



NSW GOVERNMENT
Department of Planning

MAJOR PROJECT ASSESSMENT: Nepean River Pump and Pipeline

Director-General's
Environmental Assessment Report
Section 75I of the
Environmental Planning and Assessment Act 1979

May 2007

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EXECUTIVE SUMMARY

Penrith Lakes Development Corporation, the Proponent, is seeking the Minister for Planning's approval for the construction and operation of a pump and pipeline system to extract water from the Nepean River to fill and top up Penrith Lakes. The proposed infrastructure is a vital component of the Penrith Lakes Scheme, a major undertaking in Western Sydney that involves the creation of lakes and parklands (along with urban development) to satisfy the future recreational needs in this region.

The Nepean Pump and Pipeline (NRPP) project would involve the construction and operation of a 4.3 km pipeline upstream of the Penrith Weir to the Penrith Lakes Scheme Development site and a pump station with two submersible pumps on the eastern bank of the Nepean River. A control building at Weir Reserve will house electronic instrumentation equipment and cabling and connections to the pump station.

Pumping rules for water extraction have been developed that protects environmental flows in the Nepean River whilst extracting the appropriate volume of water to supply the lakes scheme. Operation of the project will be governed by the proposed pumping rules whereby pumps can start when flow over Penrith weir reaches 500 megalitres per day; and pumps to stop when flows over Penrith Weir drop to 350 megalitres/day.

The construction of pump and pipeline infrastructure is a contractual obligation of the Proponent to the NSW Government under a Deed of Agreement made in 1987. The Proponent is a consortium of three quarry operators, (Boral, Hanson and Readymix) that is undertaking the development of the Penrith Lakes Scheme under the Deed.

The Project is located wholly within the Penrith local government area and has a capital value of \$10 million. An estimated 80 to 100 personnel would be employed during the construction period.

A total of six submissions were received from the public exhibition of the Environmental Assessment. Half of the submissions were from Penrith City Council, DECC and DPI and the rest were from individuals. Except for one private submission, all of the submissions expressed general support for the project while raising some issues that need consideration in the project assessment. The Proponent's Submissions Report addressed the issues raised in the submissions.

The project is limited in scope to the sourcing and delivery of water from the Nepean River to the receiving lake (Quarantine Lake). The on-going operation and management of the lakes will be dealt with separately in another Part 3A project, ie the Penrith Lakes Concept Plan. The Environmental Assessment for this will soon be publicly exhibited.

The key issues associated with the project are:

- water extraction and management - development of suitable pumping rules that would protect environmental flows within the Nepean River whilst drawing the appropriate volume of water supply to the lakes;
- water quality - adequacy of water quality of the Nepean River for transfer to Penrith Lakes (including environmental management measures to control transfer of aquatic weeds), and construction impacts on the river's water quality;
- soil erosion and sedimentation - potential impacts of the proposed vegetation clearing and pipeline construction on riverbank stability and water quality of the Nepean River;
- flora and fauna impacts - potential ecological impacts of the proposed vegetation clearing and intake structure/pump station construction on terrestrial and aquatic flora and fauna;
- landscaping and visual amenity – Council concerns over some aspects of the design of aboveground structures (pump station and control building); and landscaping and revegetation of the Great River Walk; and
- construction noise - predicted significant noise exceedances during construction activities on recreational users of Weir Reserve and other identified sensitive receivers.

The Department has considered the justification for the project and the appropriateness of the proposed pumping regime for river water extraction. It is satisfied that the proposal addresses adequately the requirements of the Deed and the Penrith Lakes Water Committee's recommendations (2005) regarding water management of the lakes where these are directly relevant to the project. It should be noted that the pumping rules have been endorsed by the then Department of Natural Resources, which has been closely involved with the project and the wider Hawkesbury- Nepean River water catchment issues.

The Department has recommended conditions to ensure that the project is designed, constructed and operated to meet the objectives of the project, and also to allow for potential integration with other sources of water supply in the longer term. These conditions include:

- defining the limits of project approval (ie extraction restricted to a specific purpose and in accordance with approved pumping rules);
- requirement to build in design flexibility in the pipeline system to allow future connection to Penrith or St Marys Sewage Treatment Plants, or St Marys Advanced Water Treatment Plant; and
- requirement to ensure that the pump station can withstand a 1 in 100 year ARI flood event and that the project does not reduce riverbank stability nor increase local flooding risk.

The Department has also recommended conditions to ensure minimal construction impacts on soil erosion and water quality, flora and fauna, noise, traffic and visual amenity. Other conditions cover on-going compliance mechanisms, community consultation and complaints management, performance standards, environmental management and performance audits. Together with the Proponent's proposed mitigation measures, contained in its Statement of Commitments, this would ensure that any residual impacts during construction can be suitably managed and mitigated.

The Project represents a fundamental component of the Lakes Scheme which will enable the delivery of a secure long term water supply to the lakes and contribute to the overall development of the Scheme. Potential impacts of the Project are considered to be manageable, and consequently, the Department recommends that the project be approved, subject to conditions of approval contained in **Appendix A**.

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1 BACKGROUND

1.1 Project Overview

The Nepean River Pump and Pipeline (NRPP) project is a fundamental component of the Penrith Lakes Scheme, which involves the development of approximately 1937 hectares of land for urban, open space and recreational uses. The Proponent, Penrith Lakes Development Corporation, is a consortium of three quarry operators Boral, Hanson and Readymix established in the 1980s to extract sand and gravel to meet Sydney's construction needs and to provide a major water oriented recreational facility for Western Sydney.

The Penrith Lakes Scheme includes five large lakes:

- Regatta and Warm-up Lakes which are currently operated by the NSW Department of Sport and Recreation and are used for various sporting activities;
- Lakes A and B which will mainly be used for recreation, including sailing, fishing and canoeing; and
- Wildlife Lake which will provide habitat for native plants and animals and educational opportunities.

Currently, around 5000 megalitres of water held in the lakes comes from urban run-off. Rain falling on the surrounding catchments of the Cranebrook and Castlereagh escarpment flows into the lakes via a series of detention basins flowing into the recreation lakes. To date, no water has been extracted from Nepean River to fill the lakes.

Once the lakes are completed, they will hold approximately 35,000 megalitres of water. Water drawn from Nepean River will provide the additional 30,000 megalitres of water required to fill the lakes and keep them topped up. The calculated median filling time for the main recreation lakes (Lake A and Lake B) is between 2 and 3 years. However, filling may take as long as 13 years if a severe drought were to coincide with the commencement of pumping.

The project has been developed in accordance with the 1987 Deed of Agreement between the Proponent and the NSW Government. Part 7 of the Deed requires the Proponent to design and construct a pump and pipeline to extract water from the Nepean River at a point immediately upstream of Penrith Weir to facilitate the initial filling and long term water supply of the lakes within the Penrith Lakes Scheme. The project site is wholly within the Penrith local government area. The project site plan is shown in **Figure 1**.

In 2004, the Penrith Lakes Water Committee was established by the Government, and assisted by an Independent Expert Panel for Environmental Flows to review the Deed, Water Plan and Water Principles. The objective of the review was to consider the long-term sustainability of the Lakes Scheme and to determine whether there were alternative options or strategies for future management. The Committee made certain recommendations which differ from the requirements of the Deed. The Environmental Assessment for the project has addressed those recommendations to the extent that they are fundamental to the objectives of the Project and are within the scope of the project.

The proposed pipeline route is significantly longer than anticipated in the Deed. It should be noted that commercial contractual obligations under the Deed regarding the design and construction of the pump and pipeline do not form part of the environmental assessment of the project.

At the completion of the Scheme (approximately 2012), all the parklands and lakes, including the water management infrastructure will be handed over by the Proponent to the NSW Government.

1.2 The Penrith Lakes Concept Plan

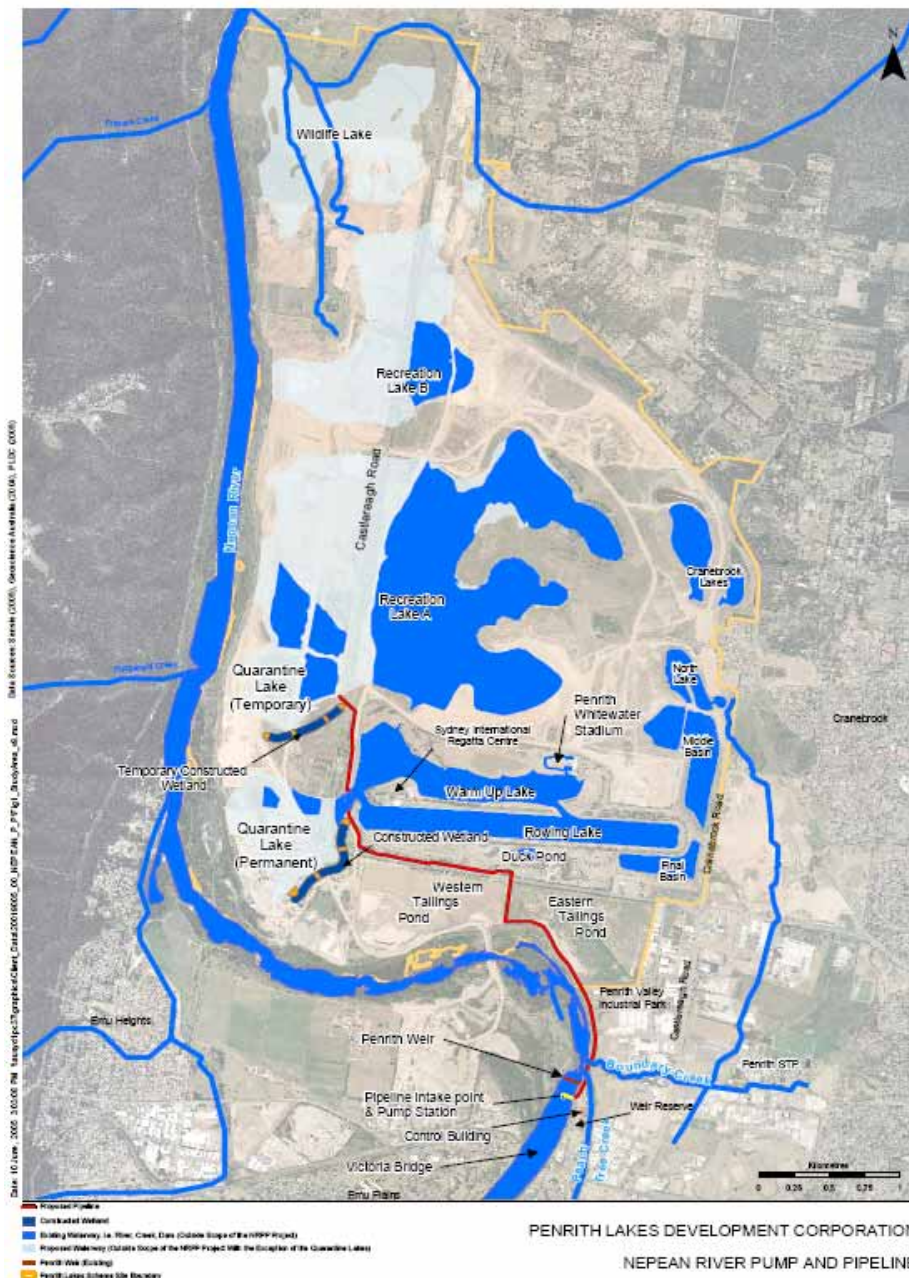
The Penrith Lakes Concept Plan is related to the project but is subject to a separate application under Part 3A of the EP&A Act. The Proponent is currently seeking to rezone the Penrith Lakes area to facilitate development for

urban and recreational purposes. The Concept Plan includes a Voluntary Planning Agreement which will contain the financial obligations of the Proponent for the Penrith Lakes Scheme, including the pump and pipeline project.

