

## **APPENDIX A**

### **Director-General's Requirements**

## Director General's Environmental Assessment Requirements

### Section 78A(8A) of the *Environmental Planning and Assessment Act 1979*

#### State Significant Development

<b>Application Number</b>	SSD 5251
<b>Development</b>	<p>The Dubbo Zirconia Project, which includes:</p> <ul style="list-style-type: none"> <li>• developing an open cut Zirconium and rare earth mine and associated infrastructure, including water pipeline, gas pipeline, electricity transmission line, rail loading facility, rail upgrade and road upgrade;</li> <li>• extracting and processing approximately 18 million tonnes of ore over a period of up to 20 years;</li> <li>• transporting the processed ore from the mine via road and rail; and</li> <li>• rehabilitating the site.</li> </ul>
<b>Location</b>	Toongi, 25 km south of Dubbo, in the Dubbo LGA
<b>Applicant</b>	Australian Zirconia Limited
<b>Date of Issue</b>	4 May 2012
<b>General Requirements</b>	<p>The Environmental Impact Statement (EIS) for the development must meet the form and content requirements in Clauses 6 and 7 of Schedule 2 of the <i>Environmental Planning and Assessment Regulation 2000</i>.</p> <p>In addition, the EIS must include a:</p> <ul style="list-style-type: none"> <li>• detailed description of the development, including: <ul style="list-style-type: none"> <li>– need for the proposed development;</li> <li>– justification for the proposed mine plan, including efficiency of resource recovery, mine safety, and environmental protection;</li> <li>– likely staging of the development - including construction, operational stage/s and rehabilitation;</li> <li>– likely interactions between the development and existing, approved and proposed mining operations in the vicinity of the site;</li> <li>– plans of any proposed building works;</li> </ul> </li> <li>• consideration of all relevant environmental planning instruments, including identification and justification of any inconsistencies with these instruments;</li> <li>• risk assessment of the potential environmental impacts of the development, identifying the key issues for further assessment;</li> <li>• detailed assessment of the key issues specified below, and any other significant issues identified in this risk assessment, which includes: <ul style="list-style-type: none"> <li>– a description of the existing environment, <u>using sufficient baseline data</u>;</li> <li>– an assessment of the potential impacts of all stages of the development, including any cumulative impacts, taking into consideration relevant guidelines, policies, plans and statutes; and</li> <li>– a description of the measures that would be implemented to avoid, minimise and if necessary, offset the potential impacts of the development, including proposals for adaptive management and/or contingency plans to manage any significant risks to the environment; and</li> </ul> </li> <li>• consolidated summary of all the proposed environmental management and monitoring measures, highlighting commitments included in the EIS.</li> </ul>
<b>Key issues</b>	<p>The EIS must address the following specific issues:</p> <ul style="list-style-type: none"> <li>• <b>Land Resources</b> - including a detailed assessment of the potential impacts on: <ul style="list-style-type: none"> <li>- soils and land capability (including salinisation and contamination);</li> <li>- landforms and topography; and</li> <li>- land use, including agricultural use;</li> </ul> </li> <li>• <b>Water Resources</b> – including: <ul style="list-style-type: none"> <li>- detailed assessment of potential impacts on the quality and quantity of existing surface and ground water resources, including: <ul style="list-style-type: none"> <li>o detailed modelling of potential groundwater impacts;</li> <li>o impacts on affected licensed water users and basic landholder</li> </ul> </li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>rights; and</li> <li>o impacts on riparian, ecological, geomorphological and hydrological values of watercourses, including environmental flows;</li> <li>- a detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures;</li> <li>- an assessment of proposed water discharge quantities and quality/ies against receiving water quality and flow objectives;</li> <li>- an assessment of proposed modifications to surface water management, including modelling the redistribution of waters and an assessment of the impact on neighbouring properties and the associated watercourse and floodplain;</li> <li>- identification of any licensing requirements or other approvals under the <i>Water Act 1912</i> and/or <i>Water Management Act 2000</i>;</li> <li>- demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP);</li> <li>- a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo; and</li> <li>- a detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts;</li> <li>• <b>Air Quality</b> – including a quantitative assessment of potential: <ul style="list-style-type: none"> <li>- construction and operational impacts, with a particular focus on dust emissions (including PM<sub>2.5</sub> and PM<sub>10</sub> emissions) and processing emissions;</li> <li>- reasonable and feasible mitigation measures to minimise dust and processing emissions, including evidence that there are no such measures available other than those proposed; and</li> <li>- monitoring and management measures, in particular real-time air quality monitoring;</li> </ul> </li> <li>• <b>Greenhouse Gases</b> – including: <ul style="list-style-type: none"> <li>- a quantitative assessment of potential Scope 1, 2 and 3 greenhouse gas emissions;</li> <li>- a qualitative assessment of the potential impacts of these emissions on the environment; and</li> <li>- an assessment of reasonable and feasible measures to minimise greenhouse gas emissions and ensure energy efficiency;</li> </ul> </li> <li>• <b>Waste</b> – including: <ul style="list-style-type: none"> <li>- accurate estimates of the quantity and nature of the potential waste streams of the development, including tailings, coarse reject and acid-generating potential;</li> <li>- a tailings and coarse reject disposal strategy; and</li> <li>- a description of measures that would be implemented to minimise production of other waste, and ensure that that waste is appropriately managed;</li> </ul> </li> <li>• <b>Hazards and Risks</b> – including a screening of potential hazards off and on site to determine the potential for offsite impacts and if a Preliminary Hazard Analysis (PHA) is required. If required, a PHA must be prepared in accordance with the <i>Department's Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis</i> and must: <ul style="list-style-type: none"> <li>- consider the risks from the proposal; and</li> <li>- demonstrate that the proposal would comply with the criteria set out in <i>Hazardous Industry Planning Advisory Paper No. 4 - Risk Criteria for Land Use Safety Planning</i>;</li> </ul> </li> <li>• <b>Biodiversity</b> – including: <ul style="list-style-type: none"> <li>- measures taken to avoid, reduce or mitigate impacts on biodiversity;</li> <li>- accurate estimates of proposed vegetation clearing;</li> <li>- a detailed assessment of potential impacts of the development on any: <ul style="list-style-type: none"> <li>o terrestrial or aquatic threatened species or populations and their habitats, endangered ecological communities and groundwater dependent ecosystems; and</li> <li>o regionally significant remnant vegetation, or vegetation corridors;</li> </ul> </li> <li>- a comprehensive offset strategy to ensure the development maintains</li> </ul> </li> </ul>
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	<p>or improves the terrestrial and aquatic biodiversity values of the region in the medium to long term;</p> <ul style="list-style-type: none"> <li>• <b>Heritage</b> – including: <ul style="list-style-type: none"> <li>- an Aboriginal cultural heritage assessment (including both cultural and archaeological significance) which must: <ul style="list-style-type: none"> <li>o demonstrate effective consultation with Aboriginal communities in determining and assessing impacts, and developing and selecting mitigation options and measures; and</li> <li>o outline any proposed impact mitigation and management measures (including an evaluation of the effectiveness and reliability of the measures); and</li> </ul> </li> <li>- a Historic heritage assessment (including archaeology) which must: <ul style="list-style-type: none"> <li>o include a statement of heritage impact (including significance assessment) for any State significant or locally significant historic heritage items; and</li> <li>o outline any proposed mitigation and management measures (including an evaluation of the effectiveness and reliability of the measures);</li> </ul> </li> </ul> </li> <li>• <b>Noise</b> – including a quantitative assessment of potential: <ul style="list-style-type: none"> <li>- construction, operational and transport noise impacts;</li> <li>- reasonable and feasible mitigation measures, including evidence that there are no such measures available other than those proposed; and</li> <li>- monitoring and management measures, in particular real-time, attended noise monitoring and predictive meteorological forecasting;</li> </ul> </li> <li>• <b>Traffic &amp; Transport</b> – including: <ul style="list-style-type: none"> <li>- accurate predictions of the road and rail traffic generated by the project;</li> <li>- an assessment of the capacity of the rail network to accommodate the transport of ore;</li> <li>- an assessment of potential traffic impacts on the safety and efficiency of the road network; and</li> <li>- a detailed description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road and rail networks in the surrounding area over the life of the project;</li> </ul> </li> <li>• <b>Visual</b> – including: <ul style="list-style-type: none"> <li>- a detailed assessment of the: <ul style="list-style-type: none"> <li>o changing landforms on the site during the various stages of the project; and</li> <li>o potential visual impacts of the project on private landowners in the surrounding area as well as key vantage points in the public domain, including lighting impacts; and</li> </ul> </li> <li>- a detailed description of the measures that would be implemented to minimise the visual impacts of the project;</li> </ul> </li> <li>• <b>Social &amp; Economic</b> – including an assessment of the: <ul style="list-style-type: none"> <li>- potential direct and indirect economic benefits of the project for local and regional communities and the State;</li> <li>- potential impacts on local and regional communities, including: <ul style="list-style-type: none"> <li>o increased demand for local and regional infrastructure and services (such as housing, childcare, health, education and emergency services); and</li> <li>o impacts on social amenity;</li> </ul> </li> <li>- a detailed description of the measures that would be implemented to minimise the adverse social and economic impacts of the project, including any infrastructure improvements or contributions and/or voluntary planning agreement or similar mechanism; and</li> <li>- a detailed assessment of the costs and benefits of the development as a whole, and whether it would result in a net benefit for the NSW community; and</li> </ul> </li> <li>• <b>Rehabilitation</b> – including the proposed rehabilitation strategy for the site, having regard to the key principles in the Strategic Framework for Mine Closure, including: <ul style="list-style-type: none"> <li>- rehabilitation objectives, methodology, monitoring programs, performance standards and proposed completion criteria;</li> <li>- nominated final land use, having regard to any relevant strategic land use planning or resource management plans or policies; and</li> <li>- the potential for integrating this strategy with any other rehabilitation and/or offset strategies in the region.</li> </ul> </li> </ul>
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<b>Plans and Documents</b>	The EIS must include all relevant plans, architectural drawings, diagrams and relevant documentation required under Schedule 1 of the <i>Environmental Planning and Assessment Regulation 2000</i> . These documents should be included as part of the EIS rather than as separate documents.
<b>Consultation</b>	<p>During the preparation of the EIS, you must consult with relevant local, State and Commonwealth Government authorities, service providers, community groups and affected landowners.</p> <p>In particular you must consult with the:</p> <ul style="list-style-type: none"> <li>• Commonwealth Department of Sustainability, Environment, Water, Population and Communities;</li> <li>• Office of Environment and Heritage (including the Heritage Branch);</li> <li>• Environment Protection Authority;</li> <li>• Division of Resources and Energy within the Department of Trade and Investment, Regional Infrastructure and Services;</li> <li>• Department of Primary Industries (including the NSW Office of Water, NSW Forestry, Agriculture and Fisheries sections, Catchments and Lands (Crown Lands Division));</li> <li>• Transport for NSW (including the Centre for Transport Planning, and Roads and Maritime Services);</li> <li>• TransGrid;</li> <li>• Central West Catchment Management Authority; and</li> <li>• Dubbo City Council.</li> </ul> <p>The EIS must describe the consultation process and the issues raised, and identify where the design of the development has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.</p>
<b>Further consultation after 2 years</b>	If you do not lodge a DA and an EIS for the development within 2 years of the issue date of these DGRs, you must consult further with the Director-General in relation to the requirements for lodgement.
<b>References</b>	The assessment of the key issues listed above must take into account relevant guidelines, policies, and plans as identified. While not exhaustive, Attachment 1 contains a list of some of the guidelines, policies, and plans that may be relevant to the environmental assessment of this development.

