 2011).

1.1 Scope of work

The aim of the fish monitoring program in relation to the Murrumbidgee River component of the Murrumbidgee to Googong (M2G) water transfer is:

> ***"To obtain ongoing fish population status to assist in the monitoring of the riverine ecosystem and potential impacts associated with operating the pipeline"***
>
> (ACTEW Water, 2014)

Whereas the key aim of the Burra Creek component is:

> ***"To obtain ongoing information with regard to the status of fish populations and recruitment to assist in the monitoring of the riverine ecosystem and potential impacts associated with operating the pipeline"***
>
> (ACTEW Water, 2014).

To complement the full survey program undertaken by the ACT Government, GHD conducted a small scale survey on Burra Creek and Angle Crossing in early autumn 2014. The aim of this survey was to confirm that carp and or Oriental Weather Loach were absent from Burra Creek as this is one of the primary concerns (i.e. the introduction of alien species into Burra Creek and Googong reservoir) identified as a key threatening process in the EIS.

It should be noted that as recommended by Beitzel et al., 2013, there was no fish sampling undertaken by the ACT Government for the Murrumbidgee River in 2014. Sampling is being done in 2015, but does not include the M2G intake pool immediately upstream of Angle Crossing.

1.2 Previous surveys

Fish surveys specific to the MEMP have been undertaken in the Murrumbidgee River since 2010; while Burra Creek was surveyed in 2008 as part of the preliminary field component of the M2G EIS (Biosis Research, 2008); in 2011 (Beitzel et al., 2011) and GHD (2012). Initial surveys were carried out yearly, but more recent recommendations made by Beitzel et al. (2011, 2013) have been to scale these surveys back to be in line with the ACT Government Biennial Surveys in recognition that M2G is not likely to be used in full operational mode for a number of years and therefore the risks associated with the pipeline will be minimal during standby periods. Table 2 provides a summary of the findings and recommendations in relation to fish monitoring to date.

1.3 Study area

As this was a waded survey, only one site (downstream of Angle Crossing) on the Murrumbidgee River was electro-fished. Gelignite Crossing on the Queanbeyan River was included as a reference site, and there were five test sites included in Burra Creek (Table 3, Figure 1). Three of these sites were further upstream and sampled as fish had been observed in the upper reaches of Burra Creek by GHD personnel and the species and extent of their distribution required documentation.

Table 2. Summary of findings from previous fish survey's related to the MEMP

Year of Survey and Location(s)	Agency	Summary of findings and recommendations
2010 (Murrumbidgee River)	ACT Government	Carp dominant (73-100% of biomass). Macquarie perch presence confirmed U/S and D/S of Angel Crossing. Resurvey in 2011. Develop a monitoring program for Burra Creek as the change of flow in Burra Creek has the potential to change fish abundance and distribution in this waterway though its effect on habitat availability and access. This may also assist as an early warning as to whether carp exclusion in the M2G pipeline has been successful.
2011	ACT Government	Carp dominant (73-100% of biomass). Despite this, threatened species were found at five sites. Murray Cod and trout cod were recorded at the extraction point and downstream. Macquarie perch were recorded in the vicinity of Angle Crossing.
2011 (Burra Creek Baseline)	ACT Government	All fish captured or observed in Burra Creek were exotic species, which have a wide temperature tolerance. The authors suggest that because of this, these species are unlikely to be affected by the modified pumping regime.
2012	ACT Government	Juvenile Murray Cod caught at Angle Crossing upstream of Gigerline Gorge. Murray Cod observed at Lawler road upstream of Angle Crossing . Coincide with the biennial ACT Government Surveys from 2013 until the scheme is required for water supply; Inclusion of Angle Crossing as an investigation site into the Murray Cod Research Program. Utilise proportion of native biomass and proportion of native species as surrogates for site condition. Undertaking monitoring of the performance of the egg screen during the maintenance phase.
2013	ACT Government	Juvenile Murray Cod caught at above and below Angle Crossing. Macquarie perch recorded at above Angle Crossing and for the first time in this program at Casuarina Sands.

