Nepean River Pump and Pipeline Environmental Assessment

Penrith Lakes Development Corporation

August 2006

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Environmental Assessment

Prepared for

Penrith Lakes Development Corporation

Prepared by

Maunsell Australia Pty Ltd
Level 11, 44 Market Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 2 8295 3600 F +61 2 9262 5060 www.maunsell.com
ABN 20 093 846 925

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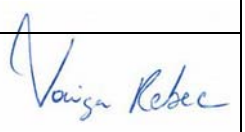
3	07/09/2006	Final EA submitted to DoP	Louisa Rebec Technical Director - Environment	

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List of Abbreviations

AHIMS	Aboriginal Heritage Information Management System
ANZECC	Australian & New Zealand Environment and Conservation Council
ARI	Average Recurrence Interval
BOM	Bureau of Meteorology
CBD	Central Business District
CEMP	Construction Environmental Management Plan
DA	Development Application
DEC	NSW Department of Environment and Conservation
DEH	Commonwealth Department of Environment and Heritage
DEUS	NSW Department of Energy, Utilities and Sustainability
DG	Director-General
DGRs	Director-General's Requirements
DIPNR	NSW Department of Infrastructure, Planning and Natural Resources (now divided into Department of Planning (DoP) and Department of Natural Resources (DNR))
DoP	NSW Department of Planning
DPI	NSW Department of Primary Industries
EA	Environmental Assessment
EEC	Endangered Ecological Community
ENCM	Environmental Noise Control Manual
ENM	Environmental Noise Model
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPA	Environment Protection Authority
EPBC Act	Commonwealth Environment Biodiversity Conservation Act 1999
EPI	Environmental Planning Instrument
EPL	Environmental Protection Licence
ESCP	Erosion and Sediment Control Plan
ESD	Ecologically Sustainable Development
FM	NSW Fisheries Management Act 1994
GRW	Great River Walk
HDD	Horizontal Directional Drill
HNRMF	Hawkesbury-Nepean River Management Forum
IEP	Independent Expert Panel
INP	Industrial Noise Policy
KTP	Key Threatening Processes
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
NES	National Environmental Significance
NPW Act	NSW National Parks and Wildlife Act 1974
NRPP	Nepean River Pump and Pipeline
PCC	Penrith City Council
PE	Polyethylene
PFM	Project Focus Meeting
PLC	Programmable Logic Controller

PLDC	Penrith Lakes Development Corporation
PLWC	Penrith Lakes Water Committee
POEO	NSW Protection of the Environment Operations Act 1997
RBL	Rating Background Level
RCP	Reinforced Concrete Pipe
REP	Regional Environmental Plan
RES	Regional Environmental Study
RFEF	River-flat Eucalypt Forest
RL	Recorded Level
RNE	Register of National Estate
RWMP	Resource and Waste Management Plan
SCA	Sydney Catchment Authority
SEE	Statement of Environmental Effects
SEPP	State Environmental Planning Policy
SEPP MP	State Environmental Planning Policy (Major Projects) 2005
SIS	Species Impact Statement
SMP	Stormwater Management Plan
SoC	Statement of Commitments
SREP	Sydney Regional Environmental Plan
TMP	Traffic Management Plan
TSC Act	NSW Threatened Species Conservation Act 1995
TSP	Total Suspended Particulates
WQMS	Water Quality Management Strategy
WRL	Water Research Laboratory

Executive Summary

Introduction

Penrith Lakes Development Corporation is proposing to develop a water pipeline and associated pump infrastructure to provide a secure long-term water supply to the Penrith Lakes Scheme development (the Scheme) in western Sydney. This would involve the construction of a new 4.3 km, 900 mm, pipeline from a point upstream of the Penrith Weir to the Scheme site.

The Scheme is to be developed in accordance with the provisions of a Deed of Agreement between PLDC and the NSW Government that was made in 1987. Under Part 7 of the Deed, PLDC is required 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 Scheme.

The Scheme has been gazetted as a Specified site under State Environmental Planning Policy (Major Projects) 2005. As infrastructure associated with a major project, the Nepean River Pump and Pipeline (NRPP) project is subject to assessment under Part 3A of the EP&A Act. As such approval is being sought by PLDC (the proponent) from the Minister for Planning (the approval authority) before any pipeline and pump works are carried out.