## ATTACHMENT 1 Technical and Policy Guidelines

The following guidelines may assist in the preparation of the Environmental Impact Statement. This list is not exhaustive and not all of these guidelines may be relevant to your proposal.

Many of these documents can be found on the following websites:

<http://www.planning.nsw.gov.au>  
<http://www.bookshop.nsw.gov.au>  
<http://www.publications.gov.au>

### Policies, Guidelines & Plans

Risk Assessment	
	AS/NZS 4360:2004 Risk Management (Standards Australia)
	HB 203: 203:2006 Environmental Risk Management – Principles & Process (Standards Australia)
Land Resources	
	Agricultural Impact Assessment Guidelines 2012 (DP&I)
	Agfact AC25: Agricultural Land Classification (NSW Agriculture)
	State Environmental Planning Policy No. 55 – Remediation of Land
	Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC)
Biodiversity	
	Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians (DECCW 2009)
	Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DECC 2004)
	Threatened Species Assessment Guidelines: the Assessment of Significance (DECC 2007)
	Guidelines for Threatened Species Assessment (DoP 2005)
	BioBanking Assessment Methodology and Credit Calculator Operational Manual (DECCW 2008)
	NSW State Groundwater Dependent Ecosystem Policy (DLWC)
	Policy & Guidelines - Aquatic Habitat Management and Fish Conservation (NSW Fisheries)
	Policy & Guidelines - Fish Friendly Waterway Crossings (NSW Fisheries)
	State Environmental Planning Policy No. 44 – Koala Habitat Protection
Water Resources	
Surface Water	National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Guidelines for Sewerage Systems – Effluent Management (ARMCANZ/ANZECC)
	National Water Quality Management Strategy: Guidelines for Sewerage Systems – Use of Reclaimed Water (ARMCANZ/ANZECC)
	Using the ANZECC Guideline and Water Quality Objectives in NSW (DEC)
	State Water Management Outcomes Plan
	Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009
	NSW Government Water Quality and River Flow Objectives (DECC)
	Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC)
	Managing Urban Stormwater: Soils & Construction (Landcom) and associated Volume 2E: Mines and Quarries.
	Managing Urban Stormwater: Treatment Techniques (DECC)
	Managing Urban Stormwater: Source Control (DECC)
	Floodplain Development Manual (DIPNR)
	Floodplain Risk Management Guideline (DECC)
	A Rehabilitation Manual for Australian Streams (LWRRDC and CRCCH)

<i>Groundwater</i>	Technical Guidelines: Bunding & Spill Management (DECC)
	Environmental Guidelines: Use of Effluent by Irrigation (DECC)
	National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC)
	NSW State Groundwater Policy Framework Document (DLWC, 1997)
	NSW State Groundwater Quality Protection Policy (DLWC, 1998)
	NSW State Groundwater Quantity Management Policy (DLWC, 1998)
	Murray-Darling Basin Groundwater Quality. Sampling Guidelines. Technical Report No 3 (MDBC)
	Murray-Darling Basin Commission. Groundwater Flow Modelling Guideline (Aquaterra Consulting Pty Ltd)
	Guidelines for the Assessment & Management of Groundwater Contamination (DECC, 2007)
	Any relevant Water Sharing Plan for groundwater and surface water resources
<b>Air Quality</b>	
	Protection of the Environment Operations (Clean Air) Regulation 2002
	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC)
	Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC)
<b>Noise &amp; Blasting</b>	
	NSW Industrial Noise Policy (DECC)
	Environmental Noise Management – Assessing Vibration: a technical guide (DEC)
	NSW Road Noise Policy (DECCW)
	Interim Guidelines for the Assessment of Noise From Rail Infrastructure Projects (DECC)
	Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZECC)
<b>Traffic &amp; Transport</b>	
	Guide to Traffic Generating Development (RTA)
	Road Design Guide (RTA)
<b>Heritage</b>	
<i>Aboriginal</i>	Draft Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation (DEC 2005)
	The Burra Charter (The Australia ICOMOS charter for places of cultural significance)
<i>Historic</i>	NSW Heritage Manual (NSW Heritage Office)
	The Burra Charter (The Australia ICOMOS charter for places of cultural significance)
<b>Greenhouse Gases</b>	
	National Greenhouse Accounts Factors (Australian Department of Climate Change (DCC))
	Guidelines for Energy Savings Action Plans (DEUS)
<b>Waste</b>	
	Waste Classification Guidelines (DECC)
<b>Hazards</b>	
	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
	Hazardous and Offensive Development Application Guidelines - Applying SEPP 33
	Hazardous Industry Planning Advisory Paper No. 4 – Risk Criteria for Land Use Safety Planning
	Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis

<b>Rehabilitation</b>	<p>Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth of Australia)</p> <p>Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth of Australia)</p> <p>Strategic Framework for Mine Closure (ANZMEC-MCA)</p>
<b>Socio-Economic</b>	<p>Draft Economic Evaluation in Environmental Impact Assessment (DoP)</p> <p>Techniques for Effective Social Impact Assessment: A Practical Guide (Office of Social Policy, NSW Government Social Policy Directorate)</p>





V12/1982  
OUT12/10030

14<sup>th</sup> May 2012  
Alex Irwin  
RW Corkery & Co.  
62 Hill Street  
ORANGE NSW 2800

Dear Alex

**RE: Dubbo Zirconia Project - Director General Requirements**

*Fisheries NSW* are responsible for ensuring that fish stocks are conserved and that there is "no net loss" of key fish habitats upon which they depend. To achieve this, the Department ensures that developments comply with the requirements of the *Fisheries Management Act 1994* (namely the aquatic habitat protection and threatened species conservation provisions in Parts 7 and 7A of the Act respectively) and the associated *Policy and Guidelines for Aquatic Habitat Management and Fish Conservation (1999)*. In addition the Department is responsible for ensuring the sustainable management of commercial and recreational fishing and aquaculture within NSW.

*Fisheries NSW* (Fisheries Conservation and Aquaculture Branch) have reviewed the preliminary EA and offer the following comments on the EA. The EA should specifically address the impacts on the aquatic ecology, waterway crossings, off-site impacts, threatened species and proposed offsets and compensatory habitats as proposed below;

**GENERAL AQUATIC ECOLOGICAL ASSESSMENT**

The aquatic ecological environmental assessment should include the following information;

- A recent aerial photograph (preferably colour) of the locality (or reproduction of such a photograph) should be provided.
- Area which may be affected either directly or indirectly by the development or activity should be identified and shown on an appropriately scaled map (and aerial photographs).
- Waterways within the area of development are to be identified.
- Description and quantification of aquatic and riparian vegetation should be presented and mapped. This should include an assessment of the extent and condition of riparian vegetation and the extent and condition of freshwater aquatic vegetation and the presence of significant habitat features (e.g. gravel beds, snags, reed beds, etc)
- Quantification of the extent of aquatic and riparian habitat removal or modification which will result from the proposed development,
- Details of the location of all waterways crossings and construction designs, such as bridges, culverts, access tracks, or water pipelines.

- Aspects of the management of the proposal, both during construction and after completion, which relate to impact minimisation e.g Monitoring of the water quality in receiving waters such as Wambangalang Creek.

#### **WATERWAY CROSSINGS**

The design and construction of bridges, culverts, access tracks and pipeline crossings across all waterways should be undertaken in accordance with the Department's Policy and *Guidelines for Fish Friendly Waterway Crossings (2004) and Why Do Fish Need to Cross the Road?* The waterway crossings need to ensure that the works are undertaken with minimal impact on the aquatic environment within the immediate vicinity of the proposed works. *Fisheries NSW* need to be consulted with regards to any temporary measures that will result in blocking fish passage. This includes coffer dams, temporary access tracks or redirecting flows whilst works are conducted.

#### **OFF-SITE IMPACTS – MACQUARIE PIPELINE**

The construction of a pipeline from the Macquarie River is likely to potentially have significant impacts on the aquatic ecology on the Macquarie River. The department has been collaboratively working with the irrigation industry for several years to reduce the impacts of irrigation infrastructure removing and damaging juvenile/adult fish from river systems through the use of extraction screen technology on irrigation pump inlet valves. The EA should address the use of pump extraction screen technology for water extraction from the Macquarie River to minimise the impacts of fish mortality.

These potential impacts (Both direct and indirect) include:

- The entrainment and loss of eggs, larvae, and juvenile fish (including threatened species) extracted via the pump and pipeline system
- Mechanical damage and fish mortality from pumps
- Impacts on refuge pools, key fish habitats and threatened species habitat due to extraction during low flows
- Alterations to the existing hydrology within the Macquarie River as a result of extraction.

The matters raised above are to be identified, documented and discussed within the EA.

#### **RIPARIAN BUFFER ZONES**

*Fisheries NSW* policy advocates the use of terrestrial buffer zones as per the *Policy and Guidelines Aquatic Habitat Management and Fish Conservation 1999* available on the Department's website at <http://www.fisheries.nsw.gov.au/pub/aquahab.htm> which states that "Terrestrial areas adjoining freshwater, estuarine or coastal habitats be carefully managed in order to minimise land use impacts on these aquatic habitats. As a precautionary approach, buffer zones at least 50 metres wide should be established and maintained, with their natural features and vegetation preserved. Such buffer zones may need to be fenced or marked by signs. The width of these buffer zones may need to be increased to 100 metres or more where they are adjacent to ecologically sensitive areas."

