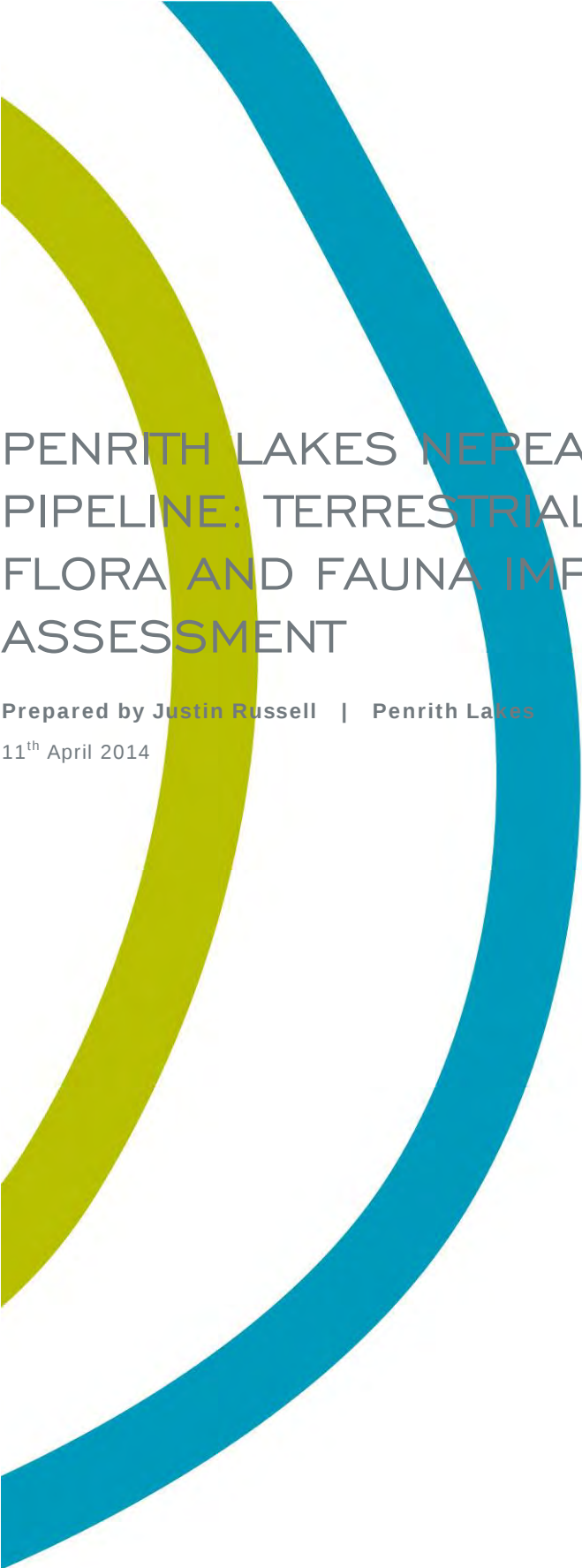




PENRITH LAKES NEPEAN PUMP AND PIPELINE: TERRESTRIAL AND AQUATIC FLORA AND FAUNA IMPACT ASSESSMENT

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I .O INTRODUCTION

I .I BACKGROUND

In 2007, PLDC was granted approval under the former Part 3A of the EP&A Act for the construction and operation of a water pipeline and pumping station to be located upstream of the Penrith Weir and of the confluence of Nepean River and Boundary Creek (major project number MP 05_0078). The purpose of the pumping station and pipeline was to extract water from the Nepean River for the short-term filling of lakes and to maintain lake water levels as part of the Penrith lakes Scheme (PLS). Construction of the approved Nepean River Pump and Pipeline project has not commenced.

The location of the previous project application was designed to avoid the intake of tertiary treated effluent that was discharged from the then Penrith Sewage Treatment Plant (STP) to Boundary Creek. The tertiary treated effluent entered the Nepean River downstream of Penrith Weir. The pumping station was to be located upstream of Penrith Weir to avoid intake of the discharged effluent.

Subsequent to granting the approval for the Nepean River Pump and Pipeline project in 2007, the Western Sydney Recycled Water Initiative – Replacement Flows project (MP 06_190) was approved, constructed and is now operational. The Replacement Flows project treats STP effluent to a higher standard than the previous tertiary treatment system prior to its ultimate discharge to Boundary Creek. As a result of the improved water quality of discharged effluent, previous issues associated with the intake of effluent no longer restrict the location of the pump station to upstream of the Penrith Weir. As a result, PLDC has reviewed the location and design of the pump and pipeline. A preferable location has been identified based on an initial constraints analysis that assessed environmental, engineering and cost issues. The preferred location for the pumping station and pipeline is downstream of the Boundary Creek and Nepean River confluence which is in closer vicinity to the PLS.

The Development would include the following:

- Construction and operation of a pumping station containing centrifugal pumps located approximately 600 m downstream of the Penrith Weir on the eastern embankment of the Nepean River;
- Construction and operation of a water supply pipeline extending from the Nepean River, via the pump station, to a discharge point on PLDC land; and
- Provision of ancillary infrastructure, such as intake/discharge pipe-work and structures, and works to enable the construction works.

The water extracted from the Nepean River would be discharged to a proposed constructed wetland system that would be located to the north to north-west of the extraction location. The constructed wetland would be designed using a system of wetlands, screens and grates, rip rap, silt curtains and/or other physical barriers, such as weed booms, to achieve the water quality criteria established as part of this assessment.

Biosis Research Pty. Ltd. was commissioned by Maunsell Australia Pty Ltd to undertake a terrestrial and aquatic flora and fauna assessment for the proposed Nepean pump and project in June 2005. Their report assessed the conservation significance of the area covered by three proposed pipeline routes in terms of threatened species, populations (and their habitats) or ecological communities that occur, or have the potential to occur, in the study area in accordance with the requirements of the Environmental Planning and Assessment Act 1979 (EP&A Act), Threatened Species Conservation Act 1995 (TSC Act), Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and the Fisheries Management Act 1994 (FM Act). Biosis Research undertook an additional aquatic ecology assessment with a focus on the intake structure only in April 2006.

The methodology employed for the Terrestrial and Aquatic Flora and Fauna Assessment and the additional aquatic ecology assessment comprised the following steps:

- Literature review and search of relevant databases, i.e. NSW Bionet Atlas of NSW Wildlife, NSW DPI (Fisheries) Fisheries Bionet for the Hawkesbury-Nepean River, Commonwealth DE EPBC Online (Fisheries) Fish Files published sources and records to identify the presence and distribution of threatened and endangered flora and fauna species, and ecology communities.
- Assessment of habitat values of the study area.
- Targeted field surveys of threatened terrestrial species, populations (and their habitats) or ecological communities listed under the Commonwealth EPBC Act and State (NSW) TSC Act and FM Act that are known or likely to occur in the study area.
- Seven Part Tests under Section 5A of the EP&A Act for threatened species, populations and ecological communities listed under the TSC Act.
- An Assessment of Significance under the EPBC Act.
- Recommendations of appropriate mitigation measures to minimise potential environmental impacts.

PLDC has undertaken walkovers of the proposed site having regard to the Biosis research to ascertain whether further investigations were required. The walkover confirmed that the Biosis research is still relevant for the current proposal, as habitat features of the site remain the same as at the time of the original research. Where appropriate PLDC have updated the species lists based on observations during the walkovers and updated database searches.

1.2 DESCRIPTION AND FEATURES OF THE STUDY AREA

The study area comprises the southern sector of the PLDC Scheme Area (the Scheme) and a section of Riparian Vegetation adjacent to the Nepean River, (Figure 1). The study area lies within the Penrith Local Government Area (LGA) and is managed by the PLDC. The PLDC Scheme Area is bounded by residential, rural and industrial development to the east, north and south and dense vegetation adjoining Blue Mountains National Park to the west. The Nepean River borders the Scheme to the south and the west and dense areas of vegetation occur at Castlereagh to the north-east.

A large sand and gravel quarrying operation on the Hawkesbury-Nepean River floodplain occurs within the Scheme boundary. Historically sand and gravel quarry operations have occurred both within the river and in the floodplains within the scheme area. There are a number of man-made lakes and dams present that are the result of rehabilitation of past quarrying activities and are used for recreational activities such as rowing and canoeing. The majority of native vegetation within the study area has been historically cleared. Remaining remnants of native vegetation are mainly restricted to the banks of the Nepean River.

1.3 PROPOSED DEVELOPMENT ACTIVITY

Development would involve the construction and operation of a pumping station, intake/discharge pipe-work and structures, water supply pipeline and instrumentation equipment.

The water intake point would be located approximately 600 metres downstream of Penrith Weir, on the eastern bank of the Nepean River and adjacent to a light industrial area. The motor control centre of the pump station comprising the motor and electrical equipment would be constructed above the 100 year Average Recurrence Interval (ARI) flood event. The pump would be installed below the minimum operating level of the river. This would allow sufficient depth for the pump to ensure the submergence criterion is met.

The pump support structure would comprise piled foundations supporting a stainless steel frame, extending from above the 100 year flood level on the bank to the edge of the Nepean River.

River water would pass through a fine mesh screen fitted at the intake prior to being transferred through the main pipeline system. The screen would filter aquatic river weeds, large to medium-sized debris and sediments. Water would be transferred through the pipeline to the discharge point where it would flow via a constructed wetland and transfer system to a quarantine lake and be directed to the lakes as required.

Appropriate water extraction allocations based on the operation of the proposed pump have been developed. The rules were based on the pumping operation rules outlined within the Conditions of Approval for the Nepean River Pump and Pipeline project that was approved in 2007.

A previously approved water allocation licence (10SL047922 expires 17th April 2015) permits pumping operation when total river flow exceeds 500ML/day. Pumping operations must cease when total river flows drop below 350ML/day. These allocations were based on reducing impedance to fish passage along the Nepean River and were based on flow calculations taken from the Penrith Weir. A new licence or variation will need to be applied for taking into consideration the new location, the relation between the net flow in the river downstream of the newly proposed pump intake, as well as additional environmental flows entering below the weir from the replacement flows program. A number of variations to these rules would also be considered as part of the assessment to determine pumping rules and volume of water intake. (Maunsell 2006)

I.4 AIMS

The general aims of this report are to:

- review the previous assessment to remove information which has become irrelevant due to the relocation of the proposed pipeline and the subsequent reduction in area covered by the project;
- Provide an assessment of the habitat values of the proposed construction site area;
- Undertake targeted field surveys for threatened terrestrial species, populations (and their habitats) or ecological communities listed under the schedules of the TSC Act, FM Act and/or EPBC Act that are known or likely to occur within the study area;
- Assess the previous literature review and database searches and conduct updated database searches;
- Undertake Section 5A assessments Seven Part Test of Significance for threatened species, populations and ecological communities listed under the TSC Act and/or Assessment of Significance for threatened and migratory species listed under the EPBC Act that are either directly or indirectly impacted by the proposal; and
- Recommend control measures to minimise the environmental impacts of the proposed development.



Figure 1 – Proposed Nepean River Pump and Pipeline plan



Figure 2 – Proposed Nepean River Pump and Pipeline location

2.0 METHODS

The study area for the 2007 approval was surveyed on the 16th of June 2005. The 2005 surveys were generally undertaken with consideration of the Threatened Species Survey and Assessment Guidelines (DEC 2004) by suitably qualified ecologists. The general condition of the site was assessed and observations made of extant plant and animal species and vegetation communities (as detailed below). During the site visit the weather was sunny with moderate winds.