Table 3. Sampling locations for the autumn fish survey

Site Code	Location	River	Date Sampled	Latitude	Longitude
BUR2	At discharge structure	Burra Creek	18/03/2014	-35.598508	149.227399
BURLR	U/S Lagoon Road Causeway	Burra Creek	18/03/2015	-35.521185	149.251575
BUR2B	Downstream of weir	Burra Creek	19/03/2014	-35.542260	149.230151
BURLC	Limestone Crossing	Burra Creek	19/03/2014	-35.541609	149.229777
BURLB	London Bridge	Burra Creek	19/03/2014	-35.519195	149.261213
QBYN1b	Gelignite Crossing	Queanbeyan River	19/03/2014	-35.512686	149.286402
MUR19	Angle Crossing	Murrumbidgee River	18/03/2014	-35.582723	149.110042

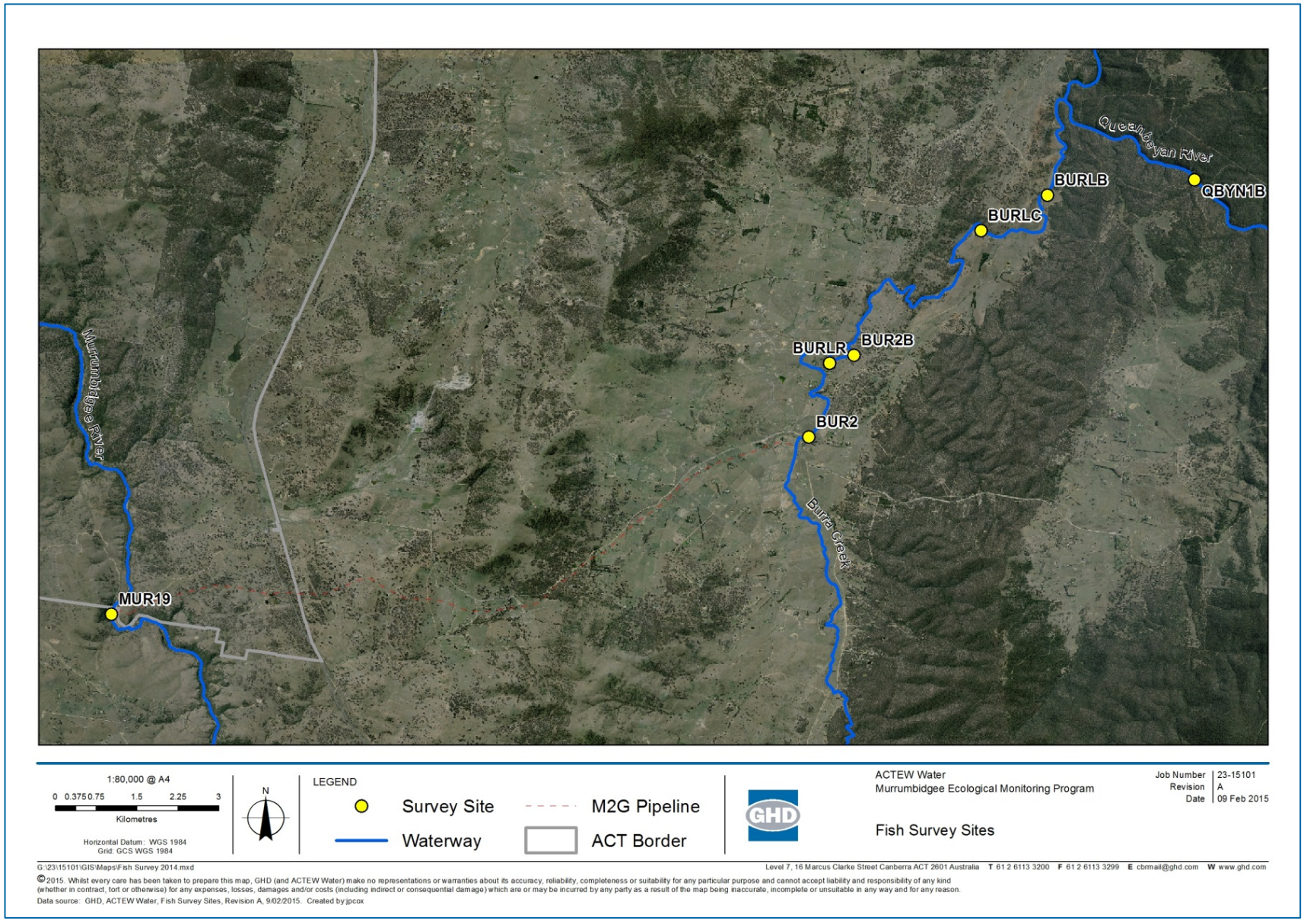

Figure 1 Sampling location for the autumn 2014 fish survey.