#### **THREATENED SPECIES, POPULATIONS AND ECOLOGICAL COMMUNITIES– FISHERIES MANAGEMENT ACT 1994**

The proposal should include a threatened aquatic species assessment (as per part 7A *Fisheries Management Act 1994*) to address whether there are likely to be any significant impacts on listed threatened species, populations or ecological communities listed under the *Fisheries Management Act 1994*. Assessment of the

impacts should include initial 'Seven-Part Test's. Species, populations and ecological communities likely to be present within this catchment include:

- The olive perchlet *Ambassis agassizii* listed under Schedule 4, (Endangered populations) of the *FM Act*.
- The Murray Darling Basin population of eel tail catfish *tandanus tandanus* is listed under Schedule 4 of the *FM Act*.
- The purple-spotted gudgeon *Mogurnda adspersa* is listed under Schedule 4, (Endangered species) of the *FM Act*.
- The Trout cod *Maccullochella macquariensis* listed under Schedule 4 (Endangered species) of the *FM Act*.
- The silver perch *Bidyanus bidyanus* listed under Schedule 5 (Vulnerable species) of the *FM Act*.
- The Murray cod *Maccullochella peelii peelii* is nationally listed as vulnerable under the *EPBC Act*.

#### **COMPENSATORY HABITATS AND OFFSETS**

A key outcome sought with rehabilitation and compensation measures is to ensure their longevity and ongoing management post initial construction or implementation. Compensatory habitats are a requirement if the environmental assessment indicates there may be a loss of aquatic or riparian habitats, and may need to be included in site rehabilitation plans or compensatory aquatic habitat offsets elsewhere in the catchment on other aquatic rehabilitation projects.

*Fisheries NSW* has guidelines for compensatory habitat outlined in the document *Policy and Guidelines Aquatic Habitat Management and Fish Conservation 1999* available on the Department's website at:  
<http://www.dpi.nsw.gov.au/fisheries/habitat/protecting-habitats/toolkit#Policies-&-guidelines>).

Should you have any queries regarding this correspondence please contact me on (02) 6763 1255 or 0429 908 856.



David Ward (Fisheries Conservation Manager- Greater Darling)

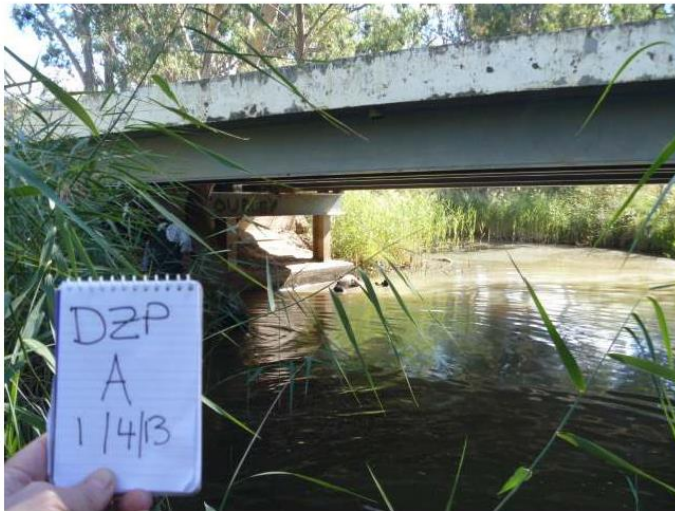
cc Kane Winwood (DP&I)

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## **APPENDIX B**

### **Photographs of Survey Sites**

**Site A – Wambangalang Creek, Obley Road**



**Plate 1** Site A - Showing bridge, pools and Common Reed



**Plate 2** Site A - Obley Road and road reserve

**Site B – Watercourse B Tributary of Wambangalang Creek**



**Plate 3** Site B - Shallow dam and surrounding landuse



**Plate 4** Site B - Erosion along unnamed drainage line upstream of dam. Ore body in far distance



Site C – Wambangalang Creek Railway Crossing



**Plate 5** Site C - Trestle railway bridge



**Plate 6** Site C – Eel—tailed Catfish habitat. Upstream of bridge. River Red Gums along banks.



**Site D –Unnamed Tributary of Cockabroo Creek**



**Plate 7** Site D - Rocky outcrop showing Cypress Pine and surrounding landuse



**Plate 8** Site D - Shallow stream

Site E – Paddys Creek



**Plate 9** Site E -  
Surrounding landuse



**Plate 10** Site E - Shallow  
pools

**Site F – Hyandra Creek, Obley Road**



**Plate 11** Site F - Obley Road  
bridge over Hyandra Creek.  
Snags and vegetated banks.



**Plate 12** Site F -  
Minor area of riffles  
and surrounding  
landuse

Site G – Ugothery Dam  
Watercourse A



**Plate 13** Site G -  
Overview of dam and  
adjacent landuse



**Plate 14** Site G - Dam showing  
southern end near headwaters.  
Standing stag trees.



**Site H – Wambangalang Creek, Benalong Road**



**Plate 15** Site H -  
Overview of dam and  
adjacent landuse



**Plate 16** Site H -  
Bank erosion and  
River Red Gum

Site I – Cockabroo Creek, Nuberingerie Road



**Plate 17** Site I - Pool  
downstream of  
Nuberingerie Road



**Plate 18** Site I - Bank  
erosion and vegetation  
disturbance

**Site J – Little River, Terrabella Road**



**Plate 19** Site J -  
Pool downstream of  
Nuberingerie Road



**Plate 20 Site J** - Bank  
erosion and vegetation  
disturbance

## **APPENDIX C**

**Modified River descriptors, associated categories and values used in the modified riparian, channel and environmental inventory (RCE) across DZP Site and study area**



**Modified River descriptors, associated categories and values used in the modified riparian, channel and environmental inventory (RCE) across DZP Site and study area**

Descriptor	Category	Score	Site and Designation									
			A	B	C	D	E	F	G	H	I	J
Land use pattern beyond the immediate riparian zone	Undisturbed native vegetation	4										
	Mixed native vegetation and pasture/exotics	3	3						3			
	Mainly pasture, crops or pine plantation	2		2	2	2	2	2		2	2	2
	Urban	1										
Width of riparian strip of woody vegetation	More than 30 m	4										
	Between 5 and 30 m	3						3	3			
	Less than 5 m	2	2		2		2			2	2	2
	No woody vegetation	1		1		1						
Completeness of riparian strip of woody vegetation	Riparian strip without breaks in vegetation	4										
	Breaks at intervals of more than 50 m	3										
	Breaks at intervals of 10 - 50 m	2										
	Breaks at intervals of less than 10 m	1	1	1	1	1	1	1	1	1	1	1
Vegetation of riparian zone within 10 m of channel	Native tree and shrub species	4										
	Mixed native and exotic trees and shrubs	3										

Descriptor	Category	Score	Site and Designation									
			A	B	C	D	E	F	G	H	I	J
	Exotic trees and shrubs	2										
	Exotic grasses / weeds only	1	1	1	1	1	1	1	1	1	1	1
Stream bank structure	Banks fully stabilised by trees, shrubs	4										
	Banks firm but held mainly by grass and herbs	3	3					3	3		3	
	Banks loose, partly held by sparse grass etc.	2		2		2						2
	Banks unstable, mainly loose sand or soil	1					1			1		
Bank undercutting	None, or restricted by tree roots	4							4			
	Only on curves and at constrictions	3	3			3				3	3	
	Frequent along all parts of stream	2			2		2	2				2
	Severe, bank collapses common	1		1								
Channel form	Deep: width / depth ratio < 7:1	4										
	Medium: width / depth ratio 8:1 to 15:1	3			3	3		3				
	Shallow: width / depth ratio > 15:1	2	2	2			2		2	2	2	2
	Artificial: concrete or excavated channel	1										
Riffle / pool sequence	Frequent alternation of riffles and pools	4										

Descriptor	Category	Score	Site and Designation									
			A	B	C	D	E	F	G	H	I	J
	Long pools with infrequent short riffles	3						3				
	Natural channel without riffle / pool sequence	2	2	2	2	2	2		2	2	2	2
	Artificial channel; no riffle / pool sequence	1										
Retention devices in stream	Many large boulders and/or debris dams	4										
	Rocks / logs present; limited damming effect	3										3
	Rocks / logs present, but unstable, no damming	2						2		2		
	Stream with few or no rocks / logs	1	1	1	1	1	1		1		1	
Channel sediment accumulations	Little or no accumulation of loose sediments	4				4						
	Some gravel bars but little sand or silt	3			3			3				
	Bars of sand and silt common	2	2	2			2		2	2		
	Braiding by loose sediment	1									1	1
Stream bottom	Mainly clean stones with obvious interstices	4										
	Mainly stones with some cover of algae / silt	3			1			3				

Descriptor	Category	Score	Site and Designation									
			A	B	C	D	E	F	G	H	I	J
	Bottom heavily silted but stable	2	2		2				2			
	Bottom mainly loose and mobile sediment	1		1		1	1			1	1	1
Stream detritus	Mainly unsilted wood, bark, leaves	4										
	Some wood, leaves etc. with much fine detritus	3			3			3				3
	Mainly fine detritus mixed with sediment	2	2	2					2	2		
	Little or no organic detritus	1				1	1				1	
Aquatic vegetation	Little or no macrophyte or algal growth	4			4			4		4		
	Substantial algal growth; few macrophytes	3					3		3			
	Substantial macrophyte growth; little algae	2	2								2	2
	Substantial macrophyte and algal growth	1		1		1						
<b>Source:</b> Chessman <i>et al.</i> 1997			<b>26</b>	<b>19</b>	<b>26</b>	<b>23</b>	<b>21</b>	<b>33</b>	<b>29</b>	<b>25</b>	<b>22</b>	<b>24</b>

## **APPENDIX D**

### **Threatened communities, population and species with potential to occur within the Central West CMA**

Threatened communities, population and species with the potential to occur within the Central West CMA