1.3 Project Need and Justification

Stormwater runoff from the surrounding catchments is deemed to be adequate to supply the top-up water for the lakes to offset evaporation losses, but is not adequate to initially fill up the lakes. Relying on stormwater run-off from the catchment alone could take decades to fill the lakes. The Independent Expert Panel (IEP) for the Hawkesbury-Nepean River assessed, on behalf of the Penrith Lakes Water Committee, a number of alternative water supply options for the Scheme. The IEP recommended that the Nepean River be used as the long-term, sustainable water supply for the Scheme's lake system, including the establishment of a specific receiving lake (known as the Quarantine Lake) to receive the river water.

Figure 1: Project Site Plan



Thus, the project has been developed to provide the mechanisms, together with rainfall and stormwater runoff within the local catchment area, to fill the lakes and maintain long-term water levels.

The Scheme design is based on the lakes being maintained within normal operating ranges of plus or minus 0.5 m, 90% of the time, to maintain the supply. Without an additional water supply to the Scheme, the main recreational lakes (ie Lakes A and B) will be in the order of two metres below operating water levels 50% of the time. This is significantly outside the desired operating range. The project is designed to deliver a maximum of 86.4 megalitres per day of water.

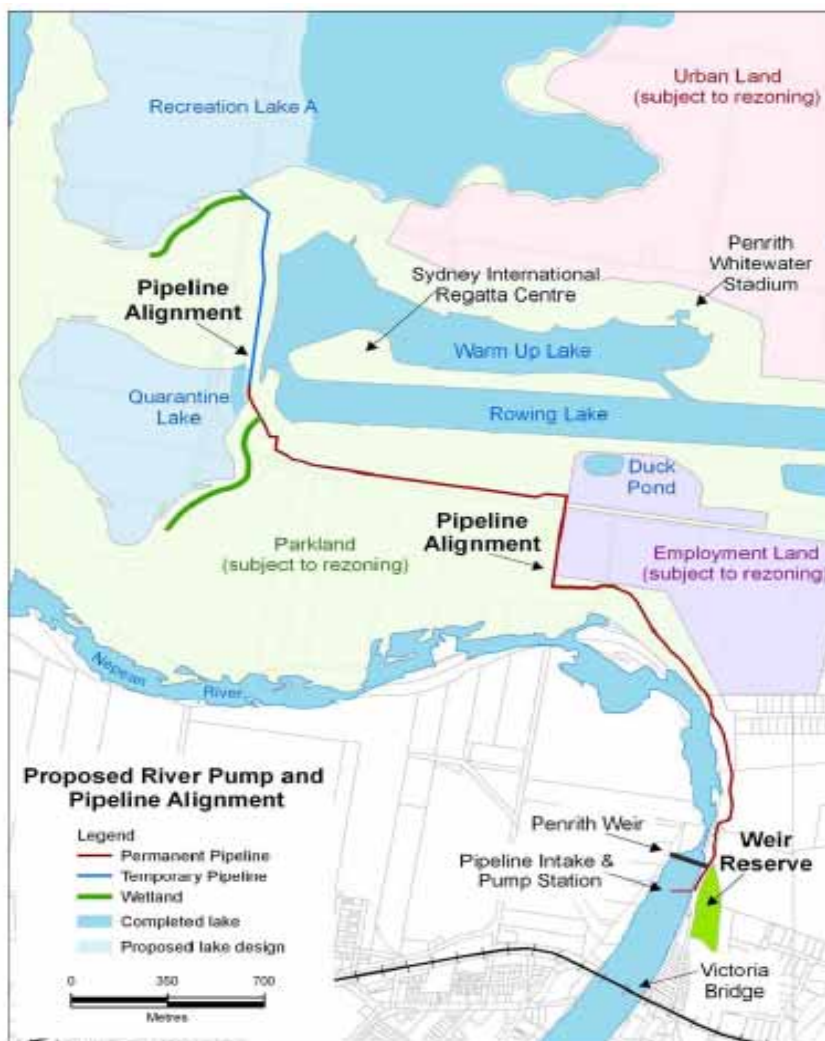
The objectives of the project, as stated in the Environmental Assessment, are:

- to resolve the long term water supply issue for the Penrith Lakes Scheme through providing an effective and reliable long term water supply;
- to develop pumping rules that deliver adequate water supply to the Scheme;
- to provide a mechanism to fill the lakes;
- to integrate the pipeline route with the Great River Walk; and
- to minimise environmental impacts, working towards sustainable outcomes.

1.4 Pipeline Route Options Selection

Three feasible pipeline options (Options 1, 2 and 3) were identified and evaluated by the Proponent. The Proponent's approach in route selection involved consideration of engineering and environmental constraints, including input from key stakeholders consulted during the preparation of the Environmental Assessment. Details of the evaluation and selection process are contained in Section 5 of the Environmental Assessment.

Figure 2: Nepean River Pump and Pipeline Route



Option 3, shown in **Figure 2**, was selected by the Proponent as the preferred route due to its overall good performance on most issues relative to the other options. It formed the basis for the development of the concept engineering design and associated environmental impact assessment.

The proposed route runs from a point 110 metres upstream of the Penrith Weir along the eastern bank of the Nepean River before diverting northwards crossing Castlereagh Road, then westwards and eventually north to follow the haul road that passes between the western and eastern tailing ponds and beneath Castlereagh Road. The route crosses back over Castlereagh Road before discharging into a temporary Quarantine Lake and subsequently into Lake A. The total length of the pipeline route is 4.3 km, which includes a temporary extension of 0.9 km. This route is twice the length of the envisaged pipeline contained in the Deed of Agreement (Figure 1.1 of the Deed – Water Management Facilities).

The temporary Quarantine Lake and ancillary treatment wetland will operate from approximately 2008 until Lakes A and B and the Wildlife Lake are full, or until the permanent Quarantine Lake is completed in approximately 2012. The site for the permanent Quarantine Lake in the south western corner of the Penrith Lakes Scheme is currently utilised for the Readymix and fine sand processing plants.

2 PROPOSED DEVELOPMENT

2.1 Approval Sought

The project is part of the wider Penrith Lakes Scheme. Related aspects of the Lakes Scheme have been, or will be approved through other statutory approval processes. In its Submissions Report, the Proponent has clarified the scope of the project and is specifically seeking the approval of the Minister for Planning for:

1. a 4.3 km, 900 mm diameter pipeline that will convey water from the Nepean River to the Scheme site (this includes temporary and permanent pipelines);
2. a pump station comprising two submersible pumps built into the eastern bank of the Nepean River, each with a capacity of 500 litres per second;
3. inlet and discharge pipe work connected to the intake structure and submersible pumps;
4. a control building that will house electronic instrumentation equipment and cabling at Weir Reserve and connections to the pump station;
5. earthworks associated with the establishment of working areas, pipe trench excavation and backfilling, landscaping and reinstatement;
6. wetlands (temporary and permanent systems) at the pipeline discharge point within the Scheme boundary; and
7. operation of the pump and pipeline system to fill up and top up the lakes in accordance with the proposed pumping rules – pumps can start when flow over Penrith Weir reaches 500 megalitres per day; and pumps will automatically stop when flows over Penrith weir drops to 350 megalitres per day

The following features are subject to other approvals, and not the current project application:

1. Quarantine Lakes, both permanent and temporary;
2. pipelines to transfer water from the Quarantine Lakes to the rest of the Penrith Lakes Scheme; and
3. water management within the Penrith Lakes Scheme, including the Quarantine Lakes.

Design details of the proposed infrastructure are outlined in the table below:

Table 1: Infrastructure Design Details

Project Element	Description
Pipeline	The pipeline will be installed below ground level for its entire length of 4.3 km. Water from the Nepean River will be pumped at a maximum flow rate of 1.0m ³ /second to a pressure break tank at a high point where the pressure pipeline will discharge into a gravity main.
Pump Station	The 43m ² pump station will be built below ground into the eastern bank of the Nepean River approximately 110 m upstream of the Penrith Weir. The roof structure and the wall adjacent to the river will be the only parts visible above ground. The station can withstand inundation from a 100 ARI flood event without damage. The operation of the pump station will be fully automatic, with monitoring and overriding control from the PLDC offices.
Intake Structure and Pipework	Intake pipework (twin 630 mm diameter pipelines) will be submerged in a minimum of two metres of water under the Nepean River bed to connect the intake structure to the pump station. The screens (Johnson Screens) will be located approximately 70 m from the eastern riverbank and 110 m upstream of Penrith Weir. The screens will comprise a matrix of fine spaced bars to prevent weed fragments and other debris from entering the pipes, and in turn, the pipeline.