The proposed construction site (see Figure 1) was surveyed on the 4th December 2012. The general condition of the site was assessed and observations made of extant plant and animal species and vegetation communities (as detailed below). During the site visit the weather was sunny with moderate winds. Due to the highly mobile nature of terrestrial fauna a second walkover was conducted on the 8th April 2014 to observe which species had appeared or disappeared.

The walkovers were carried out by a PLDC staff member responsible for Natural Heritage issues on site. They were carried out when birds are most likely to be active i.e. in the morning before the temperature rose too high. Each walkover lasted approximately 3 hours. The 2012 inspection covered approximately 450m of riverbank either side of the proposed site while the 2014 was reduced to 150m either side.

2.1 TAXONOMY

The plant taxonomy (method of classification) used in this report follows Harden (1990, 1992, 1993, 2002) and subsequent advice from the National Herbarium of NSW. In the body of this report plants are referred to by their scientific names only. Common names where available have been included in the Appendices.

Names of vertebrates follow the Census of Australian Vertebrates (CAVs) maintained by Commonwealth Department of the Environment (DE). Names of fish follow the Census of Australian Aquatic Biota (CAAB) maintained by CSIRO and DE. In the body of this report vertebrates are referred to by both their common and scientific names when first mentioned. Subsequent references to these species cite the common name only. Common and scientific names are included in the Appendices.

2.2 STATUTORY REGULATIONS

Federal and State Acts and Policies that apply to the study area with regard to terrestrial and aquatic flora and fauna are listed below.

- Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth) (EPBC Act),
- Threatened Species Conservation Act 1995 (NSW) (TSC Act) and Environmental Planning and Assessment Act 1979 (NSW) (EP&A Act),
- Fisheries Management Act 1994 (FM Act),
- Water Management Act 2000 and Rivers and Foreshores Improvement Act 1948 (RFI Act),
- State Environmental Planning Policy (SEPP) 19 – Urban Bushland,
- NSW DPI Fisheries Habitat Protection Plan 3 Hawkesbury Nepean Catchment,
- SEPP 44 Koala Habitat Protection
- State Environmental Planning policy (Penrith lakes Scheme)1989 (formerly Sydney Regional Environmental Plan (SREP) 11 Penrith Lakes Scheme), and
- Sydney Regional Environmental Plan (SREP) 20 – Hawkesbury-Nepean River

2.3 LITERATURE AND DATABASE REVIEW

A list of documents used to prepare this report is located in References. Database searches were conducted in May 2005, December 2012 and April 2014. Records of threatened species, populations and communities were obtained from the NSW Office of Environment and Heritage (OEH) Bionet Atlas of NSW Wildlife within a 10 km radius of the study area, using the Penrith 1:100 000 map sheets. Records of threatened fish species were obtained from Department of Primary Industries (DPI) Fisheries BioNET for the Hawkesbury-Nepean River system. Records for threatened species, populations and communities listed under the EPBC Act were obtained from the Department of the Environment (DE) EPBC Online Database within a 10 km radius of the study area. In addition DPI Fishfiles for the Hawkesbury-Nepean River were checked for potential species of significance occurring within the study area.

2.4 TERRESTRIAL AND AQUATIC FLORA SURVEY

Flora growing in the study area was surveyed by undertaking a general habitat assessment and targeted searches for threatened species were conducted within likely habitats.

The condition of the vegetation was assessed according to the degree to which it resembled relatively natural, undisturbed vegetation using the following criteria:

- Species composition (species richness, degree of weed invasion); and,
- Vegetation structure (representation of each of the original layers of vegetation).

The three categories used to evaluate general habitat value were Good, Moderate or Poor, as detailed below:

Good: Containing a high number of indigenous species; no weeds present or weed invasion restricted to edges and track margins; vegetation community contains original layers of vegetation; vegetation layers (ground, shrub, canopy etc) are intact.

Moderate: Containing a moderate number of indigenous species; moderate level of weed invasion; weeds occurring in isolated patches or scattered throughout; one or more of original layers of vegetation are modified; vegetation layers (ground, shrub, canopy etc) are largely intact.

Poor: Containing a low number of indigenous species; high level of weed invasion; weeds occurring in dense patches or scattered throughout; one or more of the original layers of vegetation are highly modified; one or more original vegetation layers (ground, shrub, canopy etc) are modified or missing.

2.5 TERRESTRIAL FAUNA SURVEY

Fauna using the site were surveyed by undertaking active searching and listening, and recording incidental observations.

The three categories used to evaluate habitat value were Good, Moderate or Poor, as detailed below:

Good: Ground flora containing a high number of indigenous species; vegetation community structure, ground, log and litter layer intact and undisturbed; a high level of breeding, nesting, feeding and roosting resources available; a high richness and diversity of native fauna species.

Moderate: Ground flora containing a moderate number of indigenous species; vegetation community structure, ground log and litter layer moderately intact and undisturbed; a moderate level of breeding, nesting, feeding and roosting resources available; a moderate richness and diversity of native fauna species.

Poor: Ground flora containing a low number of indigenous species, vegetation community structure, ground log and litter layer disturbed and modified; a low level of breeding, nesting, feeding and roosting resources available; a low richness and diversity of native fauna species. Other habitat features such the value of the study area as a wildlife corridor, the presence of

remnant communities or unusual ecological vegetation community structure were also investigated to assess habitat quality.

2.6 AQUATIC FAUNA SURVEY

Aquatic habitats were surveyed by undertaking visual assessment and by recording incidental observations. At each survey site an assessment of the waterway and riparian condition and habitat was undertaken following a modified Ausrivas and Riparian Channel Environment (RCE) assessment (Chessman *et al.* 1997).

The aquatic habitats were classified according to the 2013 Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management, which assesses the waterway on their potential for fish habitat. The habitat classes are defined as:

Class 1 - Major Fish Habitat Large named permanently flowing stream, creek or river. Threatened species habitat or area of declared "critical habitat" under the threatened species provisions of the FM Act. Aquatic vegetation is present. Known fish habitat and/or fish observed inhabiting the area;

Class 2 - Moderate Fish Habitat Smaller named permanent or intermittent stream, creek or watercourse. Clearly defined drainage channels with semipermanent to permanent waters in pools or connected wetland areas. Marine or freshwater aquatic vegetation present. Known fish habitat and/or fish observed inhabiting the area;

Class 3 - Minimal Fish Habitat Named or unnamed watercourse with intermittent flow, with potential refuge, breeding or feeding areas for some aquatic fauna (e.g. fish, yabbies). No to minimal defined drainage channel. Semi-permanent pools, ponds, farm dams or wetlands nearby, or form in the watercourse after a rain event. Watercourse interconnects wetlands or stream habitat; and

Class 4 - Unlikely Fish Habitat Named or unnamed watercourse with intermittent flow during rain events only, little or no defined drainage channel, little or no free standing water or pools after rain (e.g. dry gully, shallow floodplain depression with no permanent wetland aquatic flora present). No aquatic or wetland vegetation present. The waterways class is used to determine the appropriate type of bridge required and whether inclusion of a fish-way is required within a development (NSW Fisheries 1999).

2.7 LIMITATIONS

This study was by design a habitat assessment and was conducted in accordance with methodology that would be employed for an assessment in accordance with Section 5A of the EP&A Act. Therefore no trapping, spotlighting, fish trapping, electro-fishing, water quality testing, call playback or vegetation quadrat sampling techniques were used.

The study area was surveyed in winter in 2005, summer 2012 and Autumn 2014. Due to the highly mobile nature of fauna and the limited access due to impenetrable weed growth, it is possible that some animals and plants were not observed during the surveys. However, as the assessment of impact is based on the presence or absence of suitable habitat for threatened flora and fauna (which is adequate to satisfy the requirements of the EP&A Act), such species are taken into account during the assessment even though they may not be conspicuous during the survey. Such an assessment is considered conservative, in that the presence of habitat for a threatened species, population or ecological community is sufficient to warrant further consideration in the impact assessment process. The assessment does not need to rely on actual records of threatened species.

3.0 RESULTS

A list of the flora and fauna species recorded during the surveys are provided in Appendix 1 Flora Results and Appendix 2 Fauna Results respectively. A map showing the results of the Bionet Atlas search can be found in Appendix 3 Bionet Atlas Search results.

3.1 SOIL

The soils of the study area are mapped by Hazelton *et al.* (1989) at a 1:100 000 scale as the fluvial derived landscapes Richmond (map unit ri) and Upper Castlereagh (map unit up). Richmond soil landscape is described as Quaternary terraces of the Nepean and Georges Rivers (Hazelton *et al.* 1989). Upper Castlereagh soil landscape is described as terraces of the Nepean and Hawkesbury Rivers (Hazelton *et al.* 1989).

3.2 VEGETATION COMMUNITIES

The vegetation along the Nepean River at the proposed pump location is dominated by exotic weed species. Vegetation along the water's edge consisted of scattered *Casuarina cunninghamiana* ssp. *Cunninghamiana* along with the occasional *Callistemon salignus* and *Ficus coronata*. Tree and shrub species dominating this area consisted of *Salix nigra*, *Erythrina crista-galli*, *Morus alba* and *Lantana camara*.

The understorey along the lower banks of the Nepean River was degraded and dominated by the weed species *Alternanthera philoxeroides*. Scattered natives such as *Persicaria decipiens* occurred on the banks and emergent *Typha domingensis*. Exotic species *Salvinia molesta* was not recorded in the water during the 2012 or 2014 surveys although there is a history of its presence in large amounts in the Nepean River.

The mid and upper banks were dominated by weed species such as *Gleditsia triacanthos*, Large and Small Leaf Privet, *Morus alba*, *Acer negundo*, *Cardiospermum grandiflorum*, and *Lantana camara* (see Figure 3). Scattered Acacias are present along the top of the bank.

At the top of the slope along the cleared ridgeline, there were a number of plantings of species such as *Bursaria spinosa*, a number of Acacia and Eucalypt species, *Kunzia ambigua*, *Leptospermum polygalifolium*, *Melaleuca decora* and *M. styphelioides*. The understorey beneath these plantings was dominated by exotic grasses and herbaceous species.

3.2.1 NPWS (2002) Vegetation Mapping

Vegetation adjoining the banks of the Nepean River, has been identified by NPWS (2002b) as Alluvial Woodland and Riparian Forest (in green and purple respectively Figure 4), both of which are sub-communities of Sydney Coastal River-flat Forest. Until recently Sydney Coastal River-flat Forest was listed as an Endangered Ecological Community under schedule 3 of the TSC Act, but has subsequently been removed from the TSC Act and replaced by a number of listings of communities on floodplains along the NSW east coast, including River-flat Eucalypt Forest and Swamp Oak Floodplain Forest.



Figure 3 – Vegetation at the proposed location of pipeline. Dominant species visible include Lantana, Chinese Balloon Vine, Large leaf Privet, Giant Reed and Honey Locust.

The vegetation recorded along the banks of the Nepean River appears to best fit the description of River-flat Eucalypt Forest which has been listed as an EEC under the TSC Act, with the dominance of *Casuarina cunninghamiana* ssp. *cunninghamiana*. River-flat Eucalypt Forest in the study area is restricted to a thin degraded strip of vegetation adjoining the Nepean River, dominated by *Casuarina cunninghamiana* ssp. *cunninghamiana* in the canopy and exotic herbaceous species in the understorey.