EEC / Population / Species	Status	Description and Preferred Habitat	Likely Occurrence Along PSC
<b>Endangered Ecological Community</b>			
Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River	EEC-FM	<p>The aquatic ecological community of the Darling River includes all native fish and aquatic invertebrates within all natural creeks, rivers, streams and associated lagoons, billabongs, lakes, anabranches, flow diversions to anabranches and the floodplains of the Darling River within NSW, and includes the Macquarie River downstream from the Burrendong Dam and its tributaries. Excluded are the manmade / artificial canals, water distribution and drainage works, farm dams and off-stream reservoirs.</p> <p>Threats include:</p> <ul style="list-style-type: none"> <li>• Modification of natural river flows as a result of river regulation (dams, weirs).</li> <li>• Altered floodplain and wetland inundation as a result of instream structures.</li> <li>• Spawning failures resulting from cold water releases from dams.</li> <li>• Degradation of the riparian zone through clearing of native vegetation and stock access, leading to loss of shelter and increased sedimentation.</li> <li>• Removal of snags.</li> <li>• The presence of introduced fish species.</li> <li>• Agricultural practices such as irrigation runoff, clearing, grazing and the use of fertilisers and pesticides.</li> <li>• Overfishing.</li> </ul>	<p><b>Recorded.</b></p> <p>The aquatic communities of the Macquarie River, Little River, Wambangalang Creek and Cockabroo Creek below 500 m AHD would all support this EEC. Does not include farm dams across the DZP. Potential for direct and indirect impacts.</p>

EEC / Population / Species	Status	Description and Preferred Habitat	Likely Occurrence Along PSC
<b>Endangered Populations</b>			
Western NSW population of the Olive Perchlet, <i>Ambassis agassizii</i>	EP-FM	<p>Olive Perchlet is a small native fish with an oval shaped body with a moderately large mouth, very large eyes and a forked tail. Can grow to about 70-80 mm but are more commonly less than 60 mm. The western population is genetically distinct from the eastern population. This species inhabits rivers, creeks, ponds and swamps. They are usually found in slow-flowing or still waters, near overhanging vegetation or amongst logs, dead branches and boulders. They often congregate around suitable shelter (e.g. snags and vegetation) during the day but disperse during the night to feed on micro-crustaceans and insects, including larvae.</p> <p>Threats include: predation by introduced fish such as Eastern Gambusia and Redfin Perch, habitat degradation and loss, rapid fluctuations in water levels (due to river regulation) and cold water pollution restricting spawning.</p>	<p>Known from the CWCMA. Records from the Bogan River in 1995, 2002.</p> <p>Suitable habitat present in the Macquarie River, Little River and sections of the Wambangalang Creek and Hyandra Creek although likely to be at risk of predation by Eastern Gambusia and Redfin Perch.</p> <p>None recorded during DZP surveys.</p> <p>Unlikely to occur.</p>
<i>Tandanus tandanus</i> – Eel-tailed Catfish in the Murray/Darling Basin as an Endangered Population	EP-FM	<p>This species is naturally distributed throughout the Murray-Darling Basin and in the Eastern drainages of NSW north of Newcastle. <i>Tandanus tandanus</i> is non-migratory and lives in a wide range of habitats including rivers, creeks, lakes, billabongs and lagoons, and, although it inhabits flowing streams, prefers sluggish or still waters. Benthic and feeds on crustaceans (mainly yabbies and shrimp), molluscs, aquatic insects and small fish. Rare in natural riverine habitats but can be found in farm dams throughout inland NSW and southern Qld.</p>	<p><b>Recorded at</b> Wambangalang Creek at Site C - disused railway line creek crossing.</p> <p>Known from the CWCMA. Numerous records across the CMA including Macquarie and Little</p>

EEC / Population / Species	Status	Description and Preferred Habitat	Likely Occurrence Along PSC
		Threats include: Invasive species, cold water pollution, fishing pressures.	Rivers.  Potential for direct and indirect impacts.
<b>Species</b>			
Trout Cod <i>(Maccullochella macquariensis)</i>	E-FM E-EPBC	<p>The Trout Cod is a large, elongated, deep-bodied fish that is very similar in appearance to the Murray Cod. It can grow to 85 cm and 16 kg (mostly 50 cm and 1.5 kg). Endemic to the southern Murray-Darling river system, including the Murrumbidgee and Murray Rivers, and the Macquarie River in central NSW. It has been restocked into the Murrumbidgee and Macquarie Rivers over the last decade. Trout Cod are often found close to cover and in relatively fast currents, especially in fairly deep water close to the bank, and often congregate around snags. Tend to remain at the one site and to have small home ranges. They are carnivores, preying mainly on other fishes as well as crustaceans and aquatic insects.</p> <p>Threats include: modification of natural river flows and temperatures as a result of river regulation, habitat degradation, over-harvesting, competition from or interactions with introduced fish species.</p>	<p>Known from the CWCMA. Records in the Macquarie River &amp; anecdotal records from Little River.</p> <p>Unlikely to be present across the DZP Site.</p>
Murray Cod <i>(Maccullochella peelii peelii)</i>	V-EPBC	<p>Murray Cod is the largest freshwater fish found in Australia. It is a long-lived predatory species that is highly territorial and aggressive. It occurs naturally in the watercourses of the Murray–Darling Basin in a wide range of warm water habitats that range from clear, rocky streams to slow flowing turbid rivers and billabongs up to 5 m deep. . Generally found in areas sheltered by rocks, wood or overhanging banks. Wood debris is an essential habitat feature used for sheltering from currents. This species is mostly found in major rivers and larger tributaries.</p> <p>Threats include: modification of natural river flows and temperatures as a</p>	<p>Known from the CWCMA. Numerous records across the CMA including Macquarie and Little Rivers.</p> <p>Unlikely to be present across the DZP Site.</p>



EEC / Population / Species	Status	Description and Preferred Habitat	Likely Occurrence Along PSC
		result of river regulation and habitat degradation resulting in unsustainably low recruitment rates.	
Purple Spotted Gudgeon ( <i>Mogurnda adspersa</i> )	E-FM	<p>Small and robust fish with a rounded head, a relatively small mouth and a rounded tail and generally grow to between 7 and 12 cm in length. Occur in inland drainages of the Murray-Darling basin as well as coastal drainages of northern NSW and Qld. The western population was previously widespread in the Murray, Murrumbidgee and Lachlan River systems and tributaries of the Darling, but has experienced a significant decline in recent times. Now extremely rare in inland NSW and has only been recorded once since 1983. Prefer slow-moving or still waters of rivers, creeks and billabongs, often amongst weeds, rocks or large snags. Threats include:</p> <ul style="list-style-type: none"> <li>• Predation by introduced fish such as Gambusia and Redfin Perch.</li> <li>• Fluctuations in water levels as a result of river regulation.</li> <li>• Habitat degradation, particularly the loss of macrophytes.</li> </ul>	<p>Only known naturally occurring population in the Central West, 47 km south-east of DZP.</p> <p>Some potential habitat present in Macquarie and Little Rivers and some sections of Wambangalang Creek.</p> <p>Unlikely to be present.</p>
Silver Perch ( <i>Bidyanus bidyanus</i> )	V-FM	<p>Once widespread and abundant throughout most of the Murray-Darling system. The most abundant remaining natural population occurs in the central Murray River downstream of Yarrawonga Weir as well as several of its anabranches and tributaries (including the Edward River, an anabranch of the Murray which flows through Deniliquin and the Murrumbidgee River). Silver perch seem to prefer fast-flowing, open waters, especially where there are rapids and races, however they will also inhabit warm, sluggish water with cover provided by large woody debris and reeds.</p> <p>Threats include: modification of natural river flows and temperatures as a</p>	<p>Known from the CWCMA. Numerous records in the Macquarie River.</p> <p>Unlikely to be present across the DZP Site.</p>

EEC / Population / Species	Status	Description and Preferred Habitat	Likely Occurrence Along PSC
		result of river regulation, degradation of instream habitats, competition with introduced fish such as Gambusia and Redfin Perch, stocking of inappropriate genetic strains and disease carried by introduced species.	
River Snail ( <i>Notopala sublineata</i> )	E-FM	<p>Occurs in Darling River and its tributaries. The river snail once occurred in flowing rivers throughout the Murray-Darling system, where it was found along the banks attached to logs and rocks or crawling in the mud. Although now virtually extinct throughout its natural range, some populations have been recorded as surviving in artificial habitats (irrigation pipelines) in the Murray and Darling systems.</p> <p>Threats include:</p> <ul style="list-style-type: none"> <li>• Habitat modification as a result of river regulation.</li> <li>• Switch from bacterial biofilms (flowing waters) to algal dominated biofiles (still waters) as a result of river regulation.</li> <li>• Deliberate removal from irrigation pipelines on the Murray River.</li> </ul>	<p>No records from the CWCMA. No live specimens recorded in NSW for &gt; 30 years. Live specimen found in irrigation pipeline near Mildura.</p> <p>Unlikely to be present due to the modification of habitat.</p>
<p><b>Note:</b> EPBC = <i>Environment Protection and Biodiversity Conservation Act 1999</i>, FM = <i>NSW Fisheries Management Act 1994</i>, EEC = Endangered Ecological Community, V = Vulnerable, E = Endangered</p> <p><b>Source:</b> NSW DPI Fisheries. CWCMA = Central West Catchment Management Authority.</p>			

## **ATTACHMENT E**

### **Assessment under the EPBC Act**

### Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The criteria detailed in the *EPBC Act Policy Statement 1.1 – Significant Impact Guidelines: Matters of National Environmental Significance* (DEH 2006) were used to assess the significance of likely impacts as a consequence of the proposed DZP on Murray Cod (*Maccullochella peelii peelii*) and Trout Cod (*Maccullochella macquariensis*).

### Endangered Listing

**Trout Cod (*Maccullochella macquariensis*)** is listed as Endangered under the FM Act and EPBC Act. It is known from the Central West CMA and there are records from the Macquarie River and anecdotal records from Little River (Little River Landcare Group Inc. 2001a&b). The Trout Cod is a large, elongated, deep-bodied fish that is very similar in appearance to the Murray Cod. It is endemic to the southern Murray-Darling river system, including the Murrumbidgee and Murray Rivers, and the Macquarie River in central NSW. However, this species has undergone a dramatic decline in its range and abundance and the only known natural population is now restricted to the Murray River from below Yarrawonga Weir to Strathmerton. This species has been restocked with hatchery-bred Trout Cod into the Murrumbidgee and Macquarie Rivers over the last decade. Trout Cod are often found close to cover and in relatively fast currents, especially in fairly deep water close to the bank, and often congregate around snags. They tend to remain at the one site and to have small home ranges. They are carnivores, preying mainly on other fishes as well as crustaceans and aquatic insects.