Control Building	The control building will be co-located with the existing public amenity building immediately to the west of the existing car park, on the high bank within Weir Reserve. It will be approximately 75m ² in area and up to 3.8 m in height.
Transformer and substation	A transformer and substation will be installed to provide power supply to the project. This will be housed as a pad mounted unit adjacent to the control building.
Constructed Wetlands and Quarantine Lakes	Constructed wetlands will be located along the eastern boundary of both the temporary Quarantine Lake and permanent Quarantine Lake to act as a 'biological filter' (ie to capture and retain weed fragments and seeds transported from the Nepean River via the pipeline). They will also function as a water quality control mechanism to settle suspended sediments and to remove nutrients in conjunction with the Quarantine Lake.

3 STATUTORY CONTEXT

3.1 Permissibility

Land traversed by the Project is subject to the zoning controls administered by Penrith City Council under various Local Environmental Plans (LEPs) and Interim Development Orders (IDOs). The relevant zonings are outlined in Table 1 below.

Table 2: Relevant LEP Zonings

Zone	Relevant LEP	Permissibility	Comments
1(a2) Rural 'A2'	<i>Interim Development Order No 93 - Penrith</i>	Prohibited	Development of the Project within this zone is prohibited as it does not fall within the land uses listed under clause 3 of IDO No 93.
4(a) General Industry Zone	<i>Penrith LEP 1996 – Industrial Lands</i>	Permissible with consent	Development of the Project within this zone is permissible with consent as the construction of a pipeline is a land use that is 'any other land use other than those included in item (b)(iii)', which lists prohibited development.
6(b) Proposed Public Recreation and Community Uses	<i>Penrith LEP 1998 – Urban Lands</i>	Prohibited	Development of the Project within these zones is prohibited as the development does not fall within the definition of a utility undertaking.
6(d) Regional Open Space	<i>Penrith LEP 1998 – Urban Lands</i>	Prohibited	

As indicated in the Environmental Assessment, Council has confirmed that the Project is a prohibited development on land zoned 6(b) – Proposed Public Recreation and Community Uses, and 6(d) – Regional Open Space. However, *Sydney Regional Environmental Plan No 11 – Penrith Lakes Scheme* (SREP 11) applies to land within the Penrith Lakes Scheme, which includes part of the project located on land zoned Rural 1(a2) Rural 'A2'. Clause 8(1) of SREP 11 permits with consent '*development for the purposes of implementing the Penrith Lakes Scheme*', which applies to the Project, and overrides the LEP.

Under clause 75J(3)(b) of the EP&A Act, the Minister cannot approve of the carrying out of a project that would but for Part 3A of the EP&A Act be wholly prohibited under environmental planning instruments. As the Project is not wholly prohibited under the relevant planning instruments, the proposal can be approved under Part 3A.

3.2 Other Relevant Environmental Planning Instruments

Several environmental planning instruments are directly relevant to the project and were considered in the Environmental Assessment. These instruments are the *Sydney Regional Environmental Plan No 11 (Penrith Lakes Scheme)*, *Sydney Regional Environmental Plan No 20 (Hawkesbury-Nepean River and State Environmental Planning Policy No 19 (Bushland in Urban Areas))*.

3.3 Major Project

On 6 December 2005, the Director-General of the Department of Planning, as delegate of the Minister for Planning, formed the opinion that the proposed development is a project to which Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) applies. The proposal achieves the Major Project criteria in the *State Environmental Planning Policy (Major Projects) 2005* by being infrastructure associated with the Penrith Lakes (located in and outside the Penrith Lakes area) for the purpose of extraction, rehabilitation or lake formation (Schedule 2, Clause 6).

3.4 Minister's power to approve

The Minister is the approval authority for projects subject to Part 3A of the EP&A Act of which the proposal is one. Under section 75J of this Act, the Minister may approve (or disapprove) of the carrying out of the project.

The Department has exhibited the Environmental Assessment (EA) in accordance with section 75H(3) of the Act, as described in Section 3.5 below. Additionally, the project meets the requirements of the Major Projects SEPP. Therefore, the Department has met its legal obligations and the Minister has the power to determine this project.

3.5 Environmental Assessment Exhibition

The EA for the Project was publicly exhibited between 25 September and 30 October 2006 at the Department's Head Office and Parramatta Regional Office, Penrith City Council Civic Centre and the PLDC office. The EA has also been published on the Department and the Proponent's websites.

3.6 Environmental Assessment Adequacy

The Director-General's Requirements for the preparation of the Environmental Assessment were issued on 14 December 2005. The Environmental Assessment was deemed to be adequate for exhibition on 16 September 2006 in accordance with section 75H of the EP&A Act. It is compliant for the purpose of section 75(2)(g) of the EP&A Act.

4 ISSUES RAISED IN SUBMISSIONS

4.1 Issues raised in the Submissions

A total of six submissions were received from the public exhibition of the EA, as summarised in Table 2. The issues raised in the submissions are summarised in Table 3.

Table 3: Summary of Submissions Received

Submissions type	No of submissions
Government agencies <ul style="list-style-type: none"> • Dept of Environment and Conservation (now the Department of Environment and Climate Change, DECC) • Dept of Primary Industries (DPI) • Penrith City Council 	3
Private companies	1
Individuals	2
Total	6

Two of the three private submissions supported the project, and one objected. Penrith City Council raised concerns over some design aspects of the proposed pump station and control building, proposed location of a construction compound on Weir Reserve, traffic management, and impact of works on the Great River Walk. The DECC and DPI identified some specific environmental requirements.

Table 4: Summary of Issues Raised in Submissions

Issues	Details
Water extraction and pumping rules	<ul style="list-style-type: none"> • water should only be taken when the Nepean River is in flood conditions. • pumps should only be started when natural flows over Penrith Weir reach 1000megalitres/day and cease automatically when the flow drops to 500megalitres/day. • potential use of a sediment control system, such as a CDS unit, to remove small particles of aquatic weeds would assist in removing sediment and nutrients from the raw water. • concerns about potential impact of construction works on water quality of the Nepean River. Ensure stringent sediment and erosion controls are in place and monitored by relevant authorities.
Species protection	<ul style="list-style-type: none"> • doubts that a targeted survey for <i>E benthamii</i> (vulnerable plant species) was undertaken.
Aboriginal cultural heritage	<ul style="list-style-type: none"> • the Proponent should follow the recommendations in the Aboriginal Cultural Heritage Assessment Report (Appendix E to EA) as well as those from the local Aboriginal community in handling Aboriginal heritage matters.
Design and landscaping	<ul style="list-style-type: none"> • proposed location and design of the control building on Weir Reserve should minimise any loss of vegetation. • the control building should reflect a contemporary design in its context, including adaptive re-use. • if the existing building is to be retained, it should be an integrated addition to present as a single built form.

	<ul style="list-style-type: none"> • concerns over the use of gabion walls in terms of structural integrity, vandalism and maintenance. • the concrete wall elements of the proposed pump station/platform do not sit aesthetically well in its natural setting. Concrete walls embedded with Nepean River stone, as used in the main entry gates to the Sydney International Regatta Centre (SIRC), are recommended.
Construction and traffic management	<ul style="list-style-type: none"> • Council objects to the proposed location of a temporary site compound on Weir Reserve or in close proximity of the river. Also recommends that no work occurs within Weir Reserve on weekends. • the pipeline should be bored under Castlereagh Road to maintain its current condition and minimise impacts. • access to Weir Reserve via the existing public road should be maintained. • a dilapidation report on existing infrastructure (including roads and buildings) should be submitted to Council, and any damage rectified prior to finalising the works. • any necessary Roads Act approvals should be obtained prior to undertaking works not in the PLDC's ownership. • evidence (ie shells) that the Cumberland Land Snail has existed north of Boundary Creek. Any necessary actions should be implemented during construction.
Future pipeline connection	<ul style="list-style-type: none"> • the pipeline should be constructed in a way that permits future connection of treated effluent from the Penrith Sewage Treatment Plant subject to acceptable water quality being achieved.
Impact on the Great River Walk	<ul style="list-style-type: none"> • Council requires the following measures in relation to the Great River Walk: <ul style="list-style-type: none"> ◦ reinstatement of the Great River Walk, where impacted by construction works; and ◦ preparation and implementation of a landscape plan within the easement of the riparian zone.

5 ASSESSMENT OF ENVIRONMENTAL IMPACTS

5.1 Water Extraction and Management

Issues

The key issue for water extraction from the Nepean River is to protect environmental flows in the river whilst extracting the appropriate volume of water to supply the lakes scheme. This objective is reflected in the 1987 Deed of Agreement between PLDC and the NSW Government, which includes Water Principles and a Water Plan.

Longer term water supply issues involve:

- use of treated effluent from the Penrith Sewage Treatment Plant (STP) as an alternative source of water supply in the long term, as recommended by Penrith Lakes Water Committee; and
- a recommendation from the then DNR to include system flexibility in the pipeline design so as to allow interaction of the Penrith Lakes Scheme with future stages of the Western Sydney Recycled Water Initiative.

Background

The interrelationship between the Nepean River and the Penrith Lakes Scheme, in relation to the project, is described in the Environmental Assessment. The scope of the Environmental Assessment is limited to the sourcing and delivery of water from Nepean River to the Quarantine Lake and the construction and operation of the infrastructure to enable it. The on-going water management of the lakes is addressed separately in the Penrith Lakes Concept Plan (another Part 3A project) which covers the residential and recreational development of the Penrith Lakes Scheme.

Water Research Laboratory (WRL, University of NSW) conducted an assessment of adequacy (both quantity and quality) of the Nepean River to supply water to the Scheme. It also assessed if the 170 megalitres per day cease to pump rule, as specified in the Proponent's current water extraction licence from the then Department of Natural Resources (DNR) is appropriate to the ecological needs of the River. This licence permits pumping of water when river flows exceed 170 megalitres per day and at a maximum rate of 147 megalitres per day.

Field investigations on the appropriateness of this pumping rule were conducted on 1 June and 7 December 2005 when flows at the Nepean River were 70 megalitres per day and 580 megalitres per day respectively (based on the Sydney Catchment Authority's gauging station). Seven sets of rapids were assessed. The investigations found that 170 megalitres per day would provide passage for all the rapids, other than Rapid 3, which may impede fish movement downstream and upstream of the Penrith Weir.

To optimise extraction from the Nepean River, WRL developed a dynamic water balance model to devise a pumping regime that would:

- meet the environmental flow requirements of Nepean River to maintain its health;
- maintain the operating levels in the Scheme, without compromising water quality; and
- determine whether the Nepean River is an adequate and reliable long-term water source for the lakes.