3.2.2 Groundwater Dependent Ecosystems

GDEs are defined as 'Ecosystems which have their species composition and natural ecological processes wholly or partially determined by groundwater' (NOW 2012). GDEs are dependent upon groundwater to varying degrees. The depth to the groundwater table is a key determinant of groundwater dependency, with groundwater dependency decreasing to minimal levels in areas where the groundwater table is greater than 10m (NOW 2012). There are no GDEs identified by NOW (2011) located within or near to the site. However, River-Flat Eucalypt Forest on Coastal Floodplains is listed as a high priority endangered ecological community (NOW 2011).

Sydney Coastal River-Flat Forest is listed as a high probability GDE by NOW (2012) and is mapped as a GDE (as Cumberland River Flat Forest) on the Atlas of Groundwater Dependent Ecosystems (BoM 2014). However, no justification for the listing of the community as a GDE is given. No changes to the groundwater regime would occur as a result of the development.



Figure 4 –Location of proposed Pump site (Red circle) with vegetation association of the Nepean River. Group 11 Alluvial Woodland, Group 12 Riparian Forest. (NSW NPWS 2002b)

3.3 FLORA

Between the two surveys conducted, 120 vascular plant species were recorded from this area, comprising 53 (45%) locally indigenous species, one non local indigenous species and 66 (55%) exotic species. It must be noted that the plant list from the 2005 survey does not distinguish the locations of each species and some may not have been present in the vicinity of the proposed Pump and pipeline. A list of plant species recorded is provided in Appendix 1 Flora Results.

Twelve of the species recorded in the study area are declared as noxious weeds in the Penrith LGA and six of these are categorised as Weeds of National Significance (WONS). The details of these species can be seen in Table 1.

Table 1: Noxious weeds of the Penrith LGA

COMMON NAME	SCIENTIFIC NAME	NOXIOUS WEED RATING
African Box Thorn	<i>Lycium ferocissimum</i>	4, WONS
African olive	<i>Olea europaea</i>	4
Alligator Weed	<i>Alternanthera philoxeroides</i>	3, WONS
Green Cestrum	<i>Cestrum parqui</i>	3
Lantana	<i>Lantana camara</i>	4, WONS
Long-leaf Willow Primrose	<i>Ludwigia longifolia</i>	3
Pampas Grass	<i>Cortaderia sp</i>	3
Privet (Broad leaf)	<i>Ligustrum lucidum</i>	4
Privet (Small leaf)	<i>Ligustrum sinense</i>	4
Sagittaria	<i>Sagittaria platyphylla</i>	5, WONS
Salvinia	<i>Salvinia molesta</i>	3, WONS
Willows	<i>Salix sp</i>	5, WONS

Biosis (2006) states that twenty-three threatened flora species listed under the TSC Act and 22 threatened flora species listed under the EPBC Act, or their habitat had been previously recorded within the local area (OEH Bionet Atlas of NSW Wildlife and DE Online EPBC Database). A total of 24 threatened flora species were considered in their report.

A search of the Bionet Atlas of NSW Wildlife of all Valid Records of Threatened (listed on TSC Act 1995) or Commonwealth listed Plants in selected area [North: -33.67 West: 150.63 East: 150.73 South: -33.77] returned a total of 10 species. The habitat requirements of these species and those identified by Bietzel et al (2006) can be seen in Table 2.

No significant flora species or their habitats were recorded within the study area. As such, Seven Part Tests and Assessments of Significance are not required for any threatened flora.

Table 2: Terrestrial flora listed on the TSC Act or EPBC Act that have the potential to occur in the local area.

SPECIES	TSC ACT	EPBC ACT	ROTAP	PREFERRED HABITAT	POTENTIAL HABITAT
<i>Acacia bynoeana</i>	E1	V	3V	Sandstone ridgetop and Castlereagh Woodlands on sandy clay soil, often with ironstone gravels (NSW Scientific Committee 1999).	No. These communities not recorded in the study area.
<i>Acacia gordonii</i>	E1	E	2K	Grows on sandstone outcrops in dry sclerophyll forest (Harden 1991) and heaths amongst rock platforms (NSW Scientific Committee 1997).	No. These communities not recorded in the study area.

<i>Acacia pubescens</i>	V	V	3V	Grows in open sclerophyll forest or woodland on clay soils (Harden 1991, Robinson 1994), usually on gravelly clay containing ironstones (NPWS 1999a, Fairley and Moore 2000). This species typically occurs at the integrate between shales and sandstones in Cooks River/ Castlereagh Ironbark Forest, Shale/Gravel Transition Forest or Cumberland Plain Woodland (NPWS 2003).	No. None of these native vegetation communities remain in the study area.
<i>Acrophyllum australe</i>	V	V	2Vi	Restricted to an area between Springwood and Lawson in the Blue Mountains. Usually found near waterfalls where it grows in damp crevices in sandstone, usually near waterfalls (Harden 1990) or under drip ledges below sandstone cliffs (Fairley and Moore 2000).	No. Study area not within species known range
<i>Allocasuarina glareicola</i>	E1	E	2E	Known only for a few small populations in or near Castlereagh S.F. where it is found in open forest on lateritic soil (Harden 1990, Robinson 1994).	No. No open forest recorded in study area.
<i>Cryptostylis hunteriana</i>	V	V	3V	This species typically grows in swamp-heath on sandy soils chiefly in coastal districts (Harden 1993) but has also been recorded on steep bare hillsides (Bishop 1996).	No. No swamp heath recorded in the study area.
<i>Cynanchum elegans</i>	E1	E	3Ei	Rainforest gullies scrub and scree slopes in Gloucester and Wollongong districts (Harden 1992).	No. Study area not within species known range.
<i>Dillwynia tenuifolia</i>	V&EP	V	2Vi	Occurs in the Cumberland Plain and Blue Mountains to Howes Valley area where it grows in dry sclerophyll woodland on sandstone, shale or laterite (Harden 2002). Typically it forms large populations within a restricted distribution and specific habitat (Castlereagh Ironbark Forest) (Rymer <i>et al.</i> 2002).	No. Castlereagh Ironbark Forest was not recorded in the study area.
<i>Epacris sparsa</i>	V	V	2Vi	Only known to grow beside Grose River where it is found on in sandy soil among rocks (Harden 1992).	No. Study area not near grove River.
<i>Eucalyptus benthamii</i>	V	v	2Vi	Restricted but locally abundant, in wet forest on sandy alluvial soils along valley floors (Harden 1991).	No. No wet forest recorded in study area.
<i>Grevillea juniperina</i> ssp. <i>Juniperina</i>	v	-	-	It's distribution is centred on an area bounded by Blacktown, Erskine Park, Londonderry and Windsor with outlier populations at Kemps Creek and Pitt Town (NPWS 2002a). It is found on clay soils in open forest on the Cumberland Plain (Robinson 1994). Grows in moist sites, usually near creeks on acidic soils (Harden 1991).	No. No open forest recorded in the study area.
<i>Haloragodendron lucasii</i>	E1	e	2Ea	Grows in dry sclerophyll forest or low open woodland on sheltered sandstone slopes near creeks in moist sandy loam soil (Harden 1991, NPWS 1999e). Often found below cliff lines with an understorey of ferns and sedges (Fairley and Moore 2000).	No. No dry sclerophyll forest or low open woodland recorded in the study area.

<i>Marsdenia viridiflora</i> ssp. <i>Viridiflora</i>	EP	-	-	subcoastal and southern Queensland but has been recorded rarely in NSW and from a disjunct occurrence near Sydney where it occurs as occurs as very scattered plants in areas of remnant vegetation (NSW Scientific Committee 2003). Grows in woodland and scrub (Harden 1992) and is a characteristic species of Sydney Turpentine Ironbark Forest (NSW Scientific Committee 1998b).	No. None of the communities listed were recorded in the study area.
<i>Melaleuca deanei</i>	v	V	3R	Wet heath on sandstone – coastal districts from Berowra to Nowra (Harden 1991).	No. no wet heath recorded in the study area
<i>Micromyrtus minutiflora</i>	E1	V	2V	Found on the Cumberland Plain within dry sclerophyll forest (Harden 1992) on old alluviums (Robinson 1994).	No. No dry sclerophyll forest remains in the study area.
<i>Persoonia acerosa</i>	V	V	2V	Found in heath or dry sclerophyll forest on sandstone from central Blue Mountains south to Hilltop (Harden 2002).	No. No heath or dry sclerophyll forest in the study area.
<i>Persoonia hirsuta</i>	E1	E	3Ki	It occurs from Gosford to Royal NP and in the Putty district from Hill Top to Glen Davis where it grows in woodland to dry sclerophyll forest on sandstone (Harden 2002) or rarely on shale (NSW Scientific Committee 1998a).	No. No woodland or dry sclerophyll forest in study area
<i>Persoonia nutans</i>	E1	E	2Ei	Grows in Woodland to dry sclerophyll forest on clay soils and old alluviums on the Cumberland Plain (Harden 1991, Robinson 1994). It is restricted to Castlereagh Scribbly Gum Woodlands and in Agnes Banks Woodland (NPWS 2001)..	No. No woodland or dry sclerophyll forest in study area
<i>Pimelea spicata</i>	E1	E	3Ei	In western Sydney, <i>P. spicata</i> grows in Grey Box- Ironbark Woodland with an understorey of <i>Bursaria spinosa</i> and <i>Themeda australis</i> (NPWS 2000b).	No. Grey Box- Ironbark Woodland was not recorded in the study area.
<i>Pomaderris brunnea</i>	V	V	2V	Open forest confined to the Colo River & upper Nepean River (Harden 1990), on clay & alluvial soils (Fairley and Moore 1995).	No. Study area not near Colo or upper Nepean Rivers..
<i>Pterostylis saxicola</i>	E1	E	-	Shallow soils over sandstone sheets often near streams – Picnic Point to Picton (Harden 1993). Occurs where vegetation up-slope of potential habitat is shale derived – preference for shale sandstone interface (T. James pers. comm.).	No. No shale/sandstone interface on or near the study area.
<i>Pultenaea glabra</i>	V	V	3Va	Found in dry sclerophyll forest on sandstone in the higher Blue Mountains and Glen Davis area (Harden 1991). Grows above south facing escarpments of the main plateau and sometimes in forest with an open canopy and moist soil (Baker and Corringham 1995).	No. Study area not within species known range

<i>Pultenaea parviflora</i>	E1	V	2E	<i>P. parviflora</i> is endemic to the Cumberland Plain, with a core distribution from Windsor to Penrith and east to Dean Park. Outlier populations are recorded from Kemps Creek and Wilberforce. <i>P. parviflora</i> may be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays and in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland (NPWS 2002c).	No. None of the listed communities were recorded in the study area.
<i>Zieria involucreta</i>	-	V	2Va	Occurs chiefly in the Lower Blue Mountains and west to Katoomba district where it grows in moist gullies containing wet sclerophyll forest (Robinson 1994, Harden 2002).	No. Study area not within species known range

Key: 1) Listed on the TSC Act as Endangered (E1), Extinct (E4), Vulnerable (V) or Endangered Population (EP)
 2) Listed on the EPBC Act as Endangered (E) or Vulnerable (V)
 3) ROTAP= Rare or Threatened Australian Plant (Briggs and Leigh 1995);

3.4 TERRESTRIAL FAUNA HABITATS

The principal habitat types present within the study area comprise:

- River and riparian vegetation:
 - This habitat has been highly modified and is generally in a poor to moderate condition due to the low number of fauna resources it provides such as hollow-bearing trees, roost sites and foraging areas.
 - Threatened and migratory fauna that have the potential to occur within river and riparian vegetation include Freckled Duck, Painted Snipe, Large-footed Myotis, Whitebellied Sea- Eagle and Rufous Fantail.
- Man-made dams:
 - To be constructed at the pipeline discharge point within the Scheme boundary. Will initially be considered to be in poor to moderate condition until vegetation cover and foraging habitat develop.
 - Threatened and migratory fauna that have the potential to occur within the man-made dams include Freckled Duck, Australian Painted Snipe, Latham's Snipe, Australian Wood Duck, Pacific Black Duck, Masked Lapwing, Australasian Shoveler, Grey Teal and Hardhead.
- Shrubby understorey with scattered trees:
 - Exists due to revegetation works either side of the pipeline.
 - Shrubby understorey with scattered trees provided some foraging habitat for common birds (such as Zebra Finch and Silvereye), however, the majority of trees present were young with thin trunk diameters and no hollows or substantial branching to provide nesting resources for threatened fauna such as bats and owls. The habitat is considered to be in poor condition providing little foraging and breeding resources for threatened fauna.