Given its preference for relatively fast currents and fairly deep water, it is unlikely that this species would be present across the DZP Site due to lack of habitat. However, there is potential habitat for this species around the off-take site within Macquarie River and in downstream habitats within the catchment and consequently this species could potentially be indirectly impacted by this proposal.

### Significant Impact Criteria for Endangered Species and Critically Endangered Species

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- *Lead to a long-term decrease in the size of a population;*

Given the Trout Cod's preference for relatively fast currents and fairly deep water, it is unlikely that this species would be present across the DZP Site due to lack of habitat. Suitable habitat downstream within the catchment could potentially be indirectly impacted by this proposal through erosion and sedimentation during construction of the DZP or leakage of sedimentation ponds and chemical spills (e.g. fuel and reagents) during operation of the facility. Given that an Erosion and Sedimentation Control Plan would be prepared for the construction and operation of the site and that all storage areas for chemicals would be bunded and sedimentation ponds would be lined, the opportunities for downstream impacts would be minimal and hence a long-term decrease in the size of a population of Trout Cod is unlikely to occur.

Impacts at the water pipeline off-take site in the Macquarie River also have the potential to affect the long-term survival of populations of this species through entrainment of larvae and juveniles and mechanical damage through contact with the pumps and pipes. To reduce these potential impacts a vertically mounted axial flow pump would be located outside of the river channel (on the bank) and the intake pipe would be fitted with a Johnson screen (2 mm mesh) to reduce the potential for entrainment and mechanical damage of eggs, larvae and juveniles.

- *Reduce the area of occupancy of the species;*

The watercourses of the DZP Site are unlikely to provide habitat for the Trout Cod due to its preference for waterways with complex habitat including deep fast flowing waters, sand, silt or clay substrata combined with shallow pools interspersed with riffles and cascades. This species may occur within the Macquarie River and Little River. Habitat from these areas would not be removed and therefore a reduction in any area occupied by the Trout Cod is not anticipated.

- *Fragment an existing population into two or more populations;*

The proposal is unlikely to disrupt the movement of individuals to such an extent that it would fragment a population as available habitat is unlikely to support a population of Trout Cod and any instream crossings would comply with the *Guidelines and Policies for Aquatic Habitat Management and Fish Conservation* (NSW Fisheries 1999) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge 2003). Therefore it is unlikely that the DZP would cause the fragmentation of an existing population.

- *Adversely affect habitat critical to the survival of a species;*

Habitat has not been identified as critical habitat within a recovery plan for this species or listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act (SEWPaC 2012c) or identified in a recovery plan.

- *Disrupt the breeding cycle of a population;*

It is unknown if any Trout Cod released into the upper Macquarie River over the past decade have survived to sexual maturity and if so whether they have established a breeding population (Trout Cod Recovery Team 2008). Nonetheless, the DZP would have little overall impact on the Macquarie River or Little River and consequently it is unlikely that it would disrupt the breeding cycle of a population if a breeding population is present.

- *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;*

It is unlikely that the construction or operation of the DZP would substantially alter any habitat for the Trout Cod within the Macquarie River or Little River given that the current flow regimes would be unlikely to be substantially altered and that implementation of an Erosion and Sedimentation Control Plan would stringently applied.

- *Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;*

There are seven invasive fish species known to occur in the watercourses of the Central West CMA including Goldfish, Common Carp, Eastern Gambusia, Rainbow Trout, Redfin Perch, Brown Trout and Brook Trout. The abstraction of water from the Macquarie River has low risk of entrainment of larvae or juveniles of these species due to the fitting of a 2 mm mesh to the intake pipe and it is considered unlikely that this proposal would assist any of these invasive species in becoming established in areas in which they are not currently recorded as water would not be transferred between watercourses.

- *Introduce disease that may cause the species to decline; or*

The construction and operation of the DPZ is unlikely to promote the introduction of disease.

- *Interfere with the recovery of the species.*

Recognised threats to this species include removal of large woody debris (desnagging), river regulation, barriers to movements, loss to irrigation, poor water quality, siltation, altered water temperatures, predation and competition, recreational fishing, hybridisation, disease, and low genetic diversity. The overall objective of the National Recovery Plan for this species is to minimise the probability of extinction of the Trout Cod in the wild, and to increase the probability of important populations becoming self-sustaining in the long term by reducing these recognised threats (Trout Cod Recovery Team 2008).

The NSW Trout Cod Recovery Plan also aims to ensure the recovery and natural viability of Trout Cod populations throughout their former range in NSW and list recovery actions such as including habitat protection and restoration, reduction of the impact of illegal fishing and incidental capture, minimising risks from inter-specific competition and introduced species, establishing new populations through stocking, research and monitoring and community awareness involvement and support (DPI 2006).

The DZP is unlikely to interfere with the recovery of the Trout Cod or contribute to recognised threats as the likelihood that it would have a real impact on the Macquarie River system is low given that water abstraction would be regulated in line with water volumes within the Macquarie River and that the off-take system has been designed with the intent of protecting aquatic diversity. In addition, the opportunity for indirect impacts on the Macquarie and Little Rivers is likely to be remote given that a stringent Erosion and Sedimentation Control Plan would be implemented reducing the likelihood of downstream habitats being affected through on-site pollution.

## Conclusion

It is unlikely that the DZP would impact any local or regional population of Trout Cod as this species is unlikely to occur across the DZP Site and any potential off-site impacts would be managed and mitigated with stringent on-site management measures.

**Murray Cod (*Maccullochella peelii peelii*)** is listed as Vulnerable under the EPBC Act. It is the largest freshwater fish found in Australia (grows up to 1.8 m in length and can weigh > 100 kg) and is a long-lived predatory species that is highly territorial and aggressive. It occurs naturally in the watercourses of the Murray–Darling Basin in a wide range of warm water habitats that range from clear, rocky streams to slow flowing turbid rivers and billabongs up to 5 m deep. During spring and early summer (at temperatures between 15 – 21 °C) during flood events Murray Cod migrate upstream prior to spawning. Distances travelled vary among individuals but many travel 40 or 50 km and some 120 km (SEWPaC 2013). Overfishing, river regulation, sedimentation and barriers to passage have caused dramatic declines in their abundance and hence the species is now patchily distributed across its historical range. Murray Cod is generally found in areas sheltered by rocks, wood or overhanging banks, with wood debris acting as an essential habitat feature used for sheltering from currents. This species is mostly found in the major rivers and larger tributaries and is considered a main channel specialist (SEWPaC 2013). Whilst Murray Cod are known from the Macquarie River and anecdotal reports suggest their presence in the Little River, it is unlikely that any of the smaller tributaries across the DZP study area would regularly provide habitat for this species.

## **Significant Impact Criteria for Vulnerable Species**

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- *Lead to a long-term decrease in the size of an important population of a species;*

Murray Cod's preference for deep waters means that it is unlikely that this species would be present across the DZP Site due to lack of habitat, although it is known from the broader study area and locality. Suitable habitat downstream within the catchment has the potential to be indirectly impacted by this proposal through erosion and sedimentation during construction of the DZP or chemical spills (e.g. fuel and reagents) during operation of the facility. Given that an Erosion and Sedimentation Control Plan would be prepared for the construction and operation of the site and that all storage areas for chemicals would be bunded and sedimentation ponds would be lined, the opportunities for downstream impacts would be minimal and hence a long-term decrease in the size of a population of Murray Cod is unlikely to occur.

Impacts at the water pipeline off-take site in the Macquarie River also have the potential to affect the long-term survival of populations of this species through entrainment of larvae and juveniles and mechanical damage through contact with the pumps and pipes. To reduce these potential impacts a vertically mounted axial flow pump would be located outside of the river channel (on the bank) and the intake pipe would be fitted with a Johnson screen (2 mm mesh) to reduce the potential for entrainment and mechanical damage of eggs, larvae and juveniles.

- *Reduce the area of occupancy of an important population;*

The watercourses of the DZP Site are unlikely to provide habitat for the Murray Cod due to its preference for deep water (up to 5 m deep). However, this species is known to occur within the study area and locality, including within the Macquarie River and Little River. Habitat from these areas would not be removed and therefore a reduction in any area occupied by the Murray Cod is not anticipated.

- *Fragment an existing important population into two or more populations;*

The DZP proposal is unlikely to disrupt the movement of individuals to such an extent that it would fragment a population as available habitat is unlikely to support Murray Cod and any instream crossings would comply with the *Guidelines and Policies for Aquatic Habitat Management and Fish Conservation* (NSW Fisheries 1999) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge 2003). Therefore it is unlikely that the DZP would cause the fragmentation of an existing population.

- *Adversely affect habitat critical to the survival of a species;*

Habitat has not been identified as critical habitat within a recovery plan for this species or listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act (SEWPaC 2012c) or identified in a recovery plan.

- *Disrupt the breeding cycle of an important population;*

Murray Cod may move upstream in the Macquarie River and Little River for spawning and this is generally initiated by flood events (National Murray Cod Recovery Team 2009). This proposal

would not result in significant changes to flow regimes or changes to the movement of water across the floodplain during flood events so it is unlikely to disrupt the breeding cycle of this species.

- *Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;*

It is unlikely that the construction or operation of the DZP would substantially alter any habitat for the Murray Cod within the Macquarie River or Little River through destruction of habitat or reduction in water quality given that an Erosion and Sedimentation Control Plan would be developed and stringently applied.

- *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;*

There are seven invasive fish species known to occur in the watercourses of the Central West CMA Goldfish, Common Carp, Eastern Gambusia, Rainbow Trout, Redfin Perch, Brown Trout and Brook Trout. The abstraction of water from the Macquarie River has low risk of entrainment of larvae or juveniles of these species and it is considered unlikely that this proposal would assist any of these invasive species in becoming established in areas in which they are not currently recorded as water would not be transferred between watercourses.

- *Introduce disease that may cause the species to decline; or*

The construction and operation of the DPZ is unlikely to promote the introduction of disease.

- *Interfere substantially with the recovery of the species.*

Regulation of flows, habitat degradation, lowered water quality, barriers to movement, alien species, commercial and recreational fishing, illegal fishing, genetic diversity, disease, stocking and translocation and climate change are all recognised threats to this species. The National Recovery Plan for the Murray Cod (National Murray Cod Recovery Team 2010) aims to have self-sustaining populations managed for conservation, fishing and culture. This aim would be achieved through research to determine the distribution, structure and dynamics of this species across the Murray-Darling Basin, management of river flows to enhance recruitment, determination of habitat requirements for all life stages and management of recreational fishing. The DZP is unlikely to interfere with the recovery of this species given that substantial changes to flow regimes and removal of habitat would not occur during construction or operation.