The following objectives have been developed specifically for the NRPP project.

- To resolve the long term water supply issue for the 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 for lake filling by Scheme completion.
- To integrate the pipeline route with the Great River Walk (GRW).
- To minimise environmental impacts and work towards sustainable outcomes.

Key environmental issues associated with the development of the NRPP include:

- Water quality.
- Water management.
- Aquatic ecology.
- Terrestrial ecology.
- Aboriginal heritage and archaeology.
- Noise and vibration.
- Landscape and visual amenity.

Project Justification

The completion of the Scheme will seek to enhance local visual amenity and provide an interconnected system of lakes not present elsewhere on the Cumberland Plain in western Sydney. A fundamental component of the Scheme is the formation and construction of an interconnecting system of lakes that can satisfy the recreational needs of western Sydney. Adequate water supply to the lakes is essential for the completion and long term viability of the Scheme's development.

A number of alternative water supply options for the Scheme were assessed by the Independent Expert Panel (IEP) for the Hawkesbury Nepean River on behalf of the Penrith Lakes Water Committee. The IEP recommended that the Nepean River be used as the long-term, sustainable water supply for the Scheme's lake system including establishment of a specific receiving lake (known as the Quarantine Lake) to receive the river water.

Stormwater runoff from catchments surrounding the Scheme is adequate to supply the top-up water for the lakes to offset evaporation losses, but is not adequate to initially fill the lakes. The NRPP project, together with rainfall and stormwater runoff within the local catchment area will provide the mechanisms to initially fill the lakes and maintain long-term water levels. Constructing a new water supply pipeline and associated infrastructure to convey water from the Nepean River during high flows is expected to deliver a maximum of 86.4 ML/day of water to the Scheme's lake system.

Around 5,000 ML of water is held within the current Penrith Lakes Scheme. Water extracted from the Nepean River will provide the 30,000 ML of water required to fill the lakes and once completed, the lakes will hold approximately 35,000 ML of water. Based on flow records from 1909 to 1995, Water Research Laboratory has estimated that it may take as little as less than one year to greater than 13 years to fill the lakes. The filling will be dependent on the adopted pumping rules and climatic conditions. The median time to fill the lakes is expected to be between two and three years.

Stakeholder Involvement

Stakeholder involvement has been an integral component in the preparation of the EA. Stakeholder involvement activities have included the following:

- Risk Management Workshop.
- Planning Focus Meeting.
- Individual meetings with Penrith City Council, local Aboriginal community representatives, the NSW Department of Environment and Conservation, Department of Primary Industries (Fisheries), Department of Planning (formerly Department of Infrastructure, Planning and Natural Resources (DIPNR)), Hawkesbury Nepean Catchment Management Authority and the Hawkesbury-Nepean Water Users Association.
- Discussions with key affected landowners.

Route Options Assessment

The approach to the identification and evaluation of pipeline route options involved the consideration of engineering and environmental issues, together with input from key stakeholders consulted during the preparation of this EA. Three feasible pipeline route options were initially identified for the NRPP project.

During the concept design development process, a comparative analysis of feasible route options was undertaken to assist PLDC in their development of options to present to the Department of Planning (formerly DIPNR) over the preferred pipeline route option. This included focussing on the following issues:

- Location and configuration of the pipeline intake structure and pump station.
- Preferred route option alignment.
- Location of the discharge point.
- Sizing and configuration of the Quarantine Lake.

Based on the outcome of a route option comparative analysis, Option 3 was selected as the preferred option due to its overall good relative performance against the other options on most issues.

Option 3 runs from a point located 110 metres upstream of the Penrith Weir along the eastern bank of the Nepean River before diverting northwards, traversing land between the eastern and western tailings ponds which frame the southern Scheme boundary. It continues northward crossing Castlereagh Road before diverting westwards and eventually north to follow the haul road that passes between the western and eastern tailings ponds and beneath Castlereagh Road. The route crosses back over Castlereagh Road before discharging into a temporary Quarantine Lake and subsequently Lake A. This option would comprise an extension along Castlereagh Road to permanently discharge into the proposed extension of the Warm-up Lake. The total length of Option 3, including a temporary extension of 0.9 km, is 4.3 km.