Numerical simulation used 95 years data of rainfall, river flow and environmental conditions. An extensive range of scenarios were considered with various pumping capacities and pumping rules. Variation to the Penrith Weir flows with proposed increased environmental releases from the Upper Nepean catchment dams was also considered in the assessment.

The model included the four existing treatment lakes north of the Rowing Lake, as well as the four existing and proposed lakes within the Scheme (Rowing Lake, Recreation Lake A, Recreation Lake B and the Wildlife Lake). It also included a treatment lake for extracted river water (Quarantine Lake).

Pumping rules were derived based on the assessment of varying pumping scenarios, environmental flows and extractions in the Nepean River, and the water balance needs for the Scheme's lakes.

Based on the water balance model, an extraction rate of 1.0 m³/sec and the following pumping rules were devised for the Project:

- pumping can commence when flows exceed 500 megalitres per day over Penrith Weir; and
- pumping to cease when flows fall to 350 megalitres per day.

Consideration

Pumping regime

The Environmental Assessment indicated that the pumping regime must consider the existing interconnectivity of the Scheme lakes and the predetermined operating levels for the lakes. Maintenance of the levels influences pump and flow scenarios. The Deed of Agreement specifies that the operating levels for the lakes¹ should be in the order of plus or minus 0.5 metres, to be exceeded for only 5% of the time (ie the 95th percentile drawdown). The Rowing Lake is the exception which requires a narrower range of plus or minus 0.25 m for correct operation of starting equipment. Based on the WRL assessment and water balance model, the Environmental Assessment indicated that the drawdown criteria as specified in the Deed for all the lakes cannot be achieved. Thus, alternative water supplies may be required in the future to supplement the top-up water supply.

The proposed maximum pump rate of 1.0 m³/sec (derived from the water balance model) is less than the pumping rate of 1.7 m³/sec specified in the Deed. The lower rate was proposed. A comparison of these two rates concluded that the higher rate provides only minor improvement to drawdown levels and that the ecological consequence of either 1.0 or 1.7 m³ would be the same.

As indicated above, the cease to pump limit of 170 megalitres per day in the current water extraction licence is likely to reduce fish passage. A three kilometre stretch downstream of Penrith Weir was identified as particularly depth limiting. The revised pumping rules were supported by the Department of Primary Industries (DPI) in its submission, indicating that the rules appear to be suitable to reduce the risks of interfering with fish migration.

The pumping rules were questioned in one private submission, due to concerns about the drought situation and drawing water from the Nepean River. The submission suggested a more stringent pumping regime, ie pumping should only be started when natural flows over Penrith Weir reaches 1000 megalitres per day; and pumps to stop automatically when the flow drops to 500 megalitres per day.

In response to this submission, the Proponent indicated that the ecological health of the Nepean River was a principal factor in the determination of the pumping rules. Extensive investigations (including advice from the (Independent Expert Panel for the Hawkesbury-Nepean, Shoalhaven and Woronora) were undertaken to ensure the environmental flows in the Nepean River and downstream irrigators will not be affected.

The Department considers that the Proponent has demonstrated the appropriateness of the proposed pumping rules. Both the then DNR and DPI have endorsed these rules. It is also clear that Nepean River water will only be used for top up purposes once the lakes are filled. The Department's recommended conditions embody the purpose and limits for river extraction and the pumping regime that must govern the operation of the proposed infrastructure. Note that if the project is approved, the Proponent will need to obtain a new water licence from the relevant water licensing body which will reflect the new pumping rules.

Nepean River environmental flows

The environmental flows at Penrith Weir are dependent on releases from Warragamba Dam and flows passing through the Upper Nepean River weirs at Pheasants Nest and Broughtons Pass, which are fed by environmental flows from the Cataract, Cordeaux, Avon and Nepean Dams. The total volume of flows that currently pass over Penrith Weir is 45.5 megalitres per day, assuming that there are no extractions upstream. Of these, 33.3 megalitres per day comes from the Warragamba Dam.

¹ The Deed specifies the following operating levels for the lakes: Rowing Lake (Regatta) -15 m; Lake A - 14 m; Lake B -12 m; and Wildlife Lake – 10 m.

The Environmental Assessment indicated that if environmental flows are not maintained in the Nepean River (through over extraction of water), there may be hydrological impacts on the ecological and water quality of the river downstream of Penrith Weir. The environmental flow requirements of Nepean River were a primary consideration in the water balance modelling conducted by WRL which resulted in the proposed pumping rules.

The Environmental Assessment has not considered the impact/implications of the currently proposed Western Sydney Recycled Water Initiative (WSRWI) on the operation of the project. Note that WSRWI is currently the subject of a Part 3A application. This is a Sydney Water project which proposes to replace the current volume of water released daily from Warragamba Dam with treated effluent from three existing sewage treatment plants (STPs) at Penrith, St Marys and Quakers Hill. It aims to maximise the beneficial use of recycled water for residential, industrial, agricultural and environmental purposes. A new advanced water treatment plant is proposed to be constructed at St Marys STP, drawing in a total of 50 megalitres per day of treated effluent from the three plants, which once further treated will be discharged downstream of Penrith Weir near Boundary Creek (the existing discharge location for Penrith STP's treated effluent). Operation of this recycling project is targeted for commencement in 2009, at which time releases from Warragamba will cease.

The Department recognises that projects such as WSRWI and proposals for future increased releases from the Upper Nepean dams by Sydney Catchment Authority (SCA) would influence flow conditions in the Nepean River and water extraction for the lakes. However, it is envisaged that these proposals would increase and improve the flow conditions of Nepean River and not affect the operation of the project. It should be noted that the modelling conducted for the pumping rules has included scenarios of increased releases from the Upper Nepean dams.

Long term water supply and pipeline design flexibility

The Penrith Lakes Water Committee (2005) identified that in the longer term, the only reliable alternative water supply for the Scheme would be the use of treated effluent from the Penrith STP. The Department notes that the Proponent will be investigating this issue, but is outside the scope of the current project application. However, the Proponent supports the objective of a future connection with the Penrith STP and has included blanked-off T-pieces in the pipeline design at two locations (approximately chainage 300 and chainage 1675) downstream of Penrith Weir. A Condition is recommended that reinforces the importance of incorporating a future connection in the pipeline design with the Penrith or St Marys STPs, or the St Marys Advanced WTP (WSRWI) for the purpose of topping up or supplementing water supply to the Penrith Lakes Scheme.

The proposed pipeline system only allows a one-way movement of water supply from Nepean River to the receiving Quarantine Lake. The then DNR recommended that the pipeline design should increase system flexibility so as to allow water to move in all directions between the lakes, the Nepean River and the proposed Advanced WTP at St Marys. This is to enable the lakes to assist in providing variable environmental flows to the river. In response, the Proponent convened a meeting with representatives from the WSRWI project, WRL, and the then DNR to consider this proposal. The meeting concluded that this initiative is not practicable because the lakes' storage capacity is inadequate to provide additional environmental flows to the river through the storage of treated effluent in the lakes and later release to the river. The volumes required and release rate are such that the lakes could not function effectively as recreation lakes (ie several metres of surcharge water and then release over only a day or two). The overall regional network would be better able to provide environmental flows from the dams (Warragamba, Nepean Avon, etc) if the demand from these dams was reduced by the WSRWI.

Nonetheless, the Proponent indicated that it will be initiating an investigation into the strategic integration of Penrith Lakes with the WSRWI for two purposes:

- firstly, to increase the efficiency of the operation through providing a storage area for the WSRWI;
- secondly, to augment the river and catchment water for filling the lakes. Any integration of the lakes and the WSRWI will need to be contingent on lake water quality not being adversely affected, and the sustainability of any actions being demonstrated for the catchment as a whole and the lakes.

The Proponent considers that there may be an opportunity to utilise some treated effluent from Penrith STP to fill the lakes in the short term. This would be the case if there was a time lag between the availability of the treated effluent and the demand for the effluent for new release areas.

The Department acknowledges this initiative and considers it desirable that the feasibility of a future strategic integration of the lakes with the WSRWI is investigated by the Proponent. A condition is recommended to this effect, requiring the Proponent to report to the Director-General on the outcomes of the investigation prior to the commencement of project construction. The report is to include future planning and funding considerations for the recommendations that would result from the investigation.

5.2 Water quality

Issues

The key issues are:

- whether the quality of the Nepean River is adequate for transfer to the lakes, given the recreational uses and values set for the lakes in the Deed of Agreement, and government-endorsed changes based on recommendations of the Penrith Lakes Water Committee;
- potential impact of the construction of the Project on water quality in the Nepean River and adjacent creeks (Peach Tree Creek and Boundary Creek).

Consideration

In addition to water balance modelling of the Penrith lakes, water quality modelling of the Nepean River was also undertaken by WRL. The modelling was assessed against the water quality requirements for the lakes system. An assessment of aquatic weed transfer and water quality within the Quarantine Lake was also undertaken.

The Penrith Lakes Scheme currently contains three recreational lakes (Rowing Lake, Warm-Up Lake and Lake A) which are being used for primary (eg swimming) and secondary contact (eg rowing and canoeing) recreational activities. The Scheme's lakes operate as a 'closed system', the major water sources being the overland flows and stormwater runoff within the local catchment, rainfall discharges from the quarry pits and tailings dams, and groundwater recharge. Overland flows are pre-treated by detention basins located east of the Scheme before they enter the lakes.

In relation to water quality issues, assessment in the Environmental Assessment is confined to the quality of water extracted from Nepean River and the impact construction activities for the pump and pipeline may have on water quality of the River.

Nepean River water quality

An important consideration in the project system design and modelling was to determine if the water quality of the Nepean River was adequate for transfer to Penrith Lakes. The end water uses and water quality requirements of the lakes were prescribed in the Water Principles, Schedule 7 of the Deed. However, revision of these end uses and associated standards (known as Scenario 2A, summarised in **Table 4**) was recommended by the Penrith Lakes Water Committee for Lakes A and B, and subsequently approved by the NSW Government for adoption. The Deed needs to be amended to reflect these changes for Lakes A and B from primary contact to secondary contact. The recreational value of the International Regatta was changed from secondary to primary contact in an amendment of the Deed in 1989 due to its status and use as an international recreational facility.