## Conclusion

It is unlikely that the DZP would impact any local or regional population of Murray Cod as this species is unlikely to occur across the DZP Site and any potential off-site impacts would be managed and mitigated with stringent on-site management measures.



## **ATTACHMENT F**

### **Assessment of Significance Under the EP&A Act**

## Assessment of Significance

### Background

An assessment of the significance of impacts of the DZP on species, populations and ecological communities listed under the *Fisheries Management Act 1994* (FM Act) have been prepared in accordance with the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC 2007) as requested by NSW DPI – Fisheries (**Appendix A**: DGRs). The EEC, populations and species addressed include those listed here, and the assessment for each matter is provided below.

### Endangered Ecological Community

- Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River (Darling River EEC)

### Endangered Population

- Western NSW population of the Olive Perchlet, *Ambassis agassizii*; and
- *Tandanus tandanus* – Eel-tailed Catfish in the Murray/Darling Basin as an Endangered Population.

### Species

- Trout Cod;
- Purple Spotted Gudgeon; and
- Silver Perch.

### ENDANGERED ECOLOGICAL COMMUNITY

***Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River (Darling River EEC).*** This community is listed as an Endangered Ecological Community under the FM Act and is known to occur within the region. This EEC was recorded across the DZP Site, study area and locality.

The Aquatic Ecological Community of the Darling River includes all native fish and aquatic invertebrates within all natural creeks, rivers, streams and associated lagoons, billabongs, lakes, anabranches, flow diversions to anabranches and the floodplains of the Darling River within NSW, and includes the Macquarie River downstream from the Burrendong Dam and its tributaries. Excluded are man-made / artificial canals, water distribution and drainage works, farm dams and off-stream reservoirs (NSW DPI Fisheries 2007, Fisheries Scientific Committee 2010). Aquatic communities of the Macquarie River, Little River, Wambangalang Creek, and Cockabroo Creeks all support fragmented habitat for this EEC as:

- These are natural creeks and rivers of the Darling River system;
- The Macquarie River within the study area and its tributaries (i.e. Little River, Wambangalang Creek, Cockabroo Creek) are all downstream of the Burrendong Dam;
- A number of species which characterise this community were recorded in these watercourses; and
- These watercourses provide habitat for a larger range of aquatic animal species than was recorded during these surveys.

There are a number of recognised threats to this EEC:

- Modification of natural flows as a result of river regulation;
- Altered floodplain and wetland inundation as a result of instream structures;
- Spawning failures resulting cold water releases from dams;
- Degradation of the riparian and floodplain zones through clearing of native vegetation;
- Removal of snags;
- Presence of introduced fish; and
- Agricultural practices and overfishing.

- a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

Not applicable.

- b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

Not applicable.

- c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**
- I. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
  - II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

The operation and construction of the DZP is likely to partially alter the hydrology of the catchment through the removal of headwaters and the construction of storage facilities and associated infrastructure thereby reducing the extent of the local occurrence of the EEC. As a consequence, the already degraded and fragmented EEC may experience further impacts. However, the impacts will be localised and it is unlikely that the construction and operation of the DZP would place this EEC at risk of local extinction.

- d) **In relation to the habitat of a threatened species, population or ecological community:**
- I. **The extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
  - II. **Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
  - III. **The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

All naturally occurring watercourses up to 500 m AHD (i.e. watercourses excluding artificial drainages and dams) across the locality and study site and area are considered to form a part of the Darling River EEC. The headwaters and unnamed tributaries of the Cockabroo Creek, Wambangalang Creek and Macquarie River would be altered and the hydrology in the catchment changed due to the construction of storage areas and other associated infrastructure. These changes alone are unlikely to cause such serious disruption that this EEC could become significantly more fragmented and isolated from other areas and cause impacts on the long-term survival of the community.

- e) **Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**

Critical habitat has not been declared for this community.

- f) **Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**

There is currently no recovery plan or threat abatement plan for this EEC. Recognised threats for the Darling River EEC include, modification of natural flows as a result of river regulation, altered floodplain and wetland inundation as a result of instream structures, spawning failures resulting cold water releases from dams, degradation of the riparian and floodplain zones through clearing of native vegetation, removal of snags, presence of introduced fish, agricultural practices and overfishing.

Recovery strategies to address these threats include management and dissemination of existing information, remediation of fish passage, protection and reinstatement of large woody debris, restoration of riparian vegetation, pest species eradication and control and advice to consent and determining authorities.

The DZP will result in the remediation of fish passage at several of the existing road and railway crossings by installing watercourse crossings in accordance with *Guidelines and Policies for Aquatic Habitat Management and Fish Conservation* (NSW Fisheries 1999) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge 2003), large woody debris would be retained and reinstated where possible, riparian vegetation would be restored and sections rehabilitated as a part of the overall biodiversity offsets for the DZP. Consequently the construction and operation of the DZP is unlikely to substantially impede the implementation of any of these recovery strategies.

**g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

Key threatening processes of relevance to this proposal include:

- *Removal of large woody debris from New South Wales rivers and streams.* Woody debris within streams provide important habitat for many aquatic species. To minimise any potential impacts woody debris encountered within streams during construction would be relocated within the stream adjacent to the construction area;
- *Degradation of native riparian vegetation along New South Wales water courses.* The majority of water courses within the DZP Site, study area and locality are severely degraded and the majority do not support intact riparian habitat. Further removal of vegetation along the banks of these water courses would be avoided wherever possible;
- *Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams.* The off-take site for the water pipeline in the Macquarie River has been designed to minimise the impacts on biodiversity through the installation of a Johnson screen which reduces the opportunity for damage and entrainment of larvae and individuals and reduces velocities across the screen. All new and upgraded crossings of watercourses would be designed and installed in accordance with *Guidelines and Policies for Aquatic Habitat Management and Fish Conservation* (NSW Fisheries 1999) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge 2003). .

## **Conclusion**

The DZP is unlikely to substantially impact this EEC within the local catchment as flows would not significantly change from current levels, woody debris removed during construction would be replaced or relocated and riparian areas would be rehabilitated as part of the biodiversity offsets for this project. Consequently, it is considered that this proposal would not significantly impact this EEC.

## **ENDANGERED POPULATIONS**

**Western NSW population of the Olive Perchlet, *Ambassis agassizii*** is known from the Central West CMA. This once widespread population has suffered a serious decline and is now found only at a few sites in the Darling River drainage upstream of Bourke where it inhabits rivers, creeks, ponds and swamps. The most recent records of this species are from the Bogan River (1995, 2002), Dumaresq River (2003, 2004, 2005), Lachlan River (2008) and Mole River (2008) (NSW DPI Fishing and Aquaculture, Records Viewer 2012b, accessed July 2012).

They are usually found in slow-flowing or still waters, often near overhanging vegetation or amongst logs, dead branches and boulders. They often congregate around suitable shelter (e.g. large woody debris (snags) and vegetation) during the day but disperse during the night to feed on micro-crustaceans and insects, including larvae (Fisheries Scientific Committee 2009, McNeil *et al.* 2008).

It is considered unlikely that this species would occur in the watercourses of the DZP Site as the waterways across the DZP are ephemeral headwaters and / or highly degraded creeks suffering from many of the recognised threats for this species. It is more likely that this species may occur within the wider study area and locality.

- a) **In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

Not a threatened species.

- b) **In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

It is considered unlikely that this species would occur in the watercourses of the DZP Site as the waterways across the DZP are ephemeral headwaters and / or highly degraded creeks suffering from many of the recognised threats for this species. It is more likely that this species could occur within the wider study area and locality. Given that a population of the Olive Perchlet is very unlikely to be directly impacted by this proposal and that mitigation measures would be implemented to ensure that off-site impacts such as sedimentation and pollution of watercourses does not occur it would seem very unlikely that this project would adversely affect the life cycle of a local population of this species to such an extent that it would be placed at risk of extinction.

- c) **In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**
- I. **Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
  - II. **Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not an endangered ecological community.

- d) **In relation to the habitat of a threatened species, population or ecological community:**
- I. **The extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
  - II. **Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
  - III. **The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

Aquatic habitat is limited within the DZP Site and study area. Areas with permanent water tend to be degraded due to past vegetation removal and surrounding land uses including agriculture and roads. The remaining aquatic habitat tends to be ephemeral and of low water quality. It is unlikely that impacts associated with this proposal would significantly affect a population of the Olive Perchlet to such an extent that it would threaten the survival of these species as direct impacts would occur in unsuitable habitat and indirect impacts to the waterways of the larger area would be mitigated against and minimised.

- e) **Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**

No area of critical habitat has been declared for this population.

- f) **Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**

There is currently no recovery plan or threat abatement plan for this population.

Recognised threats to the population of Olive Perchlet are known to include predation by introduced fish, habitat degradation, rapid fluctuations in water levels as a result of river regulation and spawning failures due to cold water releases from dams.

Four priority recovery strategies have been developed and these include surveying and mapping of the population, monitoring, community and landholder liaison and education and preparation of a recovery plan. The DZP would not inhibit these priority recovery strategies from being successfully implemented.

- g) **Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

Key threatening processes of relevance to this proposal include:

- *Removal of large woody debris from New South Wales rivers and streams.* Woody debris within streams provide important habitat for many aquatic species. To minimise any potential impacts woody debris encountered within streams during construction would be relocated within the stream adjacent to the construction area;
- *Degradation of native riparian vegetation along New South Wales water courses.* The majority of water courses within the DZP Site, study area and locality are severely degraded and the majority do not support intact riparian habitat. Further removal of vegetation along the banks of these water courses would be avoided wherever possible;
- *Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams.* The off-take site for the water pipeline in the Macquarie River has been designed to minimise the impacts on biodiversity through the installation of a Johnson screen which reduces the opportunity for damage and entrainment of larvae and individuals and reduces velocities across the screen. All new and upgraded crossings of watercourses would be designed and installed in accordance with *Guidelines and Policies for Aquatic Habitat Management and Fish Conservation* (NSW Fisheries 1999) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge 2003).