Engineering Design

Intake Structure and Pipework

The intake structure and pipework will comprise twin 630 mm diameter pipelines submerged in a minimum of two metres of water beneath the riverbed of the Nepean River. The screens will be located approximately 70 metres from the eastern riverbank and 110 metres upstream of the Nepean Weir. The screens will comprise a matrix of fine spaced bars to prevent weed fragments and other debris from entering the twin pipes and, in turn, the pipeline.

Pump Station

The pump station will be built into the eastern bank of the Nepean River approximately 110 metres upstream of the Penrith Weir. The pump station will be constructed below ground with the roof structure and the wall adjacent to the Nepean River the only parts of the pump station visible above ground. The pump station will be able to withstand water inundation without damage.

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. The control building will be approximately 75 m^2 in area and up to 3.8 metres in height.

Pipeline

The 900 mm 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 1.0 m^3/s to a pressure break tank at a high point where the pressure pipeline will discharge into a gravity main.

Constructed Wetland and Quarantine Lake

A constructed wetland and quarantine lake will comprise two components of a multiple barrier approach that the Nepean River water will pass through prior to being discharged to the Scheme.

The constructed wetland will be located along the eastern boundary of the Quarantine Lake to act as a 'biological filter' to capture and retain weed fragments and seeds transported from the Nepean River via the pipeline. The wetland will also function as a water quality control mechanism to settle out suspended sediment and will aid in nutrient removal in conjunction with the Quarantine Lake.

The location and size of the Quarantine Lake will be formed from the proposed quarrying operations within the Scheme. The proposed volume of the Quarantine Lake will be approximately 2100 ML with a surface area of 449,701 m^2. The detention time within the Quarantine Lake for the proposed flow rate of 1.0 m^3/s will be approximately 24 days. During this period nutrients will be reduced to meet the

water quality guidelines required by PLDC, by a combination of physical, chemical and biological processes.

Construction Issues

The NRPP project construction comprises a series of sequential steps and specialist activities. The sequence of construction activities and rate of progress are dependent on local terrain and ground conditions, presence of major crossings, environmentally sensitive areas and prevailing weather conditions.

Prior to the commencement of the construction works, the contractor will produce a series of 'construction method statements' covering the range of construction activities to be carried out, including the construction techniques proposed to install the intake structure and lay the pipework in the Nepean River, cross watercourses, roads and major utility infrastructure. A CEMP and appropriate operating / maintenance manuals will also be produced by the construction contractor to assist in the implementation of environmental management controls, monitoring programmes, construction activities, incident reporting and emergency response.

The majority of Weir Reserve will be unaffected by the construction of the NRPP project and will remain open and accessible to the public. Only the working areas at the control building and pump station sites and at the offtake section of the pipeline will be secured and temporarily out of bounds to the public in the interest of safety.

Hydrology

The study area lies within the Hawkesbury Nepean River catchment area. The Nepean River is the principal watercourse in the study area and there are two minor watercourses; Peach Tree Creek and Boundary Creek.

A key issue for the NRPP project is to consider and, in turn, protect environmental flows within the Nepean River whilst extracting the appropriate volume of water to supply to the Scheme. PLDC currently hold a water abstraction licence that identifies a cease to pump limit of 170 ML/day (of water flow over Penrith Weir). A field assessment on the appropriateness of this pump rule was undertaken and identified that pumping at 170 ML/day may impede fish movement upstream.

To optimise extraction from the Nepean River a dynamic water balance model of the Scheme was configured to devise a pumping regime that would:

- Meet the environmental flow requirements to maintain the health of the Nepean River.
- Maintain the operating levels in the Scheme, without compromising water quality.
- Determine whether the Nepean River is an adequate and reliable long-term water source for the Scheme's lakes.