Table 5: Summary of Scenario 2A

Lake	Recreational Values	Ecological Values
International Regatta/Warm-up Lake	Primary Contact	Low
Main Lake A	Secondary Contact	Medium
Main Lake B	Secondary Contact	Medium
Wildlife Lake	Aesthetic	High

Water quality in the Nepean River (when flow conditions range between 170 megalitres per day and 1000 megalitres per day) has been compared with water quality from Farrell's Creek and Scopes Creek, and an area

identified as Catchment 88 (which all flow into the detention basins northeast of the Rowing Lake), to assess the potential effects of the river water on the existing water quality of the lakes. This comparison indicated that on average, Nepean River water quality appears to be better than water from surrounding catchments. In addition, 20 years (1984 to 2005) of collected water quality samples by SCA at Penrith Weir reveal that the water quality of Nepean River is approximately equal to or slightly better than the recommended ANZECC and NHMRC trigger values for Penrith Lakes².

To identify periods when water quality in the Nepean River was poor, WRL analysed correlations between water quality, seasonality and flow using all available data. The analysis found that there was little correlation between these elements. However, it also identified that in very high flows, water quality deteriorated below the acceptable quality for the lakes. High flow cut off limits were subsequently included in the modelling of pumping from the river to enable a more accurate assessment of the water balance implications for the Scheme lakes.

The Department notes that during operation, the high-end cut-off will be based on water quality trigger values using real time monitoring of water quality in the river. Sensors located at the pump station will monitor total nitrogen, chlorophyll-a, total phosphorous, and turbidity. When the trigger level for these water quality parameters is reached, the pumps will automatically cut-off.

Uncontrolled discharges of river water into the Quarantine Lake may result in a number of potential impacts, including the breeding cycle of mosquitos, blue-green algae blooms, faecal coliforms that may be discharged to the Rowing Lake, exotic and pest fauna species (eg carp), and aquatic weeds. To control the transfer of nutrients from Nepean River, a multiple barrier approach is proposed whereby the extracted water will pass through various barriers prior to discharge into the Quarantine Lake, and in turn the lakes within the Scheme. The multiple barrier approach includes the following elements:

- Johnsons Screens on the intake pipes;
- Constructed wetlands;
- Quarantine Lakes (temporary and permanent);
- Rock rip rap at the inlet of the wetland; and
- Floating silt curtains

The Environmental Assessment has demonstrated that the water quality of the Nepean River is deemed to be adequate for transfer to the lakes but not always. The Department considers that the project has incorporated adequate water quality control mechanisms to control nutrient levels and transfer of aquatic weeds. The Penrith Lakes Concept Plan will address the operational management of the lakes, including in particular the longer term water quality issues of the lakes.

Construction impacts

The DPI expressed concerns about potential impacts on the water quality of Nepean River from construction of the intake structures and pipeline crossings of creeks.

The Proponent aims to minimise impacts on the river through the use of cofferdams and erosion and sediment control measures. Works within the Nepean River will be confined within a sheet-piled cofferdam or equivalent. The cofferdam would have a height designed for a two year flood such that in the event of a significant flood, it would overtop and fill to prevent any further flooding. A sediment curtain will be fitted around the cofferdam. At the proposed creek crossings, temporary flow diversions will include in-river bunding (sheet piling) or piping of the creeks. An attenuation pond may be constructed to facilitate a reduction in flows of the diverted creek prior to discharge into the Nepean River. These measures are contained in the Proponent's SoC 2.2 and 2.3.

A groundwater plume has been identified to the east of the pipeline alignment in the vicinity of Cassola Place. Previous environmental assessment results indicate that the plume is contained within an underlying aquifer and is approximately six metres deep. The Environmental Assessment indicated that the proposed construction works will not significantly intercept the groundwater plume as the maximum depth of excavation is expected to be 3.5 m.

² The trigger values for Penrith Lakes were sourced from the ANZECC Water Quality Guidelines for Slightly Disturbed Freshwater Lakes and Reservoirs (2000) and the NHMRC Australian Guidelines for Recreational Use of Water.

The Department considers that potential water quality impacts would be avoided or minimised, subject to adequate management of the proposed environmental controls. Conditions are recommended that requires the Proponent to prepare and implement an Erosion and Sedimentation Control Plan, and also to restore the creeks to their existing conditions upon de-commissioning of the diversions, should such works for Peach Tree and Boundary Creeks be undertaken.

5.3 Soil erosion and sedimentation

Issues

The then DNR in its submission requested that the Proponent take all appropriate measures to ensure that the construction of the pipeline does not reduce bank stability within the riverine corridor.

Consideration

Approximately 1.3 km of the pipeline route will be five metres from the eastern bank of the Nepean River. Based on a review of historical records and previous studies of riverbank erosion in the area, the Environmental Assessment considered that the eastern bank area along the pipeline should be stable, provided that:

- no significant disturbances along this alignment occur (eg vehicular access);
- vegetation cover, particularly good groundcover, is maintained along the river bank for the entire length of the pipeline alignment.

A significant amount of vegetation clearing along the riverbank will be required to create a 15 m wide working corridor. This is likely to cause potential erosion and destabilisation, and can result in the sedimentation of downstream watercourses during rainfall events impacting on water quality and aquatic biota.

The potential also exists for sedimentation to occur during excavation and backfill processes at the pipeline crossings of Peach Tree and Boundary Creeks.

To retain bank stability while construction activities are undertaken, the Proponent undertakes to:

- employ 'cut to stump' clearing methods, leaving tree stumps intact;
- limiting vegetation clearing to a minimum necessary to facilitate construction of the pump station and pipeline;
- using rehabilitation techniques to ensure the stability of the reinstated creek banks; and
- revegetation of the creek banks using seedlings and reasonably established tube stock.

Other mitigation measures are proposed in the Environmental Assessment to minimise potential impacts on geology, water and soils during construction of the project (SoC 2.9). These measures include:

- preparation of a Soil and Water Management Plan including an Erosion and Sediment Control Plan, which will include measures for the management of any dewatering during the excavation of the pipe trench;
- construction of a temporary coffer dam downstream of construction activities prior to any excavations at the creek crossings;
- filtering of water discharged from the construction zone through a crush rock dam or similar device prior to re-entering the creek; and
- moving of the rock and clean fill excavated from the creek to a separate bunded area, away from the creek bank and fenced off to dry out. On completion of the works, the rock and clean fill will be used to reshape the creek banks to their original form.

The Department considers that erosion and water quality impacts would be minimised provided the proposed soil and water management controls and river bank stabilisation measures are properly implemented. Recommended conditions would ensure that the Proponent employ soil and water management controls to reduce soil erosion and the discharge of sediment and other pollutants to the waterbodies during construction activities.

5.4 Flora and Fauna

Issues

The key issues are:

- significant vegetation clearing that may have potential impacts on terrestrial ecology;
- disturbance of the river bed from construction of the intake structure and pump station and potential impact on aquatic ecology;
- doubts expressed by DECC that a targeted survey for *E bentamii* (vulnerable plant species) was undertaken because of inconsistent statements in the EA, ie the EA reports the presence of River Flat Eucalypt Forest (RFEF), a known habitat for *E bentamii*, at the same time, the EA also indicated the absence of habitat for this species in the area; and
- potential presence of the Cumberland Land Snail, an endangered species listed under the Threatened Species Conservation (TSC) Act, in the vicinity of the pipeline route. Penrith Council requested that this matter be reviewed as evidence of this species (ie shells) was found north of Boundary Creek by Council's bush regeneration Contractor during weed control activities associated with the Great River Walk in mid 2006.

Background

A Flora and Fauna Assessment of the project were undertaken by Biosis Research. The assessment included a description of the flora communities and fauna habitats in the study area, a condition assessment of the vegetation communities, identification of threatened species, populations (and their habitats), and endangered ecological communities likely to occur. The assessment methodology included literature review and search of relevant databases (ie DEC Atlas of NSW Wildlife, NSW DPI Fisheries Bionet for the Hawkesbury-Nepean DEH Online EPBC Database, etc), targeted field surveys, and Assessment of Significance both under Section 5A of the EP&A Act and the Environment Protection and Biodiversity Conservation (EPBC) Act.

The Environmental Assessment considered the key threatening processes which are primarily involved with the construction of the project, including proposed mitigation measures.

Terrestrial flora and fauna

23 threatened flora species listed on the TSC Act and 22 threatened flora species listed under the EPBC Act, or their habitat, have previously been recorded within the local area. No significant flora species or their habitat was recorded within the area during the assessment, and thus a referral to the Commonwealth Minister for the Environment and Water Resources was not considered necessary. A list of these species under the TSC and EPBC Act are provided in Appendix D to the EA.

The EA indicated that vegetation along the pipeline route has been highly modified due to land clearing, quarrying and urban development. The eastern bank of the Nepean River (near the Penrith Weir) supports a thin degraded strip of River Flat Eucalypt Forest (RFEF), a listed Endangered Ecological Community (EEC) under the TSC Act. The strip is dominated by *Casuarina cunninghamiana* which is considered to be in poor to moderate condition.

32 threatened fauna species listed on the TSC Act, as well as 13 threatened species and eight migratory species listed on the EPBC Act, or their habitat, have been previously located within the local area. No threatened fauna were recorded during the current survey. However, the study area contains potential habitat for the threatened species shown in the table below.

Table 6: Threatened Terrestrial Fauna Species

Common Name	TSC Act	EPBC Act
Green and Golden Frog	E	V
Australian Painted Snipe	E	V
Painted Snipe		M
Freckled Duck	V	M
Large-footed Myotis	V	

Note: E = Endangered, V = Vulnerable, M = Migratory

Aquatic flora and fauna

The three watercourses within the study area (Nepean River, Peach Tree Creek and Boundary Creek) were identified as potential fish habitat. Under the DPI (Fisheries) Fish Habitat Scheme, the Nepean River is classified as Class 1 – Major Fish Habitat and the two creeks (Peach Tree and Boundary) as Class 2 – Moderate Fish Habitat.

Two threatened species of fish (Macquarie Perch and Trout Cod), listed under the Fisheries Management Act (FM Act) and also under the EPBC Act as Endangered, have potential to inhabit the local area. One other species, the Australian Grayling, is listed as Vulnerable under the EPBC Act but only listed as protected under the FM Act. Of these species, potential habitat is thought to occur for only the Macquarie Perch.

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 area.

Aquatic vegetation within the Penrith Weir pool consisted of beds of *Typha sp.*, with isolated *Juncus sp.* and *Pericaria sp.* on the river banks. There was almost a total cover of submerged aquatic vegetation dominated by *Valisneria Americana* (native) and *Egeria densa* (exotic)

Freshwater mussels are also present in the vicinity of Penrith Weir, and some habitat exists close to the river banks.