## Conclusion

It is unlikely that the DZP would impact any local or regional population of Olive Perchlet as this species is unlikely to occur across the DZP Site and any potential off-site impacts would be managed and mitigated with stringent on-site management measures.

***Tandanus tandanus* – Eel-tailed Catfish in the Murray / Darling Basin** was recorded within the Wambangalang Creek at Site C where the disused railway line crosses the creek via a trestle bridge. This site consisted of a number of still, turbid pools up to 1.5 m in depth with some containing large snags. This species may also be present in other sections of the creek with suitable habitat (e.g. deep pools and snags) as well as within the Macquarie and Little Rivers.

These individuals are a part of the *Eel-tailed Catfish in the Murray / Darling Basin Endangered Population* listed under the NSW FM Act (Fisheries Scientific Committee 2008). Eel-tailed Catfish numbers in the Murray-Darling Basin have declined due to a range of impacts including invasive species, habitat degradation, cold water pollution and fishing pressures and are now almost absent from the Murray, Murrumbidgee and Lachlan catchments.

This species is naturally distributed throughout the Murray-Darling Basin and in the eastern drainages of NSW north of Newcastle. *Tandanus tandanus* is non-migratory and lives in a wide range of habitats including rivers, creeks, lakes, billabongs and lagoons, and although it inhabits flowing streams, it prefers sluggish or still waters. It can be found in clear to turbid waters, and over substrates ranging from mud to gravel and rock. This species is a carnivore that feeds on crustaceans (mainly yabbies and shrimp), molluscs, aquatic insects and small fish. It is a benthic species that lives, feeds and breeds near the bottom. The Eel-tailed Catfish can grow up to 900 mm and 6.8 kg although individuals over 2 kg are uncommon (Fisheries Scientific Committee 2008). It is rare in natural riverine habitats but can be found in farm dams throughout inland NSW and southern Queensland. Moderate remnant populations occur in the Macquarie catchment upstream of Warren, the Castlereagh catchment upstream of Mendooran, the Namoi catchment upstream of Wee Waa, the Gwydir catchment upstream of Moree and the Border Rivers catchment upstream of Goondiwindi. Eel-tailed Catfish numbers in the Murray-Darling Basin have declined due to a range of impacts including competition from invasive species, habitat degradation, cold water pollution and fishing pressures and are now virtually absent from the Murray, Murrumbidgee and Lachlan catchments.

- a) **In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

Not a threatened species.

- b) **In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

The Eel-tailed Catfish is particularly susceptible to localised disturbance due to a lack of distinct spawning or dispersal migration and these life history characteristics makes it slow to recolonise. Changes to flow regimes including temporal flow patterns and the magnitude of flows can lead to reduced reproductive success and sedimentation can smother substrata used for nest building.

The recorded Catfish population in Wambangalang Creek near Toongi has the potential to be impacted by this proposal through disturbance associated with the upgrading of the wooden rail bridge located approximately 50 m downstream from the recorded population as well as through indirect impacts associated with the potential decrease in water quality.



Reconstruction of the bridge across Wambangalang Creek should be undertaken in such a manner as to not to impact upstream habitat or change the current habitat regime supporting *Tandanus tandanus*. The design principles outlined in the *Guidelines and Policies for Aquatic Habitat Management and Fish Conservation* (NSW Fisheries 1999) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge 2003) should be incorporated into the design of the bridge. During construction of the new bridge or restoration of the old bridge, flows should be maintained within the creek which reflects the conditions at the time of construction.

An adaptive management plan would be developed specifically for the protection and conservation of the Endangered Population of the Eel-tailed Catfish at Toongi. These measures to protect and enhance the habitat of the Eel-tailed Catfish (e.g. erosion and sedimentation control and protection of habitat during construction of the rail bridge) will minimise the opportunity for impacts on the life cycle of the Catfish during construction.

- c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**
- I. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
  - II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not an endangered ecological community.

- d) In relation to the habitat of a threatened species, population or ecological community:**
- I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
  - II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
  - III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

It is likely that the local population of Catfish recorded at the remnant pool at Toongi would be near the upstream extent of habitat suitable for the Eel-tailed Catfish as Wambangalang Creek becomes shallower and more ephemeral past this point. The series of waterholes along this section of the creek would provide refuge for this species and are considered important for the ongoing survival of this local population of the Eel-tailed Catfish.

- e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**

No area of critical habitat has been declared for this population.

**f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**

There are currently no recovery plans and strategies or threat abatement plans for this population.

Likely threats to the population of the Eel-tailed Catfish include historic commercial fishing; loss of habitat (lakes, billabongs, lagoons) through river regulation, interactions with introduced species, loss of habitat and spawning sites through siltation, reduced success of spawning and recruitment, and loss of habitat due to alterations to flow patterns and flooding regimes; reduced habitat and loss of temperature spawning cues due to cold-water discharge from the base of large dams and high-level weirs, loss of aquatic plants, chemical pollution, including agricultural pesticides (Fisheries Scientific Committee 2008).

It is possible that the DZP could exacerbate key threats such as loss of habitat through direct and indirect impacts associated with construction.

**g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

Key threatening processes of relevance to this proposal include:

- *Removal of large woody debris from New South Wales rivers and streams.* Woody debris within streams provide important habitat for many aquatic species. To minimise any potential impacts woody debris encountered within streams during construction would be relocated within the stream adjacent to the construction area;
- *Degradation of native riparian vegetation along New South Wales water courses.* The majority of water courses within the DZP Site, study area and locality are severely degraded and the majority do not support intact riparian habitat. Further removal of vegetation along the banks of these water courses would be avoided wherever possible;
- *Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams.* The off-take site for the water pipeline in the Macquarie River has been designed to minimise the impacts on biodiversity through the installation of a Johnson screen which reduces the opportunity for damage and entrainment of larvae and individuals and reduces velocities across the screen. All new and upgraded crossings of watercourses would be designed and installed in accordance with *Guidelines and Policies for Aquatic Habitat Management and Fish Conservation* (NSW Fisheries 1999) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge 2003). .

## **Conclusion**

Stringent environmental management of the upgrade of the wooden rail bridge across Wambangalang Creek will be required to ensure that the Toongi population of the Eel-tailed Catfish is protected during construction and these management measures are outlined in Section 7. With these management and mitigation measures in place it is considered that this population could be adequately protected to such an extent that this project would be unlikely to significantly impact this endangered population.

## AQUATIC FAUNA

**Trout Cod (*Maccullochella macquariensis*)** is listed as Endangered under the FM Act and EPBC Act. It is known from the Central West CMA and there are records from the Macquarie River and anecdotal records from Little River (Little River Landcare Group Inc. 2001a&b). The Trout Cod is a large, elongated, deep-bodied fish that is very similar in appearance to the Murray Cod. It is endemic to the southern Murray-Darling river system, including the Murrumbidgee and Murray Rivers, and the Macquarie River in central NSW. However, this species has undergone a dramatic decline in its range and abundance and the only known natural population is now restricted to the Murray River from below Yarrawonga Weir to Strathmerton. This species has been restocked with hatchery-bred Trout Cod into the Murrumbidgee and Macquarie Rivers over the last decade. Trout Cod are often found close to cover and in relatively fast currents, especially in fairly deep water close to the bank, and often congregate around snags. They tend to remain at the one site and to have small home ranges. They are carnivores, preying mainly on other fishes as well as crustaceans and aquatic insects.

Given its preference for relatively fast currents and fairly deep water, it is unlikely that this species would be present across the DZP Site due to lack of habitat. However, there is potential habitat for this species around the off-take site within Macquarie River and in downstream habitats within the catchment and consequently this species could potentially be indirectly impacted by this proposal.

- a) **In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

It is unknown if any Trout Cod released into the upper Macquarie River over the past decade have survived to sexual maturity and if so whether they have formed a breeding population (Trout Cod Recovery Team 2008). Nonetheless, the DZP would have little overall impact on the Macquarie River or Little River and consequently it is unlikely that it would disrupt the life cycle of a population if a breeding population is present.

Given the Trout Cod's preference for relatively fast currents and fairly deep water, it is unlikely that this species would be present across the DZP Site due to lack of habitat. Potential habitat downstream within the catchment could be indirectly impacted by this proposal through erosion and sedimentation during construction of the DZP or chemical spills (e.g. fuel and reagents) during operation of the facility. Given that an Erosion and Sedimentation Control Plan would be prepared for the construction and operation of the site and that all storage areas for chemicals would be bunded and sedimentation ponds lined, the opportunities for downstream impacts would be minimal and hence a long-term decrease in the size of a population of Trout Cod is unlikely to occur.

Impacts at the off-take site of the water pipeline in the Macquarie River also have the potential to affect the life-cycle of this species through entrainment of larvae and juveniles, and mechanical damage through contact with the pumps and pipes. To reduce the potential for entrainment the intake pipe will be fitted with a Johnson screen (mesh size = 2 mm) and the pump would be installed out of the channel and on the bank to avoid mechanical damage of aquatic biodiversity.

- b) **In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

Not an endangered population.

- c) **In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**
- I. **Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
  - II. **Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not an endangered ecological community.

- d) **In relation to the habitat of a threatened species, population or ecological community:**
- I. **The extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
  - II. **Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
  - III. **The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

It is unlikely that the construction or operation of the DZP would substantially alter any habitat for the Trout Cod within the Macquarie River or Little River given that the current flow regimes would be unlikely to be substantially altered and that implementation of an Erosion and Sedimentation Control Plan would stringently applied.

- e) **Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**

No area of critical habitat has been declared for this species.

- f) **Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**

Recognised threats to this species include removal of large woody debris (desnagging), river regulation, barriers to movements, loss to irrigation, poor water quality, siltation, altered water temperatures, predation and competition, recreational fishing, hybridisation, disease, and low genetic diversity. The overall objective of the National Recovery Plan for this species is to minimise the probability of extinction of the Trout Cod in the wild, and to increase the probability of important populations becoming self-sustaining in the long term by implanting measures to reduce these recognised threats (Trout Cod Recovery Team 2008).

The NSW Trout Cod Recovery Plan also aims to ensure the recovery and natural viability of Trout Cod populations throughout their former range in NSW and list recovery actions such as including habitat protection and restoration, reduction of the impact of illegal fishing and incidental capture, minimising risks from inter-specific competition and introduced species,

establishing new populations through stocking, research and monitoring and community awareness involvement and support (DPI 2006).