2. Methodology

2.1 Water quality

Water quality data were recorded at each site using a hand held YSI 556 water quality multiprobe for the following parameters:

- pH
- Temperature (^{o}C)
- Electrical Conductivity (µS/cm)
- Dissolved Oxygen (% saturation)
- Dissolved Oxygen (mg/L)

In-situ Turbidity (NTU) was measured at the majority of sites using a calibrated HACH 2100p Turbidity unit.

2.2 Fish monitoring and electrofishing protocols

Electrofishing was conducted in accordance with the Australian Code of Electrofishing Practice (1997). At each site the reach was surveyed using a Smith-Root backpack electrofisher (model LR24 with maximum output of 990 V and 40 amps peak, 4 amps continuous, with infinitely variable settings). This technique was not used where the water quality (high conductivity or turbidity), depth, instream habitat or substrate was unsuitable for safe operation.

Fish captured were identified to species according to Lintermans, (2007).Native species were returned unharmed to the stream. Non-native species were euthanized and disposed of in accordance with ethics permit requirements.

2.3 Permits and licences

GHD have the following current permits and licenses required to conduct fish sampling across NSW rivers and streams;

- NSW DPI Scientific Collection Permit: P07/002-3.1,
- NSW DPI Animal Research Authority: 11/4686.

GHD's animal ethic committee require all monitoring programs deemed as medium to high risk (medium in this study) to produce a post survey report card detailing the sites involved in the survey, collection and observation records and any other notes of importance during the survey. The post-survey report from autumn 2014 can be found in Appendix A.

3. Results

3.1 Water quality

While there are a number of exceedances from the ANZECC (2000) guidelines; the water quality results are all within the natural range that occurs in Burra Creek (Appendix B).

3.2 Survey results

A full summary of the fish survey data are presented in Table 4. There were no fish captured in the upper-most sites (BUR2, BURLR and BUR2B) during this survey.

Redfin perch (*Perca fluviatilis*) (Plate 1) were the only species to be caught in Burra Creek with 5 collected at BUR LB and 119 captured at BURLC (Figure 2). Only the native Mountain Galaxias (Plate 2) were caught at the Queanbeyan River site QBYN 1b. While MUR 19 on the Murrumbidgee River was the only site during the survey at which multiple species were caught. The vulnerable Murray Cod (*Maccullochella peelii peelii*) (as listed under the NC Act, Table 1) was caught with two juveniles found inhabiting the artificial rocks placed around the intake structure (Plate 3), with 5 carp (Plate 4) also present in this area and in the riffle immediately downstream of Angle Crossing itself.

While no eastern gambusia were collected during the survey it is important to note that they were present and in high abundances at some sites. The only sites where eastern gambusia were not observed were the Queanbeyan River site QBYN 1b and BUR LC, while they were observed in very high numbers at BUR 2, 2b & LB.

Key findings from the autumn 2014 survey include:

- The capture of juvenile Murray Cod at Angle Crossing;
- No native fish species in Burra Creek;
- No Carp or Oriental Weather Loach detected in the catchment upstream of Googong Reservoir, and;
- During a separate assessment of Burra Creek during June 2014, unrelated to the fish survey, a rainbow trout was observed in a pool in the middle reaches of Burra Creek between BUR 2b and BUR LC (Plate 5). This follows from previous sightings of trout in the upper reaches of Burra Creek (in the discharge weir pool following an M2G maintenance release).