Consideration

Terrestrial flora and fauna

Pipeline construction works will require the clearing of native vegetation along a 400 metre section of the Nepean River's eastern bank, in the vicinity of Penrith Weir. The Environmental Assessment estimated that 0.8 hectares of RFEF will be cleared, and it may be possible to reduce this to a significantly lesser figure. The Proponent indicated that this will be further considered in the preparation of the Construction Environmental Management Plan. The total area of RFEF community mapped by the DECC (NPWS, 2002) within a 10 km radius of the study area is 1864 hectares.

An Assessment of Significance was undertaken for the RFEF. It concluded that the vegetation clearing activities will have no significant impact on this EEC. Establishment of a 15 metre wide working width will temporarily fragment the RFEF community but not isolate it from interconnecting areas. Following the construction activities, revegetation works will include strategies for weed management and the seeding and planting of local native plant species in accordance with a Vegetation Management Plan.

In response to the DECC's concern about the survey conducted for *E bentamii*, the Proponent indicated that the nearest record for this species is 9 km from the study area. The DECC species profile for *E bentamii* lists the associated species at known sites as including *Eucalyptus elata*, *E. bauerina*, *E. Amplifolia*, *E. deanei*, *E. crebra*, *E. punctata*, and *Angophora subvelutina*. None of these listed species were recorded in the RFEF in the study area, which exists as a thin degraded strip of vegetation dominated by *Casuarina cunninghamiana ssp.* Due to the poor condition of this vegetation and the fact that none of the species were recorded despite random meander transects through the RFEF, the Proponent considers it highly unlikely that it is a potential habitat for *E bentamii*.

As indicated above, no threatened fauna were recorded during the survey although there was potential habitat identified for some species. The Environmental Assessment determined that the project is unlikely to cause individual death or injury or loss/disturbance of limited foraging/breeding habitat for these species.

In relation to the Cumberland Land Snail, an additional targeted survey was conducted by Biosis Research on 22 November 2006 in the area around Boundary Creek. No species were recorded during this survey. An Assessment of Significance was undertaken which concluded that there was unlikely to be a significant impact to this species in the area. The existing habitat was considered to be in poor condition due to the construction of the Great River Walk which resulted in large areas cleared for the widening of the track, installation of bridges over Peach Tree Creek and Boundary Creek, and associated weed control and site rehabilitation.

Aquatic flora and fauna

Construction of the intake structure, pipework and pump station has potential to directly impact upon aquatic ecology through:

- disturbance of the river bed at the intake structure and pump station sites;
- temporary loss of approximately 1000 m² of macrophytes from a 15 x 70 m construction corridor;
- extraction of river water; and
- sedimentation of watercourses.

The Nepean River is approximately 120 m wide at the location of the intake structure. This section of the river has a dense cover of macrophytes which will be lost during construction. However, the macrophytes in this area are dominated by the exotic pest *E densa* and native *V. Americana*, and given the invasive nature of the exotic aquatic weeds in the weir, the area would quickly be colonised and covered by *E densa*.

The intake structure and pipelines will be constructed using a sheet-piled cofferdam and trenching under the river bed. These works would be confined within the cofferdam, and may temporarily increase the flow velocity in the channel to the west of the cofferdam. However, the Department considers that this should not be an issue due to the channel remaining open (greater than 50 m unblocked) and the low velocity of flow during most flow levels.

The Environmental Assessment indicated that the cofferdam would be designed so as not to exacerbate flooding and to minimise disruption of the flow regime and geomorphology of the river corridor. This would be achieved by ensuring that:

- the sheet pile is of an adequate height to accommodate and withstand river level fluctuations during minor storm events, and of an adequate strength to endure major stormwater flow. During a major storm event, the cofferdam structure would allow flow over to enable the Nepean River to flow at full channel width;
- a sediment curtain would be fitted around the cofferdam to manage and control releases of sediment generated during the construction works; and
- where possible, plant equipment used for excavations and works within the river would be bank side with long reach arms, to minimise the area of disturbance within the river corridor.

The use of a temporary sheet piled cofferdam is proposed for the construction of the pipeline across Peach Tree and Boundary Creeks. The creek flows will be diverted around this structure during the construction phase, and will be reinstated following installation of the pipeline. Creek banks will be reformed and stabilised by planting with native species.

The pipeline construction may encounter a small number of freshwater mussels that would die if left exposed for any length of time. The Statement of Commitments indicated that any such mussels found within the construction area, or disturbed during excavation of the substrate within the Nepean River, will be immediately relocated to similar habitat upstream of the works area.

Mitigation measures

The Proponent has committed to a range of mitigation measures to reduce the potential impact of the project on vegetation communities, fauna habitats and terrestrial and aquatic flora and fauna (SoC 2.4 and 2.5). The key measures include:

- development and implementation of Vegetation Management Plan detailing bush regeneration works, weed management strategies and monitoring to be undertaken;
- retention of large, mature trees as far as reasonably practical to maintain existing foraging and nesting habitat resources for common fauna along the eastern riverbank areas and fauna movement corridors;
- plants used for any revegetation or landscaping would be native species of local provenance and chosen based on the native vegetation community present in the area;
- implementation of appropriate erosion and sedimentation controls, particularly in the vicinity of the Nepean River, Peach Tree Creek and Boundary Creek;
- scheduling of the intake structure/pipework construction activities outside the fish migratory season, ie July through October;
- use of fine mesh intake screens (Johnson Screens) submerged in a minimum of two metres of water within the Nepean River, and arranged parallel with the main flow path to allow any passing current to flow along the face of the screen. This will minimise the accumulation of debris on the face of the screen; and

- fish trapped within the cofferdam when the construction area is pumped dry will be released back into the weir pool, with any pest species euthanized.

Subject to the implementation of the proposed environmental measures and adequate management, the Department considers that potential impacts on flora and fauna would be minimised.

5.5 Landscaping and Visual Amenity

Issues

In its submission, Penrith City Council indicated the following concerns and requirements regarding the design of the proposed building and structures and the reinstatement of the Great River Walk that would be affected by the pipeline construction. :

- the concrete wall elements of the pump station and platform do not sit aesthetically well in the natural setting. Concrete walls embedded with Nepean River stone (similar to the International Regatta Centre main entry gates) were recommended as being more compatible with the riverbank setting;
- the use of gabions raises issues of structural integrity, vandalism and maintenance;
- the control building should reflect a contemporary design in its context and provide for future utility, including adaptive reuse. If the existing amenity building is to be retained, the control building should be an integrated addition to present as a single built form;
- should a construction compound be erected on the upper level of Weir Reserve, it should be sited towards the southern end of the reserve in the vicinity of the railway line;
- reinstatement/landscaping of the Great River Walk where impacted by the works; and
- reinstatement of landscaping from Chainage 900 – 1700 to implement PLDC's commitment to the Great River Walk.

Consideration

The Project will introduce new aboveground structures on the eastern bank of the Nepean River and Weir Reserve (ie pump station and control building). During construction and for a period after, the landscape and visual amenity of these areas will have the greatest impact due to vegetation clearing to establish the working width along the pipeline route and the movement of construction plant and vehicles along the working width.

Once the pipeline has been installed and reinstated, the permanent visible structures will comprise of:

- the pump station and control building and paved access at Weir Reserve and on the lower bank of the Nepean River;
- pipeline marker posts and surface level marker plates installed at intervals along the pipeline route, particularly at watercourse crossings and at changes in direction; and
- some temporary change to the existing vegetation structure and patterns within the revegetated areas along the pipeline route.

The proposed control building (75 m² in area and 3.8 m in height to house the necessary electrical and instrumentation equipment to operate the pumps) will be co-located within an existing amenity block on Weir Reserve. The building is designed to integrate into the local landscape to reduce visual intrusion. No screen planting is proposed to maintain the open landscape of the Reserve.

The pump station will be excavated into a terrace on the eastern bank of the Nepean River and will be stabilised by a mass concrete slab and/or rock anchors. A platform will be installed, cantilevered approximately three meters over the river channel from the bank. The Department recognises that the platform will change the riverbank profile within the riparian zone, but it would serve a recreational purpose for fishing, bird watching and enjoyment of river views. The Environmental Assessment suggested that appropriate landscaping measures could be incorporated to announce the Great River Walk as part of a gateway concept.

Pump station/platform

The Proponent indicated that it will adopt the Nepean River stone wall concept, as recommended by the Council, in the detailed design for the pump station platform. However, the use of gabions will remain part of the proposed design as they will be constructed to withstand the loadings. The risk of vandalism would be minimal as the gabions will be hidden from view under the platform with little or no access.

To enable the Department to review the urban design and external finishes of the proposed structure, a condition is recommended requiring the Proponent to submit for the Director-General's approval a finishing board that demonstrates the design quality of the structure. The Proponent must consult with the Council in the development of the finishing board.

Control building in Weir Reserve

Four design options for the control building were developed by the Proponent's architects in consultation with the Council, these being:

- 1 small stand alone building;
- 2 twin hexagon integrated with the existing toilet block;
- 3 alternative hexagon integration with existing toilet block (preferred by Council); and
- 4 new toilet block and control room.

The Proponent's preferred option is Option 2 in terms of architectural merit, user outcomes and cost. Option 3, Council's preferred option, was argued by the Proponent to have several design disadvantages as well as entailing an additional cost of \$50,000 which it is not prepared to bear. The Department sought Council's view on this, and it is understood that Council appreciates the cost issue to be a reasonable concern and thus accepted the Proponent's preferred option.

The above recommended condition for a finishing board for the pump station platform also applies to the control building.

Construction compound in Weir Reserve

In its Submissions Report, the Proponent proposes a temporary construction compound at the pump station site (river's eastern bank) and at two alternative sites near the amenity block on the upper level of Weir Reserve. Council's views were sought on these locations. Council objected to any construction compound being located on this part of the Reserve due to amenity issues for recreational users. It suggested a more appropriate location at the southern end of the reserve. The Department acknowledges Council's view and recommends a condition which restricts the location of construction compound to the suggested part of the Reserve, unless Council agrees in writing to a location closer to the construction works.