3.5 TERRESTRIAL FAUNA

A detailed fauna survey was not undertaken for this assessment. Fauna using the site were surveyed by undertaking active searching and listening and recording incidental observations. Fauna observed during the surveys are listed in Appendix 2 and include one amphibian, forty-one birds (two introduced), three reptiles and one introduced mammal.

Eight migratory fauna species were recorded during the June 2005 survey (Australasian Shoveler, Australian Wood Duck, Black-Shouldered Kite, Brown Falcon, Grey Teal, Hardhead, Masked Lapwing and Pacific Black Duck) and none in the December 2012 survey. Potential habitat for a further five migratory species exists within the study area (Freckled Duck, Latham's Snipe, Painted Snipe, Rufous Fantail and White-bellied Sea-Eagle).

During the December 2012 and April 2014 survey only two species (Bell minor and Superb Fairy Wren) were recorded in the immediate vicinity of the pump and pipeline footprint. This may be due to the fact that bell minors are highly territorial. The remainder of the birds sighted (see list in Appendix 2 Fauna Results) were between 50-100m away from the pump site.

No threatened fauna were recorded during the 2005 or 2012 surveys. However, the study area contains potential habitat for number of species listed as threatened on the TSC Act and species listed on the EPBC Act.

Biosis (2006) states that twenty-three threatened flora species listed under the TSC Act and 22 threatened flora species listed under the EPBC Act, or their habitat had been previously recorded within the local area (OEH Bionet Atlas and DE Online EPBC Database). A total of 24 threatened flora species were considered in their report

A search of the Bionet Atlas of NSW Wildlife (Report generated on 11/12/2012 9:58 AM) of all Valid Records of Threatened (listed on TSC Act 1995) or Commonwealth listed Animals in selected area [North: -33.67 West: 150.63 East: 150.73 South: -33.77] recorded since 1st May 2005 until 11 Dec 2012 returned a total of 22 records of 9 species. Of these species seven have potential habitat in the study area. Table 3 presents the identified threatened terrestrial fauna species listed under the TSC Act and EPBC Act that have potential habitat in the study area.

Table 3: Threatened Terrestrial Fauna Species

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT	POTENTIAL HABITAT
<i>Litoria aurea</i>	Green and Golden Frog	E 1	V	Found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes (NPWS 1999d). Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks (White and Pyke 1996, NPWS 1999d).	Yes
<i>Lophoictinia isura</i>	Square-tailed Kite	V		In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses	Yes

<i>Rostratula benghalensis australis</i>	Australian Painted Snipe	E 2	V	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. They prefer freshwater wetlands, ephemeral or permanent, although they have been recorded in brackish waters (Marchant & Higgins 1993).	Yes
<i>Rostratula benghalensis s.lat</i>	Painted Snipe		M	Found in the fringes of swamps, dams, sewage farms and marshy areas, generally with a cover of grasses, lignum or open timber (Pizzey and Knight 1997).	Yes
<i>Stictonetta naevosa</i>	Freckled Duck	V	M	The freckled duck breeds in permanent fresh swamps that are heavily vegetated. Found in fresh or salty permanent open lakes, especially during drought. Often seen in groups on fallen trees and sand spits (Simpson and Day 1996).	Yes
<i>Myotis adversus</i>	Large-footed Myotis	V		Occurs in most habitat types as long as they are near permanent water bodies, including streams, lakes and reservoirs. Commonly roost in caves, but can also roost in tree hollows, under bridges and in mines (Richards 1995, Churchill 1998).	Yes
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	V	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops.	Yes

Source: Biosis Research, 2005

- Notes:
1. Listed on the TSC Act as Endangered (EI) or Vulnerable (V)
 2. Listed on the EPBC Act as Endangered (E) or Vulnerable (V) or Conservation Dependent (C) or covered under migratory provisions (M) on the EPBC Act

3.6 AQUATIC HABITATS

At the proposed pumping point the Nepean River is a highly disturbed lowland floodplain river which had low flow at the time of the 2005 survey.

The Nepean River above Penrith weir is fairly clear, wide and deep behind the weir with a narrow riparian zone on the eastern side and wider zone consisting mainly of *Casuarina* sp. on the western bank.

Downstream of the weir the river shallows, flowing over bolder and cobble riffles and runs into a meandering section of shallow pools and backwaters. The river at the intake point is up to 50m wide. The riparian vegetation is denser than above the weir with patches of *Salix* sp. which appear to have been poisoned as part of a control programs.

The Nepean River is classified in the 2013 Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management as Class 1 Major Fish Habitat, although impacts from the sand extraction and Penrith Sewage Treatment Plant (STP) have affected the flow and quality of habitat of this River.

3.7 AQUATIC FAUNA

There are thirty-nine species of fish that have been recorded in the mid Hawkesbury-Nepean Catchment. Eight native fish species and three alien fish species are known to inhabit the Penrith Lakes System (SKM 2004). No fish sampling was undertaken as part of this report. Water bodies within the Lakes Scheme are surveyed as part of the annual Penrith lakes monitoring program. The majority of the catch was comprised of the alien Mosquito fish *Gambusia holbrooki* with a comparatively large number of Freshwater catfish *Tandanus tandanus* along with smaller numbers of Australian Bass, *Macquaria novemaculeata*, Gudgeon sp., Carp *Cyprinus carpio* and Goldfish *Carassius auratus* (SKM 2004). However, there is a high variability between the sampling years probably due to the different sampling techniques or equipment during this period.

There are two threatened species of fish listed under the FM Act (Table 4) which have potential to inhabit the local area; the Macquarie Perch *Macquaria australasica* listed as Vulnerable and the Trout Cod *Maccullochella macquariensis* listed as Endangered. Both species are also listed as Endangered under the EPBC Act. In addition one species, the Australian Grayling *Prototroctes maraena*, is listed as Vulnerable under the EPBC Act and is only listed as Protected under the FM Act. However of these species potential habitat is only thought to occur within the study area for the Macquarie Perch.

Macquarie Perch like cool clean water, preferring deep slow flowing pools and lakes. The Eastern populations are genetically distinct from western populations. Known populations of Macquarie Perch have been recorded from Glenbrook Creek which enters the Nepean River upstream of the weir.

There are a number of important recreational and migratory aquatic species which are known to occur in the mid Hawkesbury Nepean Catchment. These include the Australian Bass *Macquaria novemaculeata* and the Freshwater Catfish *Tandanus tandanus* both of which are protected from commercial fishing under the FM Act. The Australian Bass is catadroganous (migrates to estuaries to breed) and was introduced into the Penrith Lakes system (SKM 2004). There is currently no opportunity for this species to breed with the Penrith Lakes system.

Two threatened species of Dragonfly are also listed as potentially occurring within the study area. However, field investigations revealed a lack of suitable habitat for these species within the study area.

Table 4: Aquatic Fauna Listed on the FM Act or EPBC Act that have the potential to occur in the local Area

COMMON NAME	SCIENTIFIC NAME	FM ACT	EPBC ACT	HABITAT AND DISTRIBUTION	POTENTIAL HABITAT
Invertebrates					
<i>Archaeophya adamsi</i>	Adams emerald dragonfly	V		Cool clear streams with gravely riffles and extensive riparian vegetation. The closest recorded location is 38km upstream at Bedford creek	No
<i>Austrocordulia leonardi</i>	Sydney Hawk Dragonfly	E		Deep and shady river pools with cooler water. Found in the Nepean River at Wilton/Picton	No
Fish					
<i>Maccullochella macquariensis</i>	Trout Cod	E	E	Inhabits large rivers and streams in the upper Murray Darling Basin often associated with cover such as LWD rock outcrops, boulders and deep holes	No Known from translocated stocks within Cordeaux Dam
<i>Macquaria australasica</i>	Macquarie Perch	V	E	Cool clean water preferring deep slow flowing pools and lakes. Eastern populations are genetically distinct from western populations. Known from Glenbrook Creek and Colo River	Yes Potential habitat within the river
<i>Prototroctes maraena</i>	Australian Grayling	P	V	Clear gravely coastal streams and rivers from the sea to the first barrier, up to 1000 metres	No Generally found in coastal streams or rivers further south

Key: V = Vulnerable E = Endangered P = Protected

4.0 IMPACT ASSESSMENT

Potential and/or actual habitat exists within the building footprint and in the surrounding area for a number of flora and fauna species and communities. As such there is potential to impact upon them through vegetation removal, erosion and sedimentation, weed invasion, impeding the movement of fish stocks, and lowering of water levels downstream. Seven Part Testing can be used to determine the level of impact the development may have.

4.1 TSC ACT

4.1.1 Significance Guidelines

The Seven Part Test is a statutory mechanism under Section 5A of the EP&A Act for assessing whether a proposed development activity may have a significant impact on threatened species, populations or ecological communities or their habitats. The results of this test are used to determine if a Species Impact Statement is required for each species potentially occurring within the study area.

When a threatened species is known to occur within the vicinity of a study area, however is not recorded during a survey, the presence of potential habitat for this species is used to determine the need to undertake a Seven Part Test. Where there is no potential habitat in the study area for threatened species, there is unlikely to be any impact on these species and therefore Seven Part Tests are not required for these species.

4.1.2 Terrestrial Flora

The study area contains River-flat Eucalypt Forest, which is listed as an Endangered Ecological Community under the TSC Act. A Seven Part Test has been prepared for this community (see Appendix 4 Seven Part Tests). The Seven Part Test concluded that due to the size of the footprint and the degraded condition of the vegetation the proposal would not have a significant impact on the community.

Twenty three threatened plant species have previously been recorded within a 10 km radius of the study area (OEH Bionet Atlas of NSW Wildlife database, DE EPBC online database). None of the listed threatened plant species, populations or their habitats were recorded within the study area. As such, no Seven Part Tests are required for flora species and an SIS is not required for any flora species as part of the proposed development.

4.1.3 Terrestrial Fauna

No threatened fauna were recorded during the site visit, however potential habitat does occur for a number of species. Where there is potential habitat (foraging or breeding resources) for a threatened species in the study area, further consideration must be given to the potential impact of the proposed development on these species.

The proposed development may significantly impact threatened species by causing any of the following situations to arise:

- Death or injury of individuals;
- Loss or disturbance of limiting foraging resources; and
- Loss or disturbance of limiting breeding resources.