Table 4. Survey capture results from autumn 2014

Site Code	Species Name	Common Name	Catch Abundance
BUR2	-	-	-
BURLR	-	-	-
BUR2B	-	-	-
BURLC	*Perca fluviatilis*	Redfin perch	119
BURLB	*Perca fluviatilis*	Redfin perch	5
QBYN1b	*Galaxias olidus*	Mountain Galaxias	13
MUR19	*Maccullochella peelii peelii*	Murray Cod	2
	Cyprinus carpio	Carp	5

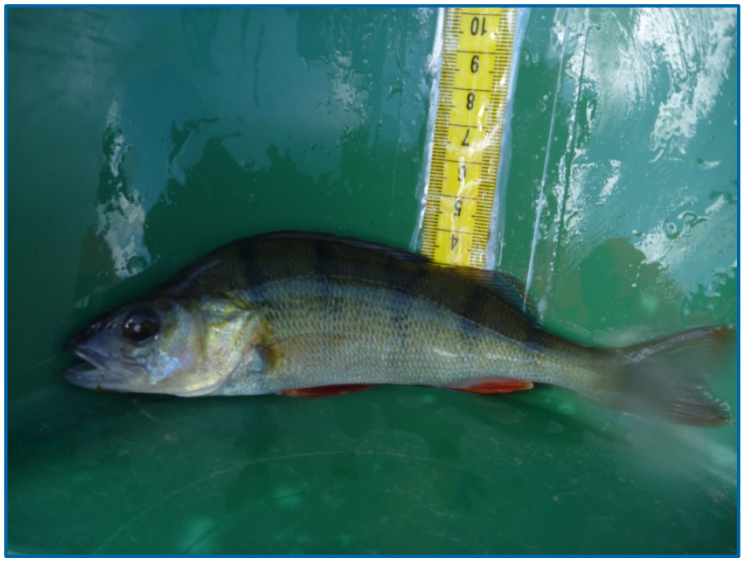

Plate 1 Redfin (***Perca fluviatilis***)

Plate 2. Mountain galaxias (*Galaxias olidus*)

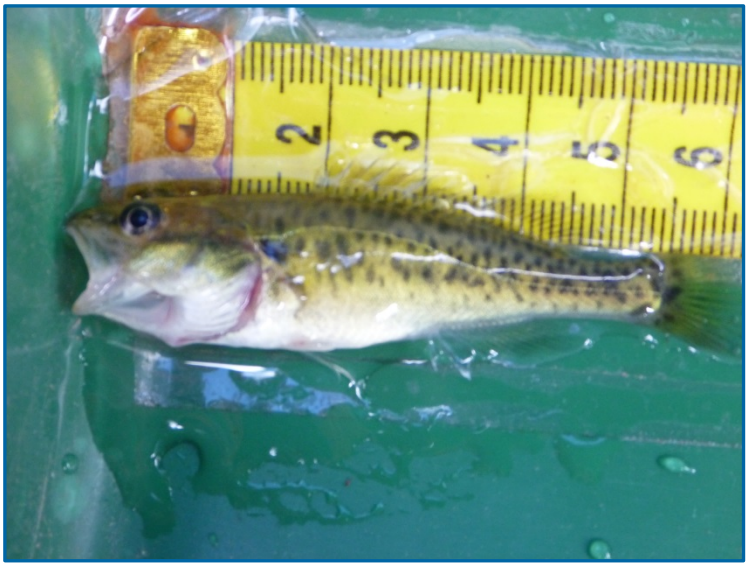

Plate 3 Murray Cod (*Maccullochella peelii peelii*)

Plate 4. Common Carp (*Cyprinus carpio*)

Plate 5. Rainbow trout (*Oncorhynchus mykiss*) observed in Burra Creek during June 2014