Impact on the Great River Walk

Council has recently completed the section of the Great River Walk between Penrith Weir and Cassola Place which includes crossings of Peach Tree and Boundary Creeks. The pipeline route traverses this area. The Proponent has committed to reinstate the Great River Walk where impacted by the works, and to undertake landscaping within the pipeline easement and riparian zone as soon as reasonably practical (SoC 2.8.2). A recommended condition requires the Proponent to prepare a Landscape Management Plan that includes details of proposed planting and landscaping, which must be consistent with the Great River Walk Project Planting List. The condition requires that the Landscape Plan be prepared by an appropriately qualified landscape architect or arborist.

The Proponent stated that until quarrying and major earthworks activities at the southern part of the Penrith Lakes Scheme have ceased, the establishment of the Great River Walk between Chainage 900 -1700 is not viable. However, it is committed to the rehabilitation of the riverbank and the integration of the Great River Walk within the Lakes Scheme.

Conclusion

The Department considers that construction activities would detract from the visual amenity and recreational use of Weir Reserve and the river area. However, this would be temporary and short term. The visual impact of the above ground structures, once revegetation and landscaping are established, will diminish over time and integrate

into the landscape. The Proponent will also have to demonstrate to the Department that the design and external finishes of the proposed building and structure will be of sufficient design quality to minimise the visual effects of the project. As for the Great River Walk, the Proponent's commitments and the Department's recommended conditions would ensure that any damage to this Walk will be repaired and the area reinstated with appropriate landscaping and revegetation.

5.6 Heritage

Issues

No significant heritage issues are anticipated from construction of the project.

Consideration

Indigenous Heritage

Biosis Research Pty Ltd conducted a search of the NSW DECC's Aboriginal Heritage Information Management System (AHIMS) on a 10 km² search area surrounding the Project. Three of the 12 known Aboriginal archaeological sites within four km² of the study area were recorded as being in close proximity (ie within 200 m) of the pipeline route. All three sites are open camp sites containing surface scatters of stone, quartz and chert flakes.

In addition to archival searches, Biosis also surveyed the three pipeline route options (10 m in width) from Penrith Weir to Penrith Lakes. The Representatives of the Deerubin Local Aboriginal Land Council, Darug Tribal Aboriginal Corporation and Darug Custodian Aboriginal Corporation participated in this survey held in July 2005. No new sites were located during this survey.

The Environmental Assessment indicated that although the Nepean River environments supported Aboriginal occupation, previous and current land uses have more than likely disturbed or destroyed Aboriginal artefacts and relics within the upper two metres of the underlying ground profile. The potential exists for buried artefacts to remain at greater depths, but this is considered unlikely along the proposed pipeline route.

Non-Indigenous Heritage

The Non-Indigenous Heritage Assessment undertaken by Maunsell involved a search of relevant historical databases, review of local heritage literature relevant to the area, site walkover (to check for potential new items) and mapping of sites of non-indigenous significance in proximity and surrounding the project. It identified four non-indigenous heritage items that are located within 100 m of the proposed pipeline route: Castlereagh Area, Methodist Church and Church Hall, Methodist Cemetery, and the Moquet farmhouse (only a concrete slab remains of the farmhouse and has no protective listing). These items were identified for preservation and integration into the Penrith Lakes Scheme.

The majority of the pipeline route traverses areas modified by previous and current land clearing. The Environmental Assessment indicated that, except for Castlereagh Road, construction of the pipeline will not directly impact upon any of the above items due to their distance (80 m from the Church and Hall and 50 m from the cemetery) and route adjustment to avoid any impacts on the remains of the Mouquet farmhouse.

To ensure the protection of both indigenous and non-indigenous heritage items, the Proponent has committed to undertake the following measures (SoC 2.6 and 2.7):

- provide appropriate induction and training for all construction personnel regarding their responsibilities under the Heritage Act 1977 in terms of archaeological relics and the specific location of the heritage items;
- erect temporary construction signage in proximity to heritage items to secure the area;
- all earthworks to be monitored by a suitably qualified archaeologist;
- stopping work should any historical relics/archaeological artefacts be encountered during construction of the project and contacting the NSW Heritage Office/Heritage Council or the DECC, as appropriate, to attend the site and advise on appropriate measures to be implemented.

The Department considers that subject to proper implementation of the above commitments, there should be no adverse impacts on existing heritage items and any archaeological objects that may be encountered during construction works.

5.7 Noise and Vibration

Issues

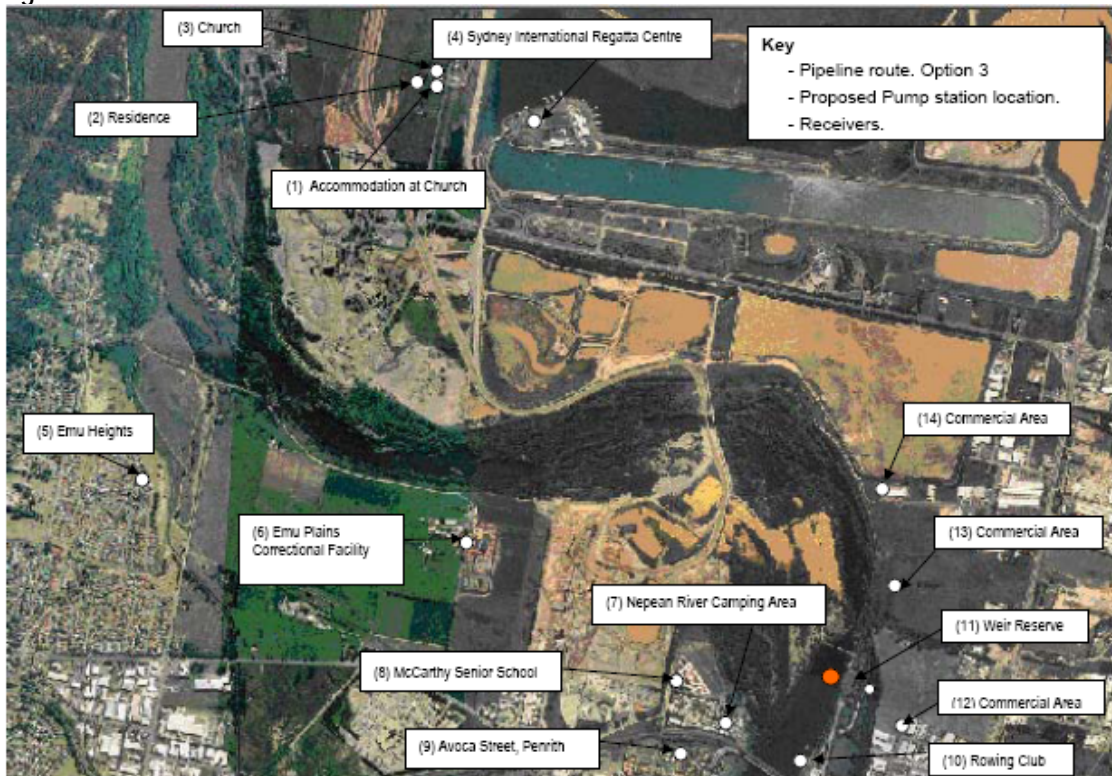
The Proponent proposes to use Saturday mornings for construction at Weir Reserve to reduce the period of disruption at this park. It argues that if work is not undertaken on weekends, the construction time would extend by two months. Council advised that there should no work on the weekends, including Saturday mornings, as the park experiences the highest recreational usage during this time.

Background

Wilkinson Murray undertook a noise assessment to identify construction and operational noise impacts associated with the project. The noise assessment was prepared in accordance with the requirements of the EPA's Environmental Noise Control Manual (ENCM) 1994 and Industrial Noise Policy (INP) 2000. Construction of the project is expected to take about 15 months. It comprises sequential steps involving site preparation and establishment, main construction works (bulk earthworks, pipe laying, construction of control building, formation of wetland, etc) and reinstatement. The pump station works (including coffer dam installation and removal, excavation backfilling, concrete pouring and intake pipe construction) are expected to take seven months. Pipeline work between the pump station and Boundary Creek crossing is expected to take approximately six months.

Figure 3 shows the identified noise sensitive receivers in proximity (between 250 m and three km) of the project site, these being an industrial/commercial area, Nepean Rowing Club, Nepean River Caravan Park, Avoca St, McCarthy Senior School, International Regatta Centre, locality of Emu Heights, and Emu Heights Correctional Facility. The nearest of these receivers is Weir Reserve where the pump station and control building would be located.

Figure 3: Noise Sensitive Receivers



Source: Wilkinson Murray, Nepean River Pump and Pipeline Environmental Noise Assessment, 2005

Background noise levels were measured at five locations, involving both unattended and attended noise measurements. Construction noise objectives were then derived for each location based on the background noise measurements and the relevant noise level goals for different construction periods as recommended in the ENCM.

The ENCM provides that for shorter duration (less than 4 weeks), construction noise levels may exceed background noise levels by up to 20 dB(A) and for longer periods greater than 26 weeks, by up to 5 dB(A). Although construction works for the project will be progressive and not limited to a specific area for any duration greater than 26 weeks, the overall construction duration is longer than 26 weeks. The 5 dB(A) exceedance criterion was thus applied to the project.

Once the project is operational, the only sources of noise will be from the pump station and the control building. The EA indicated that the noise levels at the nearest receivers will comply with the relevant operational noise criteria.

Consideration

Construction

During construction, the most significant noise would come from construction plant and equipment (excavator, vibratory piling, front end loader and dump truck) which have typical sound power levels of 110 -114 dBA. These will be used for the pump station construction.

Significant exceedances of the noise limits are predicted at a number of locations during construction of the pump station and control building, and the pipeline, as shown in Tables 7 and 8. The most affected would be Weir Reserve, Church, Church accommodation and Residence on Castlereagh Road (northeast of the Regatta Centre).

Table 7: Construction Noise Levels at Nearest Receivers - Pump Station and Control Building works

Number	Location	Calculated ⁶ L _{A10} Noise Level (dBA)	L _{A10} Construction Noise Objective (dBA)	Complies (Yes/No)
(7)	Nepean River Camping Area	54	49	No
(9)	22 Avoca Avenue	49	49	Yes
(8)	McCarthy Senior School	52	50	No
(10)	Rowing Club	56	65	Yes
(11)	Weir Reserve at 30 metres from the control building	85	55	No
(12)	Commercial Area	57	65	Yes

Source: Wilkinson Murray, *Nepean River Pump and Pipeline Environmental Noise Assessment*, 2005

The Department considers that usage of Weir Reserve during weekdays is generally low and transient and should not have significant impact during these times. The park is also a large area that would allow users to move away from noisy activities. On the weekends when the park is largely used, no work should be allowed as requested by the Council. The Department considers this request to be reasonable given the Council's caretaker/landowner role for the park. Council is amenable to construction works on occasional Saturdays for necessary activities. It also accepts extended hours during weekdays (ie from 6:00 am to 6:00 pm, Monday to Friday) to offset the work restrictions on weekends. Recommended conditions specify these construction hours and restrictions while also enabling the Director-General to waive the construction hours and allow occasional work on Saturdays on a case-by-case basis.