Based on the dynamic water balance model a pumping rate of 1.0 m^3/s has been devised. Pumping of Nepean River water will commence when flows exceed 500 ML/day over Penrith Weir and will cease when flows fall to 350 ML/day. Further expanding this rule to pumping only when required for water balance would further reduce any impacts on the Nepean River.

Water Quality

Water quality modelling was assessed against water quality requirements for the Scheme's lake system. An assessment on aquatic weed transfer and water quality within the Quarantine Lake was also undertaken.

Currently the Scheme contains three recreational lakes, Rowing Lake, Warm-up Lake and Main Lake. The lakes are used for whole body contact (primary) and incidental contact (secondary) recreation including activities such as rowing, canoeing and swimming.

The Scheme's lakes operate as a 'closed system' with the major water sources to the Scheme comprising overland flows, stormwater runoff within the local catchment, rainfall discharges from quarry pits and tailings dams and groundwater recharge. Overland flow from local catchment is pretreated by detention basins located in the east of the Scheme prior to entering the lakes.

Water quality of the Nepean River is deemed to be better quality than that of water from surrounding catchments.

Construction activities associated with the intake structure, pipeline, pump station, control building, and access road have the potential to impact on surface water quality and water quality in adjacent water bodies (namely the Nepean River, Boundary Creek and Peach Tree Creek).

Potential impacts on water quality during the construction phase will be mitigated through the development of an appropriate Water Quality Management Strategy (WQMS) and site specific Erosion and Sediment Control Plan (ESCP).

Following the construction of the pipeline and backfilling of the pipe trench, the disturbed working areas along the pipeline route will be restored to their pre-existing states (as far as practicable), with surface runoff patterns being returned to their former flow paths. It is considered that potential impacts to surface water flows during the operation phase will be negligible. However, the act of discharging Nepean River water into the Quarantine Lake uncontrolled may result in a number of potential impacts, including the breeding cycle of mosquitoes, cyanobacteria (blue-green algae) blooms, presence of faecal coliforms that may be discharged to the Rowing Lake and exotic and pest fauna species, such as carp, may breed uncontrollably and displace native fauna. Aquatic weeds present in the Nepean River and surrounding waterways, such as *Salvinia molesta, Eichhornia crassipes,* and *Egeria densa*, may also be transferred to the Scheme via the pipeline.

Mitigation measures during the operation phase of the pipeline may include controlling of nutrients at the source, installing a constructed wetland adjacent to the Quarantine Lake, implementing a water quality monitoring program as a pre-emptive management tool to identify management issues, and implementing a multiple barrier approach to weed transfer control.

Terrestrial and Aquatic Ecology

Vegetation along the pipeline route has been highly modified due to land clearing, quarrying and urban development. The eastern bank of the Nepean River comprises patches of *Casuarina Cunningham ssp. Cunninghamiana* with a few scattered shrubs of *Callistemon salignus*. The understorey along the riverbank is degraded and dominated by exotic weed species with some native plants and emergent species. An exotic species, *Salvinia molesta,* was recorded in the river.

Away from the riverbank, the vegetation communities are dominated by a mosaic of herbaceous weed species. Vegetation along the remainder of the route is characterised by herbaceous weeds and exotic grasses, scattered native and exotic trees.

A thin degraded strip of River-flat Eucalypt Forest (RFEF) is located on the eastern bank of the Nepean River in the vicinity of Penrith Weir. RFEF is a listed endangered ecological community (EEC) under Schedule 3 of the TSC Act. No EECs listed on the EPBC Act were recorded within the study area.

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

No threatened fauna was recorded during the current survey. However, the study area contains potential habitat for five threatened species listed on the TSC Act and two threatened species listed on the EPBC Act.

Two threatened species of invertebrates and two threatened species of fish listed under Part 7A of the *Fisheries Management Act 1994* (FM Act) have potential to inhabit the local area. The two fish species are also listed as Endangered under the EPBC Act. Additionally, one species, the Australian Grayling is listed as Vulnerable under the EPBC Act but only listed as protected under the FM Act.

Construction of the NRPP project has the potential to directly impact upon terrestrial ecology along the pipeline route through clearing of native vegetation along a 400 metre section of the Nepean River's eastern bank, potential loss of habitats for threatened species, fragmentation of riparian habitat creating barriers to faunal movement, weed invasion, and destabilisation and erosion of river and creek bank areas.