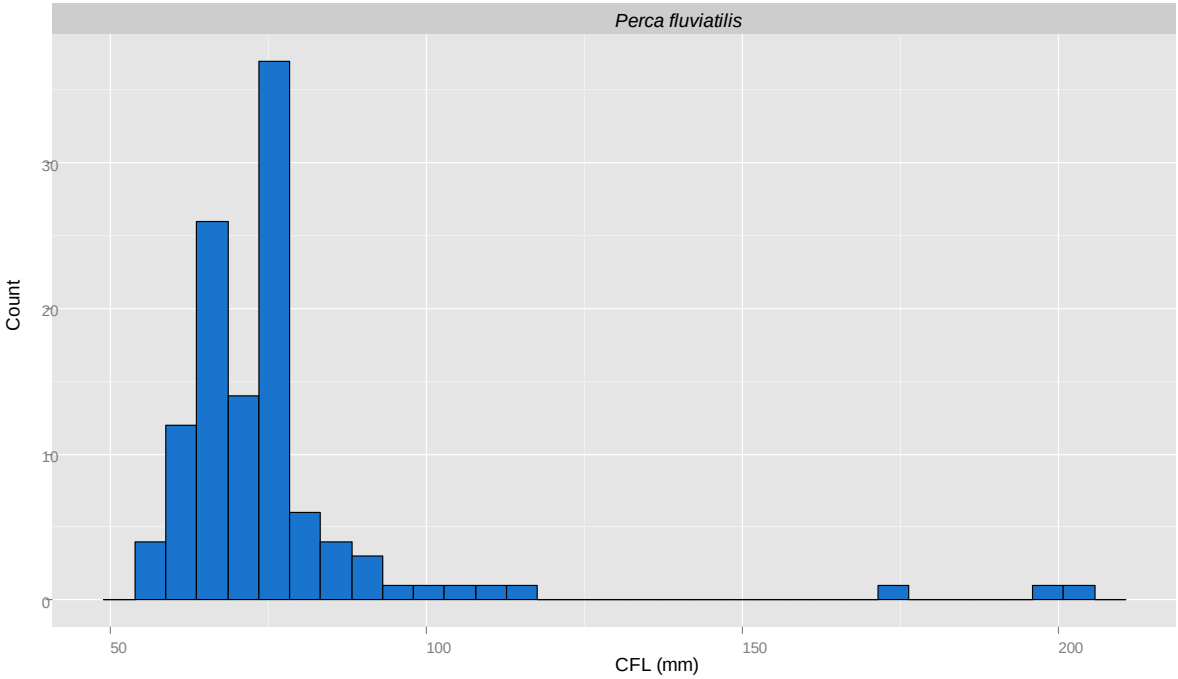

Figure 2. Length frequency histogram of redfin collected in Burra Creek

4. Discussion and Recommendations

Eastern gambusia were recorded throughout Burra Creek. The presence of eastern gambusia within Burra Creek is indicative of the habitat and flow conditions as eastern gambusia thrive in shallow, slow flowing waters (Lintermans, 2007). Under the current flow regime conditions are likely to benefit eastern gambusia and it is likely that this species will continue to inhabit and populate much of the Burra Creek catchment. Future flow releases should consider the inundations of riffle habitats and flushing flows that may discourage the colonisation by eastern gambusia and encourage the recruitment of native species, should this become a management option.

The high number of redfin caught in this survey is reflective of their preference for still or slow-flowing waters such as lakes, dams, billabongs, swamps and slower moving streams and rivers. Redfin Perch can form very dense populations in stable water bodies such as those created by dams. These populations compete for space with native fish and can destroy recreational fisheries.

Redfin are listed as a Class 1 noxious fish and are considered a serious pest in NSW. The Redfin Perch is carnivorous and feeds on a wide variety of foods ranging from small invertebrates to fish. These fish include Pygmy Perch, Carp Gudgeon and the juveniles of species such as Silver Perch, Golden Perch and Murray Cod. It has also been known to feed on other alien species such as Trout and eastern gambusia. The presence of Redfin, both in Googong Dam and in the lower reaches of Burra Creek, is likely to be a major factor influencing native fish presence in Burra Creek as Redfin are likely to directly impact native fishes through predation of eggs and juveniles, competition for food and habitat resources and possibly through introduction of disease. Evidence from this survey suggests Redfin are using the lower reaches of Burra Creek as a nursery habitat for juvenile fish.

Possibly the most significant threat to native fish stocks from Redfin Perch is its potential to spread the disease Epizootic Haematopoietic Necrosis (EHN). This disease is unique to Australia and was first isolated in 1985. Species such as Silver Perch, Mountain Galaxias and particularly Macquarie Perch are susceptible. The virus can be transmitted from one location to another on nets, fishing lines, boats and other equipment (NSW DPI, 2012).