Limiting resources are specialised habitat components that species are dependent on for their ongoing survival. Such limiting resources are predominantly associated with specialised breeding habitats (such as tree hollows or suitable nest/maternity roost sites) that occur at low densities, with high levels of competition from a range of species. However for some species, limiting resources include specialised foraging habitats that have a restricted distribution (such as Koalas feeding only on specific tree species).

The study area contains potential habitat for seven species listed on the TSC Act (and fifteen species on the EPBC Act). Likely impacts of the proposed pipeline on these species have been considered to determine if an Impact Assessment is required.

As the proposed development is unlikely to cause:

- Individual death or injury; or
- Loss or disturbance of limiting foraging habitat; and/or
- Loss or disturbance of limiting breeding habitat

For the Green and Golden Bell Frog, Australian Painted Snipe, Painted Snipe, Large-footed Myotis and Freckled Duck, Seven Part Tests have not been prepared for these species and a Species Impact Statement is not recommended.

No threatened aquatic fauna were observed during this survey. Where there is potential habitat (foraging or breeding resources) for threatened species in the study area then further consideration of the potential impact of the proposed development on these species is required. The Nepean River and Weir provides potential habitat for the Macquarie Perch *Macquaria australasica* which is known to occur in Glenbrook Creek to the south west (upstream of Penrith Weir). A Seven Part Test has been prepared in

. The Seven Part Test concluded that the proposal would not have a significant impact on this species.

Table 5: Potential impacts of proposed development on individuals and limiting resources of species with potential habitat.

COMMON NAME	TSC ACT	EPBC ACT	DEATH OR INJURY LIKELY	LOSS OF LIMITING FORAGING RESOURCES	LOSS OF LIMITING BREEDING RESOURCES	IMPACT ASSESSMENT REQUIRED
Green and Golden Bell Frog	E1	V	No	No	No	No
Large-footed Myotis	V	-	No	No	No	No
Grey-headed Flying-fox	V	V	No	No	No	No
Latham's Snipe	-	M	No	No	No	No
White-bellied Sea-Eagle	-	M	No	No	No	No
Rufous Fantail	-	M	No	No	No	No
Australian Painted Snipe	E1	V	No	No	No	No
Painted Snipe	V	M	No	No	No	No
Freckled Duck	-	M	No	No	No	No
Australasian Shoveler	-	M	No	No	No	No
Australian Wood Duck	-	M	No	No	No	No
Black-shouldered Kite	-	M	No	No	No	No
Brown Falcon	-	M	No	No	No	No
Grey Teal	-	M	No	No	No	No
Hardhead	-	M	No	No	No	No
Masked Lapwing	-	M	No	No	No	No
Pacific Black Duck	-	M	No	No	No	No
Square-tailed Kite	V		No	No	No	No

4.2 EPBC ACT

4.2.1 Significance Guidelines

Under the *EPBC Act*, if the proposed development has the potential to have an adverse impact on a threatened species, populations or ecological communities listed on the Act, the proposal must be referred to the Federal Minister for the Environment for further consideration.

Threatened species

For threatened species, an action, will have, or is likely to have a significant impact if it does, will or is likely to:

- Lead to a long-term decrease in the size of an important population of a species, or
- Reduce the area of occupancy of an important population, or
- Fragment an existing habitat critical to the survival of the species, or
- Adversely affect habitat critical to the survival of a species, or
- Disrupt the breeding cycle, or
- Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species habitat, or
- Interferes substantially with the recovery of the species.

For the assessment criteria, an important population is defined as one that is necessary for a species long-term survival and recovery, including populations that are:

- Key source populations either for breeding or dispersal,
- Populations that are necessary for maintaining genetic diversity, and/or
- Populations that are near the limit of the species range.

Migratory species

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or
- Result in invasive species that is harmful to the migratory species becoming established¹ in an area of important habitat of the migratory species, or
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

An area of important habitat is:

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or
- Habitat utilised by a migratory species which is at the limit of the species range, or
- Habitat within an area where the species is declining.

4.2.2 Flora

Twenty-two threatened plant species listed on the EPBC Act have been recorded within 10 km of the study area (DE online database). None of these threatened plant species or their habitat were recorded within the study area. No endangered ecological communities listed on the EPBC Act were recorded within the study area. Therefore, Assessments of Significance have not been prepared for any flora species and a Referral to the Environment Minister is not recommended for threatened flora and vegetation.

4.2.3 Terrestrial Fauna

Potential and/or actual habitat for two threatened and thirteen migratory terrestrial animal species listed under the EPBC Act is present within the study area. As the proposed development is unlikely to cause individual death or injury or loss/disturbance of limiting foraging and/or breeding habitat for these species (Table 5), Assessments of Significance have not been prepared for these species. A Referral to the Federal Minister for the Environment is not recommended for any terrestrial fauna species.

4.2.4 Aquatic Fauna

One threatened fish species, Macquarie Perch, listed under the EPBC has limited potential habitat within the Penrith Weir. An Assessment of Significance performed for this species concluded that there would be no significant impact (Appendix 4 Seven part Tests). A Referral to the Federal Minister for the Environment is not recommended for any aquatic fauna species.

4.3 KEY THREATENING PROCESSES

A Key Threatening Process (KTP) is an impact listed under the FM, TSC or EPBC Acts that could cause a species, population or ecological community to become threatened or is identified as an impact for two or more listed threatened species, population or EECs.

KTPs relevant to the proposal are detailed below.

Clearing of Native Vegetation and Land Clearance

'Clearing of Native Vegetation' is listed as a KTP on the TSC Act and 'Land Clearance' is listed as a KTP on the EPBC Act. The riparian vegetation along the Nepean River will be impacted by the proposed works, with some clearing required for the installation of the pipeline. The following

impacts on biological diversity are listed in the TSC Act Key Threatening Process Declaration for 'Clearing of Native Vegetation' and are relevant to the proposal:

- Destruction of habitat (resulting in loss of local populations of individual species);
- Fragmentation of habitat;
- Riparian zone degradation;
- Increased habitat for invasive species;
- Loss of leaf litter layer; and
- Changes to soil biota.

The above listed impacts will be reduced in the long term by the implementation of a Vegetation Management Plan, detailing restoration works. This VMP will draw on previous management plans used in natural heritage areas across the Penrith Lakes Scheme site. Restoration works will include weed management and re-establishment of native understorey species along the Nepean River and its tributaries. Furthermore, impacts on native trees and shrubs should be avoided where possible. Cleared native vegetation should be placed over impacted areas to assist in natural regeneration and prevent erosion. The implementation of a Vegetation Management Plan will minimise impacts to riparian vegetation along the Nepean River and potentially improve the quality of the riparian vegetation in the long term.

Installation and operation of in-stream structures and other mechanisms that alter natural flow regimes of rivers and streams

In-stream structures such as dams and water extraction devices can impact upon the riverine environment causing a wide variety of changes to the habitat, water quality and flow conditions, often creating barriers to fish passage and impacts to the river. The Nepean River is already impacted by historical changes to its water regime. Under an existing licence, the proposed pumping of 1.7 m³/sec (147 ML/day) from the Penrith Weir can be undertaken at flows exceeding 170 ML/day.

It has been estimated that flow of >300 ML/day is required to provide adequate fish passage in the Nepean River downstream of the Penrith Weir (Bishop 2004). The Independent Expert Panel for the Hawkesbury-Nepean River recommended an environmental flow regime that provided a flow of 170ML/day over the Penrith Weir > 95% of the time. This would reduce the effects of cyanobacteria and provide improved habitat and fish passage for the lower Nepean River. Currently 170ML/day at the Penrith Weir is exceeded only 61% of the time (WRL 2005).

Management of the pumping should be undertaken to reduce the effects of the abstraction and preserve the natural shape of the flow and not impact on the downstream communities, passage and environmental flow requirements of the river. This would include raising the threshold level of the pumping limit, reduction of the pumping volumes and variation in the pumping volumes. Pumped volumes should be in addition to any environmental flows released for the river.

Degradation of native riparian vegetation along New South Wales water courses

The removal of riparian vegetation is listed on the FM Act as a KTP, including the removal of vegetation in the catchment zones. Riparian vegetation contributes to the River ecosystem by providing: shade; a source of Large Woody Debris (LWD); food for fish; bank stabilisation; and protection from sedimentation and runoff.

A section of riparian vegetation will be removed for the construction of the pipeline along the bank of the Nepean River. Rehabilitation of cleared areas, including revegetation and emergency measures to protect the area from high volume flow events, should be implemented to reduce the potential for erosion and sedimentation.

4.4 GENERAL IMPACTS

4.4.1 Weed Management

A high incidence of weed invasion was observed within the study area. Measures should be taken to minimise spread of weed species during proposed works, including:

- Cleaning vehicles before or after works are completed each day to ensure weed seed is not inadvertently transported around the study area;
- Weed biomass material that is cleared from the direct impact zone should be bagged and removed from the site to be disposed of at appropriate green waste facilities. Any native biomass material should be left onsite to assist in natural regeneration of the impacted areas; and,
- A Weed Management Plan should be developed and implemented in conjunction with the Vegetation Management Plan.

A number of aquatic weeds are known within the Penrith Weir including the submerged *Egeria densa*, *Elodea canadensis* and floating *Salvinia molesta*. PLDC actively controls macrophyte growth and *Salvinia molesta*, however *E. densa* and *E. canadensis* are not currently known within the Scheme area. Measures should be put in place to prevent the transportation of exotic weeds via the pipeline through the design of the intake structures at the Nepean River and quarantine measures at the output. This may also assist in protecting the water quality of the Penrith Lakes System. Introduced fish known in the Nepean River are also currently found in the Penrith Lakes System. Additional transport of native and alien fish species through the pipeline may increase the species diversity within the Penrith lakes and provide natural recruitment for the fish stocks.

4.4.2 Erosion and Sediment Control

Erosion and sedimentation is of greatest concern in areas where proposed works are in the vicinity of the Nepean River, its tributaries and steep banks. When not controlled, erosion and sedimentation can potentially impact on water quality, aquatic habitats, creek bank stability and riparian vegetation. An Erosion and Sedimentation Control Plan should be developed and implemented in consultation with the OEH and DPI (Fisheries).

4.4.3 Water Quality

Sedimentation and runoff can cause significant degradation in water quality and can affect fish breeding by smothering eggs and nests and by causing fish kills (McDowell 1996). Sedimentation and reduction in water quality are both listed as threatening processes by the Australian Society of Fish Biology (ASFB). Historical sand extraction and associated changes in flow regime have caused significant sedimentation in the Nepean River bordering PLDC. Further changes in the flow regime for the Nepean River through the pumping from the Penrith weir may result in further sedimentation of the Nepean River and impacts to water quality. The proposed pipeline route is within the banks of the Nepean River. During construction and rehabilitation appropriate sedimentation and erosion controls should be implemented and maintained, particularly to protect against high volume flows.

Water quality within the current Rowing and Warm-up Lakes of the Penrith Lakes Scheme is managed to maintain a standard for primary contact (in accordance with 1987 Deed obligations). The water from the Nepean River will probably be below the water quality required by Penrith lakes, particularly during initial periods of high flow and during periods of low flow. The quality of water in the Nepean River should, in general, be acceptable for aquatic biota of Penrith lakes however the expansion of the lakes and nutrient levels may result in outbreaks of Cyanobacteria or excessive growth of macrophytes. Drastic changes in water quality and temperature should be avoided and further management will be necessary if water quality drops below the standards outlined in the Penrith Lakes Stage 2 Water management plan.