The DZP is unlikely to interfere with the recovery of the species as the likelihood that it would have a real impact on the Macquarie River system is low given that water abstraction would be regulated in line with water volumes within the Macquarie River and that the off-take system has been designed with the intent of protecting aquatic diversity. In addition, the opportunity for indirect impacts on the Macquarie and Little Rivers is likely to be remote given that a stringent Erosion and Sedimentation Control Plan would be implemented reducing the likelihood of downstream habitats being affected through on-site pollution.

**g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

Key threatening processes of relevance to this proposal includes:

- *Removal of large woody debris from New South Wales rivers and streams.* Woody debris within streams provide important habitat for many aquatic species. To minimise any potential impacts woody debris encountered within streams during construction would be relocated within the stream adjacent to the construction area;
- *Degradation of native riparian vegetation along New South Wales water courses.* The majority of water courses within the DZP Site, study area and locality are severely degraded and the majority do not support intact riparian habitat. Further removal of vegetation along the banks of these water courses would be avoided wherever possible;
- *Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams.* The off-take site for the water pipeline in the Macquarie River has been designed to minimise the impacts on biodiversity through the installation of a Johnson screen which reduces the opportunity for damage and entrainment of larvae and individuals and reduces velocities across the screen. All new and upgraded crossings of watercourses would be designed and installed in accordance with *Guidelines and Policies for Aquatic Habitat Management and Fish Conservation* (NSW Fisheries 1999) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge 2003).

## Conclusion

It is unlikely that the DZP would impact any local or regional population of Trout Cod as this species is unlikely to occur across the DZP Site and any potential off-site impacts would be managed and mitigated with stringent on-site management measures.

**Purple Spotted Gudgeon (*Mogurnda adspersa*)** is listed as Endangered under the FM Act. It was once common and widely distributed throughout south-eastern Australia (Faulks *et al.* 2008) but is now extremely rare in inland NSW, having been recorded from this area only once since 1983. They are generally found in slow-moving or still waters (Boxall *et al.* 2002) of rivers, creeks and billabongs, often amongst weeds, rocks or large snags (Llewellyn 2006). The only known naturally occurring population in the Central West is 47 km south-east of the DZP Site in a small tributary that flows into the Macquarie River downstream from the Burrendong dam wall. The Wuuluman Creek site is

approximately 1 km upstream from the creeks confluence with the Macquarie River. The pools are free from other fish species. Carp and Redfin have been known to swim upstream during floods as far as the site, but do not survive when water levels drop. The aquatic habitat quality is good with abundant Cumbungi and aquatic macrophytes. *In-situ* rocks are abundant and water depth was over 2 m when inspected. This pool is persistent and has reportedly never dried (David Ward, pers. comm. February 2012).

Recognised threats to the ongoing survival of this species include:

- Predation by introduced fish such as Gambusia and Redfin Perch;
- Habitat degradation, particularly the loss of aquatic plants; and
- Fluctuations in water levels as a result of river regulation, leading to negative impacts on reproduction and recruitment.

There is potential habitat present in Macquarie and Little Rivers and some very marginal habitat in sections of Wambangalang Creek. However, this species is extremely vulnerable to competition from Eastern Gambusia which occurs throughout the DZP Site and study area, making it less likely that a population of this species would occur.

- a) **In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

It is unlikely that this species is present across the DZP Site and study area due to lack of suitable habitat and the presence of invasive species such as Eastern Gambusia and Redfin Perch, which are common. However if it is present, it is unlikely that this species would be adversely impacted as any potential habitat would remain largely unaffected by this proposal

- b) **In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

Not an endangered population.

- c) **In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**

- I. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not an endangered ecological community.

- d) In relation to the habitat of a threatened species, population or ecological community:**
- I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
  - II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
  - III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

Habitat for the Purple Spotted Gudgeon could be impacted through smothering of aquatic vegetation by siltation as a result of erosion, removal of woody debris and the persistence of macrophyte beds.

However, it is unlikely that the construction or operation of the DZP would substantially alter any habitat for the Purple Spotted Gudgeon within the study area given that the current flow regimes would be unlikely to be substantially altered, that woody debris would be redeployed and that implementation of an Erosion and Sedimentation Control Plan would stringently applied.

- e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**

No area of critical habitat has been declared for this species.

- f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**

Recognised threats to the ongoing survival of this species include predation by introduced fish such as Gambusia and Redfin Perch, habitat degradation, particularly the loss of aquatic plants and fluctuations in water levels as a result of river regulation, leading to negative impacts on reproduction and recruitment.

A recovery plan for this species is currently being prepared. The four recovery strategies identified for this species include undertaking intensive surveys in areas identified as supporting or potentially supporting Purple Spotted Gudgeon, mapping of the species distribution and habitat associations, establishment of a long-term monitoring program to assess their conservation status and the success of recovery actions, investigation of the feasibility of implementing a conservation stocking program and the preparation and implementation of a recovery plan.

The DZP is unlikely to interfere with the recovery of the species as the likelihood that it would have any direct impact on any key habitat is low. In addition, the opportunity for indirect impacts on the Macquarie and Little Rivers is likely to be remote given that a stringent Erosion and Sedimentation Control Plan would be implemented reducing the likelihood of downstream habitats being affected through on-site pollution.

**g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

Key threatening processes of relevance to this proposal includes:

- *Removal of large woody debris from New South Wales rivers and streams.* Woody debris within streams provide important habitat for many aquatic species. To minimise any potential impacts woody debris encountered within streams during construction would be relocated within the stream adjacent to the construction area;
- *Degradation of native riparian vegetation along New South Wales water courses.* The majority of water courses within the DZP Site, study area and locality are severely degraded and the majority do not support intact riparian habitat. Further removal of vegetation along the banks of these water courses would be avoided wherever possible;
- *Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams.* The off-take site for the water pipeline in the Macquarie River has been designed to minimise the impacts on biodiversity through the installation of a Johnson screen which reduces the opportunity for damage and entrainment of larvae and individuals and reduces velocities across the screen. All new and upgraded crossings of watercourses would be designed and installed in accordance with *Guidelines and Policies for Aquatic Habitat Management and Fish Conservation* (NSW Fisheries 1999) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge 2003).

## Conclusion

It is unlikely that the DZP would impact any local or regional population of the Purple Spotted Gudgeon as this species is unlikely to occur across the DZP Site and any potential off-site impacts would be managed and mitigated with stringent on-site management measures.

**Silver Perch (*Bidyanus bidyanus*)** is listed as Vulnerable under the FM Act. This once widespread and abundant species is now confined to the Murray-Darling river system. Silver Perch are thought to prefer fast-flowing, open waters, especially where there are rapids and races, however they will also inhabit warm, sluggish water with cover provided by large woody debris and reeds (NSW DPI Fisheries 2005). This species is known from the Central West CMA (Goldney *et al.* 2007) with a number of records from the Macquarie River, downstream of the DZP Site (NSW DPI Fishing and Aquaculture, Records Viewer 2012b, accessed July 2012). There are some pockets of potential habitat for this species in the Little River, Wambangalang Creek and Hyandra Creek.

Recognised threats to this species include:

- River regulation through the construction of barriers such as dams and weirs, which alter natural flow patterns, prevent upstream migration, eliminate triggers for spawning (e.g. floods) and cause habitat degradation;
- Cold water releases from dams resulting in spawning failures;
- Degradation of instream habitats through the loss of riparian vegetation, sedimentation and water quality decline;
- Competition with introduced species such as Carp, Redfin Perch and Eastern Gambusia;



- Stocking of inappropriate genetic strains, poor quality silver perch or silver perch hybrids; and
  - Diseases such as EHN (epizootic haematopoietic necrosis), which is carried by Redfin Perch.
- a) **In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

Migration of this species appears to be stimulated by increases in water level and water temperature to above 20°C. In the case of adults, migration may potentially act as a trigger for spawning. Adult Silver Perch migrate upstream from November to February and older juveniles migrate between October and April. Therefore the maintenance of flows, connectivity and temperatures are important to the persistence of this species. Changes to the overall catchment are not likely to extend to changes to flows adjacent to the Macquarie River and Little River which provide known habitat for this species. However, there is a very small potential for habitat of this species to be disrupted due to the construction and operation of the DZP.

- b) **In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

Not an endangered population.

- c) **In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**
- I. **Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
  - II. **Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not an endangered ecological community.

- d) **In relation to the habitat of a threatened species, population or ecological community:**
- I. **The extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
  - II. **Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
  - III. **The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

Known habitat within the Macquarie River and potentially the Little River, is unlikely to be modified or fragmented as a consequence of this proposal due to the proposed environmental management of the construction and operation of the DZP. Less suitable habitat across the DZP Site may be marginally modified although this is unlikely to significantly impact this species.

- e) **Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**

No area of critical habitat has been declared for this species.

**f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**

A recovery plan has been prepared for this species (DPI 2005). Whilst there is very little information on the reproductive biology and habitat requirements of Silver Perch or their response to particular threats, it appears that river regulation, cold water releases, degradation of instream habitat, competition from invasive species, problems with inappropriate stocking and diseases are among the primary threatening processes.

The overall objective of this recovery plan is to prevent the extinction and ensure the recovery of Silver Perch populations in NSW through the reduction of the recognised threats. It is unlikely that this proposal would exacerbate any of the threats or reduce the capacity for recovery of this species.

**g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

Key threatening processes of relevance to this proposal includes:

- *Removal of large woody debris from New South Wales rivers and streams.* Woody debris within streams provide important habitat for many aquatic species. To minimise any potential impacts woody debris encountered within streams during construction would be relocated within the stream adjacent to the construction area;
- *Degradation of native riparian vegetation along New South Wales water courses.* The majority of water courses within the DZP Site, study area and locality are severely degraded and the majority do not support intact riparian habitat. Further removal of vegetation along the banks of these water courses would be avoided wherever possible;
- *Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams.* The off-take site for the water pipeline in the Macquarie River has been designed to minimise the impacts on biodiversity through the installation of a Johnson screen which reduces the opportunity for damage and entrainment of larvae and individuals and reduces velocities across the screen. All new and upgraded crossings of watercourses would be designed and installed in accordance with *Guidelines and Policies for Aquatic Habitat Management and Fish Conservation* (NSW Fisheries 1999) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge 2003).

## **Conclusion**

It is unlikely that the DZP would impact any local or regional population of the Silver Perch as this species is unlikely to occur across the DZP Site and any potential off-site impacts would be managed and mitigated with stringent on-site management measures.