The absence of native fish in Burra Creek may be due to a number of factors such as the presence of exotic species, Googong dam as a movement barrier, the intermittent nature of the flows in Burra Creek, high silt and sediment deposition in riffle and other breeding habitat through Burra Creek. It may be possible that native fishes have historically not colonised the Burra Creek Catchment due to its catchment geology and water quality characteristics. The presence of Mountain Galaxias *(Galaxias olidus*) and Western Carp Gudgeon (*Hypseleotris klunzingeri*) in the nearby Queanbeyan River (Beitzel *et. al*., 2011) suggest that geographic features are less likely contributors to the absence of these species in Burra Creek because of the close proximity of Burra Creek and the Queanbeyan River. The occurrence of juvenile Murray Cod in this survey is also constant with the previous surveys undertaken (Beitzel et al., 2013) and the location at which they were caught suggest that they (at least the juveniles) may be utilising the artificial rocks around the abstraction infrastructure as habitat.

Another key finding from this survey was that there were zero captures or observations of either Carp or Oriental Weather Loach in any of the surveyed sites in Burra Creek, suggesting that to date the egg filters on the M2G intake appear to be working. However, it is recommended that owing to the potential impact of Carp and Oriental Weather Loach introductions into Burra Creek and the Googong reservoir, targeted and more thorough surveys be undertaken following M2G operations and periodically following M2G maintenance releases. It is also recommended that flow releases or alterations to discharge of Burra Creek should consider maintenance of riffle habitats where possible to encourage native fish colonisation. We also support the recommendation of Beitzel et al. (2011) to undertake trials to assess fish movement in Burra Creek following flow releases.

5. References

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Appendices

Appendix A - Post Survey Report for Medium and High Risk Fauna Surveys

Post Survey Report for Medium and High Risk Fauna Surveys

Adverse Incident (Yes or No)	No
Project Details	Environmental monitoring for the inter-basin water transfer to supplement ACT water supply.
Project Number and Name	2315150 – Murrumbidgee Ecological Monitoring Program
Date(s) of Survey	18-19/03/2014
Purpose of Survey	Assessment of fish diversity at sites influenced by the Murrumbidgee to Googong Transfer Pipeline
Principle Researchers Name	Adrian Dickson
Associated Field Staff	Phil Taylor, Josh Cox
Risk rating	Medium
Location of Survey **(insert map)**	See Figure 1 in body of the Report.
Survey Method and Outcomes	
Standard Operating Procedures Employed (list them referring to section and name)	Backpack electrofishing
Number of Traps (make sure you advise AS trapping efforts over the number of days)	None
Frequency of Trap Check (e.g. once a day; every 2 hours specify what traps)	N/A
Results	

Weather Conditions over trapping period	Maximum temperature was 26.2°C and 27.1°C on the 18th and 19th respectively. Weather was sunny and fine.
Species and number of species trapped • Please provide individuals scientific and common names • Include estimated average duration of species in traps	Carp – *Cyprinus carpio* – 5 Redfin Perch – *Perca fluviatilis* – 114 Mountain Galaxid – *Galaxias olidus* – 13 Murray Cod – *Maccullochella peelii peelii* – 2
Behavioural observations of level of stress of trapped fauna (Important to explain the levels stress you observed and why they were)	Levels of stress observed in fish was minimal. Once fish were collected they were immediately placed in recovery buckets, with minimal handling time before being released. As carp and redfin are classed as noxious pest species all specimens caught were euthanized in an AQUI-S bath and disposed of in accordance with the GHD SOP for Fauna Surveys and the animal ethics permit.
Recommendations to improve Standard Operating Procedures (if applicable)	None

Appendix B – Water Quality results

Appendix B. Water quality results from the autumn 2014 fish survey in Burra Creek and Angle Crossing (Murrumbidgee River)

Date	Time	Site	Temperature (deg. C)	pH	D.O. % sat.	D.O. mg/L	EC (*us*/cm)	Turbidity (NTU)
18/03/2014	0935	MUR19	20.5	8.51	107.5	8.91	128.9	4.1
18/03/2014	1215	Lagoon Road	21	8.61	115.8	9.43	614	6.1
18/03/2014	1430	BUR2	20.1	8.08	104.3	8.26	595	9.9
19/03/2014	0920	QBYN1b	17.3	8.03	98.3	8.72	105	10.2
19/03/2014	1200	London Bridge	19.4	8.21	89.8	7.61	498	3.8
19/03/2014	1345	Limestone	22.8	8.54	132.1	10.40	516	3.8
19/03/2014	1548	BUR2b	23.2	8.58	157.5	12.3	583	8.22

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