4.4.4 Connectivity and Fragmentation

Clearing of vegetation may result in loss of connectivity within the study area. This fragmentation could act as a barrier to fauna, especially ground-dwelling birds and mammals, reptiles and frogs. corridor for fauna and revegetation over the pipeline route.

It is recommended that plant species representative of each vegetation layer (ground cover, understorey and tree canopy) be retained wherever possible or be included in the revegetation process to minimise loss of connectivity within the study area, this will restore connectivity over time.

5.0 RECOMMENDATIONS

To reduce the potential impact of the proposal on terrestrial and aquatic flora and fauna, the following mitigation measures are recommended.

Terrestrial Flora and Fauna

- Rehabilitate areas of disturbance once the pipeline is installed, particularly the riparian vegetation along the Nepean River and tributaries.
- Develop and implement a Vegetation Management Plan detailing bush regeneration works and weed management strategies. The Vegetation Management Plan should be implemented by qualified bush regenerators and should be consistent with any existing management plans for the area.
- Monitor areas to be impacted by the proposal, particularly the riparian vegetation along the Nepean River and its tributaries.
- Native species of local provenance, collected from within a 5 km radius of the study area should be used for revegetation and landscaping. Appropriate species should be selected based on the native vegetation community present in the area.
- Appropriate sediment and erosion control measures should be implemented, particularly where works are in the vicinity of creeklines and the Nepean River. An Erosion and Sedimentation Control Plan should be developed and implemented in consultation with the OEH and DPI (Fisheries).
- Where possible, retain existing trees to maintain current foraging and nesting habitat resources for common fauna, as well as to maintain existing fauna corridors.
- Vegetation representing ground cover (e.g. grass tussocks), understorey (e.g. low shrubs and trees) and tree canopy (e.g. large trees) be planted during the revegetation process to provide habitat resources for fauna along the length of the pipeline.
- Plant dense waterside vegetation (e.g. reeds) around all existing dams along the chosen route of the pipeline to provide shelter and nesting resources for threatened and migratory fauna.

Aquatic Flora and Fauna

- Minimise the impact to the Nepean River and its tributaries through sedimentation control, channel maintenance and rehabilitation.
- Regularly monitor water quality and flows in compliance with licence permit obligations.
- Should drawdown prevent either entry or passage through the fish ladder or the attractant flow within the Nepean River, measures should be implemented to correct this.
- Control measures should be implemented to prevent erosion or sedimentation under high flow and/or flood conditions during construction and rehabilitation.
- Prevent the transport of aquatic weeds (e.g. *Egeria densa*, *Salvinia molesta*, *Elodea canadensis*) through inlet and outlet design and other quarantine methods.

Penrith Lakes Development Corporation has a permit to obtain a licence to divert water from Nepean River. The limiting factor with regard to extraction of water from the Nepean River has been identified as the inhibition of fish passage (Bishop, 2005). The pumping regime (start to pump at 500ML/day and cease to pump once flow falls to 350ML/day) has been selected to minimise the impact on aquatic ecology provides details of investigations undertaken to determine these pumping constraints.

6.0 CONCLUSION

The riparian vegetation along this section of the Nepean River is highly degraded, restricted to a strip of trees with an understorey dominated by exotic flora. The remainder of the pipeline from the pump station to the outlet point traverses highly degraded, exotic dominated vegetation, with

some planted native species also present. Previous land use included sand gravel dredging within the river as well as the adjacent floodplain.

The riparian vegetation in the study area is representative of the Endangered Ecological Community River-flat Eucalypt Forest. A Seven Part Test conducted for this community concluded that the proposal would have no significant impact. No threatened flora species, populations or their habitats were recorded in the study area. Therefore, an SIS or Referral is not required for any threatened flora or vegetation within the study area.

Potential habitat occurs along the proposed route options for five threatened animal species listed on the TSC Act and two threatened and five migratory animal species listed on the EPBC Act. An additional eight migratory species were recorded during the current survey. No Seven Part Tests or Assessments of Significance were carried out as the proposed development is unlikely to cause individual death or injury or loss/disturbance of limited foraging and/or breeding habitat for these species. As no significant impacts are expected to occur for threatened and migratory fauna along any proposed route option for the pipeline, the route options have not been ranked in order of preference. A Species Impact Statement and a Referral to the Federal Minister for the Environment are not recommended for fauna.

The Macquarie Perch, a threatened aquatic species listed on the EPBC and FM Act, has limited potential habitat within the Nepean Weir. A Seven Part Test and Assessment of Significance concluded that there will be no significant impact to the Macquarie Perch as a result of the proposed pump and pipeline. The proposed pumping regime has the potential to significantly impact downstream habitats and fish passage if managed in an unsustainable manner. A review of the flow requirements and pumping rules should be undertaken to protect fish passage and downstream habitats.

7.0 APPENDIX I FLORA RESULTS

Public Report of all Valid Records of Threatened (listed on TSC Act 1995) Entities in selected area [North: -33.67 West: 150.63 East: 150.73 South: -33.77] NSW Bionet Atlas.

COMMON NAME	SCIENTIFIC NAME	TSC ACT	EPBC ACT	NO OF RECORDS
Bynoe's Wattle	<i>Acacia bynoeana</i>	E1,P	V	13
	<i>Allocasuarina glareicola</i>	E1,P	E	1
	<i>Dillwynia tenuifolia</i>	V,P		26
Juniper-leaved Grevillea	<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	E1,P,2	E	1
	<i>Micromyrtus minutiflora</i>	E1,P	V	13
Hairy Geebung	<i>Persoonia hirsuta</i>	E1,P,3	E	2
Nodding Geebung	<i>Persoonia nutans</i>	E1,P	E	63
Spiked Rice-flower	<i>Pimelea spicata</i>	E1,P	E	2
Sydney Plains Greenhood	<i>Pterostylis saxicola</i>	E1,P,2	E	1
	<i>Pultenaea parviflora</i>	E1,P	V	15

Site survey and walkover results

FAMILY	SCIENTIFIC NAME	COMMON NAME	2005	2012
Ferns and Fern-like Plants				
Marsileaceae	<i>Marsilea</i> spp	Nardoo	X	
Salvinaceae	* <i>Salvinia molesta</i>	Salvinia	X	
Monocotyledons				
Commelinaceae	* <i>Tradescantia fluminensis</i>	Wandering Jew	X	X
Cyperaceae	<i>Bolboschoenus caldwellii</i>	Salt Club-sedge	X	X
	* <i>Cyperus eragrostis</i>	Umbrella Sedge	X	X
	<i>Eleocharis sphacelata</i>	Tall Spike Rush	X	
Hydrocharitaceae	<i>Vallisneria gigantea</i>	Eelweed	X	X
Juncaceae	<i>Juncus mollis</i>		X	
	<i>Juncus</i> spp.		X	
	<i>Juncus usitatus</i>	Billabong Rush	X	X
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	X	X
Poaceae	* <i>Andropogon virginicus</i>	Whisky Grass	X	
	* <i>Arundo donax</i>	Giant Reed	X	X
	<i>Austrostipa verticillata</i>	Bamboo Grass		X
	* <i>Bromus catharticus</i>	Prairie Grass		X
	* <i>Chloris gayana</i>	Rhodes Grass	X	X
	* <i>Cortaderia selloana</i>	Pampas Grass	X	X
	<i>Cynodon dactylon</i>	Common Couch	X	X
	* <i>Ehrharta erecta</i>	Panic Veldtgrass		X
	* <i>Eleusine indica</i>	Crowsfoot Grass	X	X
	* <i>Eragrostis curvula</i>	African Lovegrass	X	X
	<i>Imperata cylindrica</i> var. <i>Major</i>	Blady Grass	X	X
	* <i>Melinis repens</i>	Red Natal Grass	X	X
	<i>Microlaena stipoides</i>	Weeping Meadow Grass		X
	* <i>Paspalum dilatatum</i>	Paspalum	X	X
	* <i>Paspalum urvillei</i>	Vasey Grass	X	X
	* <i>Pennisetum clandestinum</i>	Kikuyu Grass	X	X
	<i>Phragmites australis</i>	Common Reed	X	X
	* <i>Setaria gracilis</i>	Slender Pigeon Grass	X	X
	* <i>Stenotaphrum secundatum</i>	Buffalo Grass	X	X
	* <i>Vulpia</i>	Fescue		X

FAMILY	SCIENTIFIC NAME	COMMON NAME	2005	2012
Typhaceae	<i>Typha domingensis</i>	Narrow-leaved Cumbungi	X	
	<i>Typha orientalis</i>	Broad-leaved Cumbungi	X	X
	<i>Typha</i> spp.		X	
Dicotyledons				
Alismataceae	* <i>Sagittaria platyphylla</i>	Sagittaria	X	X
Amaranthaceae	* <i>Alternanthera philoxeroides</i>	Alligator Weed	X	X
Apiaceae	* <i>Foeniculum vulgare</i>	Fennel	X	X
Asclepiadaceae	* <i>Araujia hortorum</i>	Moth Vine	X	X
Asteraceae	* <i>Bidens pilosa</i>	Cobbler's Pegs	X	X
	* <i>Cirsium vulgare</i>	Spear Thistle	X	X
	* <i>Conyza albida</i>	Tall Fleabane	X	X
	* <i>Hypochaeris radicata</i>	Catsear	X	X
	* <i>Lactuca serriola</i>	Prickly Lettuce		X
	* <i>Senecio madagascariensis</i>	Fireweed	X	X
	* <i>Sonchus oleraceus</i>	Common Sowthistle	X	
	* <i>Tagetes minuta</i>	Stinking Roger	X	X
Basellaceae	* <i>Anredera cordifolia</i>	Madeira Vine		X
Bignoniaceae	* <i>Dolichandra unguis-cati</i>	Cats Claw Creeper		X
Brassicaceae	* <i>Brassica juncea</i>	Indian Mustard	X	X
Cactaceae	* <i>Opuntia</i> sp	Prickly Pear		X
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell		X
Caprifoliaceae	* <i>Lonicera japonica</i>	Japanese Honeysuckle		X
Casuarinaceae	<i>Casuarina cunninghamiana</i> ssp. <i>cunninghamiana</i>	River She Oak	X	X
Chenopodiaceae	<i>Einadia hastata</i>	Saloop		X
Euphorbiaceae	* <i>Ricinus communis</i>	Castor Oil Plant	X	X
Fabaceae (Caesalpinioideae)	* <i>Gleditsia triacanthos</i>	Honey Locust		X
	* <i>Senna pendula</i>		X	
Fabaceae (Faboideae)	* <i>Erythrina crista-galli</i>	Cockspur Coral Tree	X	X
	* <i>Genista monspessulana</i>	Montpellier Broom	X	X
	<i>Hardenbergia violacea</i>	False Sarsaparilla	X	
	<i>Indigofera australis</i>	False Indigo		X
	* <i>Lotus suaveolens</i>	Hairy Birds-foot Trefoil	X	X
	* <i>Robinia pseudoacacia</i>	Black Locust	X	X
	* <i>Trifolium repens</i>	White Clover	X	X
	* <i>Vicia sativa</i> ssp. <i>sativa</i>	Common Vetch	X	X
Fabaceae (Mimosoideae)	<i>Acacia binervia</i>	Coastal Myall		X
	<i>Acacia decurrens</i>	Black Wattle		X
	<i>Acacia falcate</i>		X	
	<i>Acacia fimbriata</i>	Fringed Wattle	X	
	<i>Acacia floribunda</i>	Sally Wattle		X
	<i>Acacia implexa</i>	Hickory		X
	<i>Acacia longifolia</i>	Coast/Sallow Wattle	X	X
	<i>Acacia parramattensis</i>	Parramatta Wattle	X	X
	<i>Acacia</i> spp.		X	
Gentianaceae	* <i>Centaurium tenuiflorum</i>	Slender Centaury	X	X
Lauraceae	* <i>Cinnamomum camphora</i>	Camphor Laurel	X	X
Malvaceae	* <i>Sida rhombifolia</i>	Paddy's Lucerne	X	X
	<i>Hibiscus heterophyllus</i>	Rozella		X
Meliaceae	<i>Melia azedarach</i>	White Cedar	X	X