Pipeline works within the Lakes Scheme boundary (in the quarrying areas) are subject to different construction hours which allow full weekdays and Saturday activities. As for construction hours for Weir Reserve, the Director-General can waive the hours in this area on a case-by-case basis.

In relation to the Residence, Church accommodation and Church, the Department notes that exceedances would only occur when pipeline construction is adjacent to the receiver for a period of two to four weeks. The Church

mainly operates on Sundays (outside the construction hours), and the Proponent commits to continue liaising with the Church to coordinate noisy activities around significant Church events.

Table 8: Construction Noise Levels at Nearest Receivers from Pipeline Construction

Number	Location	Calculated ¹ L _{A10} Noise Level (dBA)	L _{A10} Construction Noise Objective (dBA)	Complies (Yes/No)
(1)	Church accommodation	73	49	No
(2)	Residence	64	49	No
(3)	Church	70	50	No
(4)	Sydney International Regatta Centre	50	65	Yes
(5)	Emu Heights	37	45	Yes
(6)	Emu Plains Correctional facility	40	44	Yes
(7)	Nepean River Camping Area	51	49	No
(8)	McCarthy Senior School	49	50	Yes
(9)	22 Avoca Avenue	46	49	Yes
(10)	Rowing Club	50	65	Yes
(11)	Weir Reserve at 30 metres from the pipeline corridor	85	55	No
(12)	Commercial Area	51	65	Yes
(13)	Commercial Area	56	65	Yes
(14)	Commercial Area	56	65	Yes

Source: Wilkinson Murray, Nepean River Pump and Pipeline Environmental Noise Assessment, 2005

The Proponent undertakes to minimise noise impact and disturbance on sensitive receivers by implementing the following measures (SoC 2.10):

- prepare and implement a Construction Noise Management Plan as part of the CEMP;
- provide signage at Weir Reserve two weeks before commencing works to alert users to upcoming disruption;
- notify the local community of construction activities prior to commencing construction;
- maximise the offset distance between noisy plant and equipment, and surrounding noise sensitive receivers;
- operate stationary plant to direct maximum noise emissions away from sensitive receivers; and
- schedule any noise works for less sensitive periods of the day, wherever practicable, particularly around any significant Church events.

Provided suitable notification and mitigation measures are implemented, the Department considers that impacts on users of Weir Reserve and other noise sensitive receivers should be manageable. Work restriction on weekends when use of the reserve is high would assist in reducing noise impacts.

Operation

Operational noise is associated with the operation of the pump station and control building. An Environmental Noise Model was used to calculate operational noise levels from the equipment used in these buildings (ie pumps, air compressor and transformer). The Environmental Assessment noted that although the pumps are able to operate 24 hours a day, it will only operate for approximately 25% of the time based on current flows over the Penrith Weir.

The NSW Government's *Industrial Noise Policy* (NSW EPA 2000) was used to determine appropriate noise criteria and potential impact on both residential and non-residential receivers. The recommended criterion at Weir Reserve for both the pump station and the control building is 50 dB(A) at 10 m, assuming the transmission loss of the

building elements, reverberant levels within the building structures, and the anticipated sound power levels of equipment (pumps, compressors and transformer). A night time amenity criterion of 30 dBA was applied to residential receivers. For non-residential receivers, the criteria applied are 50 dBA for Weir Reserve and the McCarthy School, and 65 dBA for the others.

As shown in **Table 8**, the calculated operational noise levels at closest receivers would meet the relevant criteria.

Table 9: Calculated Operational Noise Levels at Closest Receivers

Number	Location	Calculated ⁸ L _{Aeq} Noise Level (dBA)	Criterion (dBA)	Complies (Yes/No)
(7)	Nepean River Camping Area	<25	30	Yes
(9)	22 Avoca Avenue	<25	30	Yes
(8)	McCarthy Senior School	<25	50	Yes
(10)	Rowing Club	<25	65	Yes
(12)	Commercial Are	<25	65	Yes

Source: Wilkinson Murray, Nepean River Pump and Pipeline Environmental Noise Assessment, 2005

The Department considers that the noise assessment was conducted appropriately. The results indicated that operational noise from the proposed infrastructure would not have a significant impact on Weir Reserve and nearby land uses. A condition is recommended setting an operational noise limit of 50dB(A) at 10 m from the building façades of the pump station and control building.

5.8 Traffic and Transport

Issues

The Environmental Assessment has not specifically assessed potential impacts of traffic movements and transport of plant, equipment and materials on the identified construction work areas. Of particular sensitivity is Weir Reserve and adjacent riverbank areas which are regularly used as recreational areas.

Consideration

The proposed construction access and transport route to and from the site are:

- Northern access, via the internal circulation road network within the Penrith Lakes Scheme site and through the adjacent industrial/commercial area; and
- Southern access, via Mulgoa Road/the Great Western Highway/Bruce Neale Drive to Weir Reserve.

The Environmental Assessment estimated that between 105 and 125 vehicle movements per day, 25 of which comprises pipe haulage and concrete trucks, would be generated during construction. As the project will be undertaken in stages, the vehicles will be spread across three or four active working areas, including Weir Reserve (access via Bruce Neale Drive off High Street), PLDC site (access via Castlereagh Road), and Cassola Place (or alternative location adjacent to the high bank of the Nepean River).

Based on the 2002 RTA traffic volume data, the Environmental Assessment compared the estimated private vehicles and truck movements for the project's construction phase with the annual average daily traffic for roads in the Penrith area. From this comparison, the EA concluded that the construction of the project will have negligible impact on the existing traffic volume and flow in the Penrith area.

The information in the EA regarding construction traffic and transport was limited to identifying the vehicular access and haulage route and assessing potential impact based on estimates of traffic that would be generated. Details of traffic management in each work area are intended to be provided in a Traffic Management Plan which the Proponent will prepare before construction.

The Department considers that traffic movements on Weir Reserve should not adversely impact users of the reserve with the implementation of a Traffic Management Plan (TMP). During weekends when use of the park is high, there would be no impact from traffic due to work restriction on these days.

A condition is recommended, requiring the preparation of a TMP in consultation with Council and the RTA. The TMP is to address a range of matters such as:

- details of measures to minimise interactions between the project and other users of the roads and construction work areas;
- identification of all public roads that may be partially or completely closed during construction and the expected timing and duration of these closures; and
- access to construction sites including entry and exit locations.

6 CONCLUSION AND RECOMMENDATION

Penrith Lakes Scheme is a major undertaking in Western Sydney that involves the creation of lakes, parklands and residential and commercial development. A major component of the Scheme's development is the formation and construction of an interconnected lakes system that will serve as a major water based recreational facility in the region.

Extracting water from the Nepean River was identified as the only viable source of water for initial filling of the lakes. Under the 1987 Deed of Agreement entered into by the Proponent and the NSW Government, the Proponent is required to design, construct and operate a pump and pipeline to extract water from the Nepean River for the initial filling and long term water supply to the lakes within the Scheme. The project was developed to achieve this objective.

The project components are comprised of a new 4.3 km water supply pipeline, intake/discharge pipework and structures, pump station and control building, and constructed wetlands.

A key aspect of the project is the development of pumping rules for water extraction that maximises the volume of water extracted from Nepean River for supply to the lakes while protecting its ecological health. The Department considers that the Environmental Assessment has demonstrated the appropriateness of the proposed pumping rules based as they were on detailed modelling that aimed to meet both the environmental flow requirements of the river and the designed operating levels of the lakes.

Construction of the project would involve some potential impacts due to the following aspects of the project:

- vegetation clearing of approximately 0.8 ha of River Flat Eucalypt Forest from the pipeline construction works along the initial 400 m of the pipeline route;
- temporary removal of approximately 1000 m² of macrophytes for erection of the cofferdam;
- disturbance of the landscape, amenity and recreational use of the riverbank area and the Weir Reserve for a short term period;
- disturbance of the section of the Great River Walk between Penrith Weir and Cassola Place, recently completed by the Council, due to the construction of the pipeline along this route; and
- predicted significant exceedances of construction noise levels at a small number of sensitive receivers, particularly the recreational users of Weir Reserve.

The Proponent has committed to a wide range of environmental management and mitigation measures which, if properly implemented, would minimise potential impacts. In addition, the Department has recommended conditions that specifically address potential construction issues such as those identified above. These conditions require implementation of vegetation clearing procedures and weed eradication, soil and water management controls, restrictions on siting of construction compounds at Weir Reserve, reinstatement of the Great River Walk and the creeks, and restricting construction hours to weekdays only at Weir Reserve to maintain amenity and recreational use of the park during the weekends.

Once the pipeline has been installed and reinstated, the permanent effects of the project will be the above ground structures - pump station and platform, control building and paved access at Weir Reserve and on the lower bank of the Nepean River. The urban design plans for these building and structures will require the Director-General's approval before they are constructed. It is expected that the visible structures should integrate well into the existing landscape as revegetation works become established.

The project will provide the necessary infrastructure to deliver water supply to fill up the lakes, which are an integral component of the Lakes Scheme development. It will fulfil the NSW Government's requirement for such an infrastructure and is in the public interest. The Department's recommended conditions of approval will ensure that the Proponent undertakes the Project within a strict framework of environmental management and reporting on the construction and operation of the project.

Consequently, the Department recommends that the proposal be approved subject to the recommended Conditions in **Appendix A**.

APPENDIX A. CONDITIONS OF APPROVAL

(AVAILABLE ON THE DEPARTMENT OF PLANNING WEBSITE)

APPENDIX B. STATEMENT OF COMMITMENTS

CONTAINED IN THE SUBMISSIONS REPORT
(AVAILABLE ON THE DEPARTMENT OF PLANNING WEBSITE)

APPENDIX C. ENVIRONMENTAL ASSESSMENT

(AVAILABLE ON THE DEPARTMENT OF PLANNING WEBSITE)