FAMILY	SCIENTIFIC NAME	COMMON NAME	2005	2012
Moraceae	<i>Ficus coronata</i>	Sandpaper Fig		X
	<i>Morus alba</i>	Mulberry		X
Myrtaceae	<i>Angophora</i> spp.		X	
	<i>Callistemon salignus</i>	Willow Bottlebrush	X	X
	<i>Corymbia maculata</i>	Spotted Gum	X	X
	<i>Eucalyptus baeuriana</i>	Blue Box		X
	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	X	X
	<i>Eucalyptus</i> spp.		X	
	<i>Eucalyptus tereticornis</i>	Forest Red Gum	X	X
	<i>Eucalyptus viminalis</i>			
	<i>Kunzea ambigua</i>	Tick Bush	X	X
	<i>Leptospermum polygalifolium</i> ssp. <i>Polygalifolium</i>		X	X
	<i>Melaleuca armillaris</i> ssp. <i>armillaris</i>	Giant Honey-myrtle	X	
	<i>Melaleuca decora</i>	Paperbark	X	X
	<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree	X	X
	* <i>Ligustrum lucidum</i>	Large-leaved Privet		X
Oleaceae	* <i>Ligustrum sinense</i>	Small-leaved Privet	X	X
	* <i>Olea europaea</i>	African Olive		X
Onagraceae	<i>Ludwigia longifolia</i>			
	<i>Ludwigia peploides montevidensis</i>	Water primrose		
Pittosporaceae	<i>Bursaria spinosa</i> ssp. <i>spinosa</i>	Sweet Bursaria	X	X
Plantaginaceae	* <i>Plantago lanceolata</i>	Lamb's Tongues	X	X
	* <i>Veronica anagallis-aquatica</i>	Blue Water Speedwell		
Polygonaceae	* <i>Acetosa sagittata</i>	Rambling Dock	X	X
	<i>Persicaria decipiens</i>	Slender Knotweed	X	X
	<i>Rumex</i> spp.	Dock	X	X
Proteaceae	<i>Grevillea robusta</i>	Silky Oak	X	
Salicaceae	* <i>Salix nigra</i>	Black Willow	X	X
Sapindaceae	* <i>Acer negundo</i>	Box Elder		X
	* <i>Cardiospermum grandiflorum</i>	Balloon Vine	X	X
	<i>Dodonaea triquetra</i>	Large Leaf Hops Bush		
Simaroubaceae	* <i>Ailanthus altissima</i>	Tree of Heaven		X
Solanaceae	* <i>Cestrum parqui</i>	Gren Cestrum		X
	* <i>Lycium ferocissimum</i>	African Box Thorn		X
	* <i>Solanum mauritianum</i>	Wild Tobacco Bush	X	X
	* <i>Solanum nigrum</i>	Black-berry Nightshade	X	X
	* <i>Solanum sisymbriifolium</i>			X
Ulmaceae	<i>Trema tomentosa</i>	Poison Peach		X
Verbenaceae	* <i>Lantana camara</i>	Lantana	X	X
	* <i>Verbena bonariensis</i>	Purple Tops		X
	* <i>Verbena</i> spp.		X	

Note: * signifies exotic species

Species found in the 2006 survey may not have been at the proposed pump site area.

8.0 APPENDIX 2 FAUNA RESULTS

Public Report of all Valid Records of Threatened (listed on TSC Act 1995) Entities in selected area [North: -33.67 West: 150.63 East: 150.73 South: -33.77] NSW Bionet Atlas.

COMMON NAME	SCIENTIFIC NAME	TSC ACT	EPBC ACT	NO OF RECORDS
Cumberland Plain Land Snail	Meridolum corneovirens	E1		10
Eastern Bentwing-bat	Miniopterus schreibersii oceanensis	V,P		3
Eastern Freetail-bat	Mormopterus norfolkensis	V,P		2
Eastern Pygmy-possum	Cercartetus nanus	V,P		1
Freckled Duck	Stictonetta naevosa	V,P		1
Gang-gang Cockatoo	Callocephalon fimbriatum	V,P,3		7
Glossy Black-Cockatoo	Calyptorhynchus lathami	V,P,2		1
Green and Golden Bell Frog	Litoria aurea	E1,P	V	2
Grey-headed Flying-fox	Pteropus poliocephalus	V,P	V	12
Koala	Phascolarctos cinereus	V,P	V	9
Little Eagle	Hieraaetus morphnoides	V,P		1
Little Lorikeet	Glossopsitta pusilla	V,P		2
Powerful Owl	Ninox strenua	V,P,3		1
Red-crowned Toadlet	Pseudophryne australis	V,P		5
Regent Honeyeater	Anthochaera phrygia	E4A,P	E	11
Scarlet Robin	Petroica boodang	V,P		1
Southern Myotis	Myotis macropus	V,P		2
Spotted Harrier	Circus assimilis	V,P		1
Spotted-tailed Quoll	Dasyurus maculatus	V,P	E	5
Square-tailed Kite	Lophoictinia isura	V,P,3		1
Squirrel Glider	Petaurus norfolcensis	V,P		1
Swift Parrot	Lathamus discolor	E1,P,3	E	8
Turquoise Parrot	Neophema pulchella	V,P,3		2
Varied Sittella	Daphoenositta chrysoptera	V,P		5

Site survey and walkover results

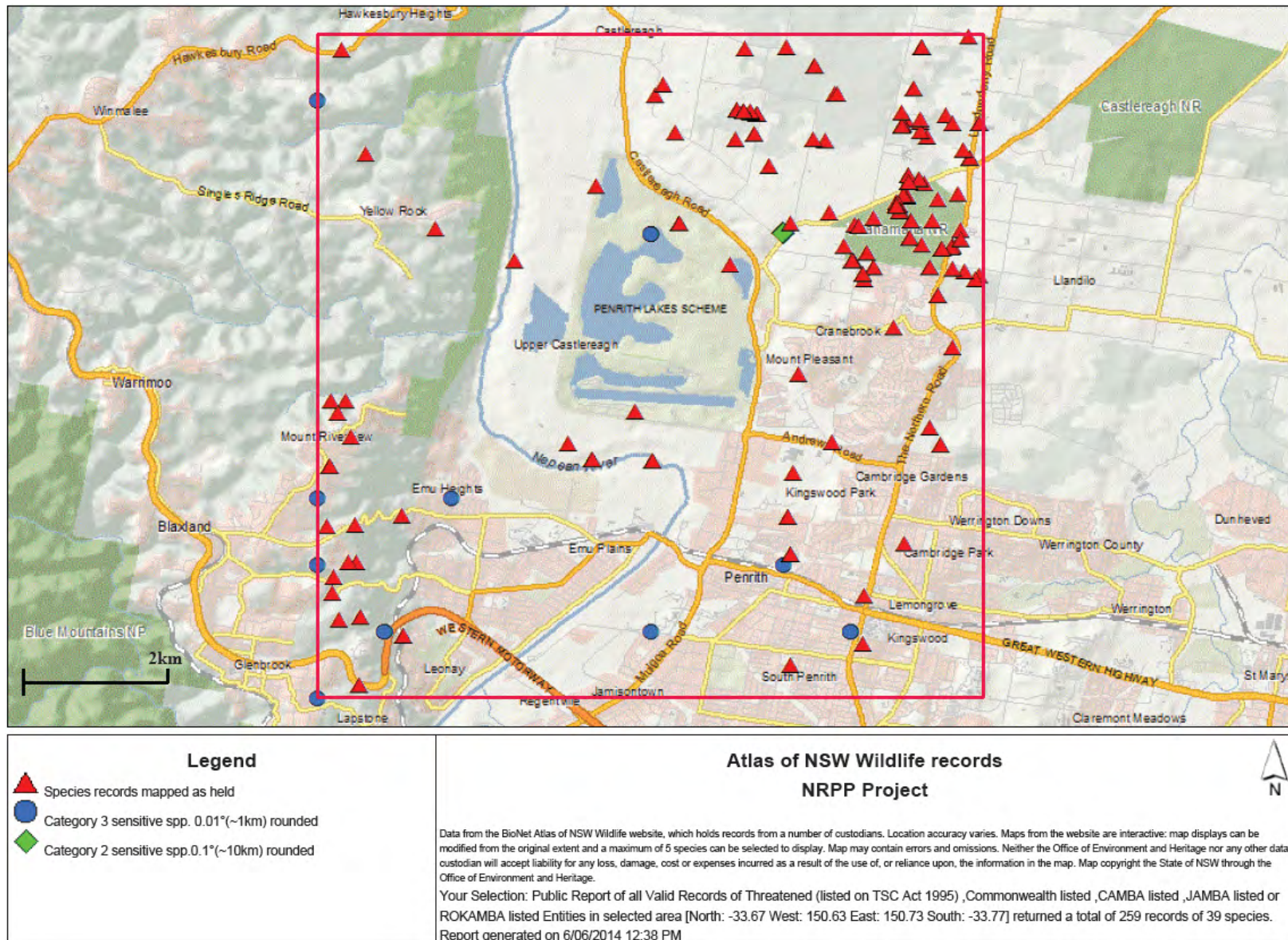
COMMON NAME	SCIENTIFIC NAME	TSC ACT	EPBC ACT	2005	2012	2014
Amphibians						
Common Eastern Froglet	<i>Crinia signifera</i>			X		
Birds						
Australasian Shoveler	Anas rhynchotis	-	M	X		
Australian Pelican	Pelecanus conspicillatus	-	-	X		
Australian Raven	Corvus coronoides	-	-	X		
Australian Wood Duck	Chenonetta jubata	-	M	X		X
Azure Kingfisher	Alcedo azurea	-	-	X		
Bar Shouldered Dove	Geopelia humeralis				X	
Bellbird	Manorina melanophrys				X	X
Black-shouldered Kite	Elanus axillaris	-	M	X		
Satin Bowerbird	Ptilonorhynchus violaceus					X
Brown Falcon	Falco berigora	-	M	X		
Common Myna	Acridotheres tristis	U	-	X		
Dusky Moorhen	Gallinula tenebrosa	-	-	X	X	X
Eastern Yellow Robin	Eopsaltria australis				X	
Eurasian Coot	Fulica atra	-	-	X	X	X
Fan-tailed Cuckoo	Cacomantis flabelliformis	-	-	X		
Great Cormorant	Phalacrocorax carbo	-	-	X		
Great Egret	Ardea alba	-	-	X	X	

COMMON NAME	SCIENTIFIC NAME	TSC ACT	EPBC ACT	2005	2012	2014
Grey Fantail	Rhipidura fuliginosa	-	-	X	X	
Grey Teal	Anas gracilis	-	M	X		
Hardhead	Aythya australis	-	M	X		
Little Black Cormorant	Phalacrocorax sulcirostris	-	-	X	X	X
Little Pied Cormorant	Phalacrocorax melanoleucos	-	-	X	X	
Magpie-lark	Grallina cyanoleuca	-	-	X	X	
Masked Lapwing	Vanellus miles	-	M	X		
Pacific Black Duck	Anas superciliosa	-	M	X		X
Pied Cormorant	Phalacrocorax varius	-	-	X		
Purple Swampphen	Porphyrio porphyrio	-	-	X	X	
Red-whiskered Bulbul	Pycnonotus jocosus	U	-	X	X	X
Silvereye	Zosterops lateralis	-	-	X		
Spotted Pardalote	Pardalotus punctatus	-	-	X		
Striated Thornbill	Acanthiza lineata	-	-	X		
Superb Fairy-wren	Malurus cyaneus	-	-	X	X	X
Unidentified Quail	Coturnix sp.	-	-	X		
Welcome Swallow	Hirundo neoxena				X	
White-Browed Scrubwren	Sericornis frontalis				X	
White-cheeked Honeyeater	Phylidonyris nigra	-	-	X		
White faced Heron	Egretta novaehollandiae				X	
White-plumed Honeyeater	Lichenostomus penicillatus				X	
Willie Wagtail	Rhipidura leucophrys	-	-	X		X
Yellow-faced Honeyeater	Lichenostomus chrysops	-	-	X		
Zebra Finch	Taeniopygia guttata	-	-	X		
Mammals						
Brown Hare	Lepus capensis	U	-	X		
Reptiles						
Eastern Water Skink (Tail only)	Eulamprus quoyii				X	
Garden/Grass Skink	Lampropholis sp.	-	-	X	X	X
Water Dragon	Physignathus lesueurii				X	

Key

M = Migratory species; U = Introduced species.

9.0 APPENDIX 3 BIONET ATLAS SEARCH RESULTS



10.0 APPENDIX 4 SEVEN PART TESTS

10.1 RIVER FLAT EUCALYPT FOREST

River-flat Eucalypt Forest (RFEF) is listed as an endangered ecological community listed on Schedule 1 (Part 3) of the TSC Act.

RFEF is associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains (NPWS 2004). Alluvial Woodland and Riparian Forest are mapped by NPWS (2003) as occurring in the study area. These vegetation units are subcommunities of RFEF. Impacts of the proposal are likely to be minimal, as the required clearing will be confined to a maximum 10m wide disturbance area, which will be actively regenerated post works. In the vicinity of the Nepean River, three route options (A, B and C) within Pipeline Route 1 have been proposed (Figure 2). For the purposes of the impact assessment, the route option with maximum potential impact has been used for calculations of impact area. The total area to be cleared as part of the proposal is a maximum of approximately 0.5 ha.

(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 to endangered ecological communities.

(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 to endangered ecological communities.

(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.**

An approximately 10m wide disturbance area will be cleared through the RFEF in the study area. Based on the NPWS (NPWS 2002b) mapping, this equates to a total of up to 0.5 ha of RFEF to be cleared for the proposal. This is not a large area of habitat given that there is approximately 1864 ha of the community mapped by NPWS (2002) within a 10 km radius of the study area.

It is recommended that the proposed clearing avoid mature native trees where practicable to prevent erosion and assist in rapid regeneration of the impacted area. Post works, the area cleared will be regenerated.

(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.**

The mapped area of RFEF is currently fragmented by existing tracks and clearings. The RFEF in the study area is restricted to a thin strip of *Casuarina cunninghamiana* adjoining the Nepean

River. The approximately 10 m wide impact corridor will temporarily fragment the RFEF, but will not isolate the community from currently interconnecting areas, as the riparian vegetation along the Nepean River is already highly fragmented. Furthermore, the proposal will only fragment the community temporarily, as the cleared areas will be actively regenerated post installation of the pipeline. Bush regeneration works are likely to involve weed control, seeding and possibly planting of local native species in accordance with a Vegetation Management Plan prepared for the site.

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

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for RFEF (DE Threatened Species Unit).

(f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.

A recovery plan is currently being prepared for the Cumberland Plain's endangered ecological communities. This will include Cumberland Plain Woodland EEC and River-flat Eucalypt Forest EEC.

The core principles on which the recovery plan will be based are that:

- The protection and management of large, intact remnants is more effective and efficient than for smaller, fragmented remnants;
- Recovery efforts need to aim to ensure that a representative sample of biodiversity is conserved;
- Active management to best practice standards is needed to prevent the degradation of bushland in a fragmented landscape; and
- Where impacts on biodiversity cannot be avoided, they should be offset using appropriate means, including BioBanking.

The proposed works would only require a small amount of poor-moderate condition River-Flat Eucalypt Forest to be removed. This would not inhibit the achievement of the above principles and would not impinge upon any conservation objectives developed for the EEC.

No threat abatement plans are applicable to this project.

(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.

Listed Key Threatening Processes (KTP) that may impact RFEF include Clearing of native vegetation; Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; Invasion of native plant communities by exotic perennial grasses; Predation, habitat destruction, competition and disease transmission by feral pigs; Anthropogenic climate change; High frequency fire; and Removal of dead wood and dead trees (NPWS 2004). The proposal involves 'Clearing of Native Vegetation', which is listed as a Key Threatening Process on the TSC Act. The native vegetation will, however, be actively regenerated post works. The RFEF in the study area is currently in a highly degraded condition.

Additional threats to the RFEF include fragmentation and degradation, flood mitigation and drainage works, landfilling and earthworks associated with urban and industrial development, pollution from urban and agricultural runoff, weed invasion, overgrazing, trampling and other soil disturbance by domestic livestock and feral animals including pigs, activation of 'acid sulfate soils', removal of dead wood and rubbish dumping, anthropogenic climate change and frequent burning (NPWS 2004).

Proposed rehabilitation works post installation of the pipeline are likely to reduce many of the listed threats, including weed invasion and pollution from urban and agricultural runoff.

Conclusion

Approximately 0.5 ha of RFEF will be cleared as a result of the proposed works. The proposed works would not have a significant impact on the community given the regional extent of the community and the fact that the area will be regenerated post works in accordance with a

Vegetation Management Plan prepared for the site. A Species Impact Statement is not considered necessary.

10.2 MACQUARIE PERCH

Macquarie Perch *Macquaria australasica* is listed Vulnerable on Schedule 5 of the FM Act. This species is also listed as Endangered on the EPBC Act. Macquarie Perch inhabit the upper reaches of catchments where there are deep pools and riffles with little sediment (McDowall 1996, Allen *et al.* 2002). They undertake an upstream breeding migration in late spring and deposit between 50,000 and 10,000 number small adhesive demersal eggs above riffles and at the tail of pools (Morris and Wooller 2001). Macquarie Perch may have been introduced into the Eastern drainages from the upper Murray Darling Basin. They are known in the upper reaches and dams of the Nepean River, Glenbrook Creek and the Colo River in the Hawkesbury Nepean Catchment and the upper Shoalhaven River (Bruce *et al.* 2001).

(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.

Macquarie Perch was not detected during this study. The species is known to occur in Glenbrook Creek approximately 6 km upstream. The Nepean Weir is potential poor quality habitat for the Macquarie Perch. The proposed works will pump water from this weir which may cause drawdown effects which creates barriers to passage and causes some sedimentation. Given the poor quality of habitat directly downstream of the Nepean Weir it is unlikely that this area would support a viable population. While areas of habitat and potentially populations may occur in tributaries downstream it is unlikely that the proposed works will isolate potential breeding and refuge areas.

It is therefore considered that the lifecycle of this species will not be disrupted such that a viable population of this species as is likely to be placed at risk of extinction.

(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.

There are currently no endangered populations of this species listed under the FM Act.

(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 Applicable

(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.

The catchment under consideration is the Hawkesbury Nepean Catchment. Macquarie Perch are known to occur in the upper reaches and dams of the Nepean River. They are also known from Glenbrook Creek approximately 6km upstream of the Nepean weir and in the Colo River downstream of the Penrith weir.

There are a number of natural and man-made barriers to fish passage within their range and it is unlikely that the proposed works would further isolate known populations of Macquarie Perch within the Hawkesbury-Nepean River System. It is unlikely that a known area of habitat will be impacted

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

Critical habitats are areas that are crucial to the survival of particular threatened species, populations and ecological communities. Under the FM Act, a register of critical habitats is maintained. No critical habitat has been declared for this species (DPI Fisheries Scientific Committee).

(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 or threat abatement plans for the Macquarie Perch.

(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 (KTP) are listed on Schedule 6 of the FM Act. The proposed development will involve the installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams which is a recognised KTP. It will also involve the removal of a small amount of riparian vegetation which is also listed as a KTP under the FM, TSC and EPBC Acts ('Clearing of Native Vegetation').

Other threats to this species include sedimentation and habitat degradation, barriers to fish passage, thermal pollution from dams, competition by salmonids, overfishing and the EHN Virus. (DPI Fisheries Scientific Committee 1998, Morris and Wooller 2001). The proposed works may increase the barrier to fish movement through the isolation of the fishladder at Penrith Weir.

Conclusion:

The proposed development is unlikely to have a significant impact on this species. A Species Impact Statement is not recommended.

11.0 APPENDIX 5 EPBC ASSESSMENT OF SIGNIFICANCE

Potential habitat occurs within the study site for Macquarie Perch *Macquaria australasica* listed as Endangered on the EPBC Act within the Nepean River Upstream of the Penrith Weir:

Is the action likely to lead to a long-term decrease in the size of an important population of a species?

Macquarie Perch are not known to occur in the Nepean weir and no individuals were observed during this survey. It is unlikely that the proposed action will cause a decrease in the size of a known population.

Is the action likely to reduce the area of occupancy of the species?

Macquarie Perch are not known to occur in the Nepean River at Penrith weir and therefore an area of known habitat will not be reduced by the proposed works

Is the action likely to fragment an existing population into two or more populations?

The Macquarie Perch is known from several tributaries and in the upper catchment of the Hawkesbury Nepean River and the Colo River and it unlikely that the proposed works will further fragment an existing population.

Is the action likely to adversely affect habitat critical to the survival of a species?

There is no critical habitat listed for the Macquarie Perch. The proposed development will not effect riffle or pool habitat within known habitat

Is the action likely to disrupt the breeding cycle of a population?

There are no known breeding populations within or downstream of the weir and the proposed works is unlikely to reduce riffle habitat which is utilised for breeding although riffle habitat downstream of the weir may be effected.

Is the action likely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The status of the eastern populations of the Macquarie perch is considered less threatened than the Murray Darling Basin populations although it is still declining. The action may result in a reduction of fish passage in the Nepean River however it is highly unlikely that the Macquarie Perch would find suitably habitat within the mid and lower Nepean River without significant improvements to the habitat, fish passage and flow regime.

Is the action likely to result in invasive species that are harmful to a critically endangered or endangered/vulnerable species becoming established in the endangered or critically endangered species/vulnerable habitat?

It is highly unlikely that the proposed action will cause an invasive aquatic species not currently established in the Nepean River to become established. Although a lack of flow may increase the disturbance and abundance of aquatic weeds such as *Salvinia molesta* and *Egeria densa*.

Is the action likely to interfere with the recovery of the species?

An action plan has yet to be developed for the Macquarie perch and fish passage below the weir is highly impacted and however it is highly unlikely that the Macquarie Perch would find suitably habitat within the mid and lower Nepean river without significant improvement to the habitat, fish passage and flow regime.

Conclusion

Based on the above assessment, Macquarie Perch are unlikely to be significantly impacted by the activities and as such a Referral under the provisions of the EPBC Act is not recommended for this species.

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