Pipeline construction works will require the clearing of a degraded area of native vegetation from a 15 metre wide working width along the initial 400 metres of the pipeline route. The total area of RFEF to be cleared from within the 15 metre wide working width is approximately 0.8 hectares. The total area of River-flat Eucalypt Forest community mapped by DEC (NPWS, 2002) within a 10 km radius of the study area is 1864 hectares. The results of an Eight Part Test concluded that there will not be any significant impacts on this EEC for the vegetation clearing activities.

The study area contains potential habitat for five species listed on the TSC Act (and fifteen species listed on the EPBC Act). Potential impacts of the NRPP project on these species have been considered to determine if an impact assessment is required. As the NRPP project is unlikely to cause individual death or injury or loss/disturbance of limited foraging and/or breeding habitat for these species, Eight Part Tests and Assessments of Significance have not been prepared and a SIS is not recommended.

Construction of the NRPP project has the potential to directly impact upon aquatic ecology (i.e. flora and fauna) through installation of instream structures, loss of aquatic habitat and obstruction of fish passage, extraction of river water, and sedimentation of watercourses.

Construction of the NRPP project has the potential to directly impact upon aquatic ecology through installation of instream structures, temporary loss of macrophytes from a construction corridor of approximately 1000 m^2, loss of aquatic habitat and obstruction of fish passage, extraction of river water, and sedimentation of watercourses.

No threatened species of aquatic fauna were observed during the survey, however the Nepean River and Penrith Weir provides potential habitat for the Macquarie Perch that is known to occur in Glenbrook Creek to the south west. Assessments of Significance under the EPBC and FM Act have been prepared in relation to the proposed intake pipeline. The assessment concluded that the proposal would not have a significant impact on this species.

To reduce the potential impact of the NRPP project on vegetation communities, fauna habitats and terrestrial and aquatic flora and fauna species a Vegetation Management Plan will be developed detailing bush regeneration works, weed management strategies and monitoring to be undertaken. Furthermore, it is recommended that intake structure/pipework construction activities are scheduled

outside fish migratory season i.e. July through to October and that appropriate erosion and sedimentation measures are employed.

Indigenous Heritage

There were no sites of Aboriginal archaeological or cultural significance identified or found within 50 metres of the infrastructure associated with the NRPP project during the archival searches and site walkovers conducted with members of the Aboriginal community in June/July 2005. It is on this basis that approvals under Section 87 and Section 90 of the *National Parks and Wildlife Act 1974* (NPW Act) are not required.

Whilst historical evidence indicates the Nepean River environments supported Aboriginal occupation, previous and current land uses have more than likely disturbed and/or destroyed Aboriginal artefacts and relics within the upper two metres of the underlying ground profile. The potential does exist for buried or in-situ artefacts to remain at greater depths, but this is considered unlikely along the pipeline route.

In the event that buried or in-situ relic, artefact or material (including skeletal) remains suspected of being of Aboriginal origin are encountered during ground investigations works or during construction appropriate mitigation measures will be applied.

Non-Indigenous Heritage

A total of four non-indigenous heritage items are located within 100 metres of the proposed pipeline route; Castlereagh Area, Upper Room Chapel, Hall and Cemetery, and Mouquet farmhouse.

The pipeline route crosses the Castlereagh Road alignment and traverses the 'Castlereagh Area' for approximately 20 metres before discharging into Recreation Lake A. The Castlereagh Area is listed on the Register of National Estate (RNE) as an 'indicative' place. The Australian Heritage Council is currently determining whether this indicative place should be entered onto the RNE. No decision has been made on this listing during the preparation of this EA.

The latter three occur approximately 100 metres west of the warm-up lake. The pipeline route alignment is located approximately 80 metres from the chapel and hall and approximately 50 metres from the eastern boundary of the cemetery. The Upper Room Chapel, Hall and Cemetery area is listed on the RNE as an 'indicative' place and no decision has been made on this listing during the preparation of this EA.

The pipeline route alignment was adjusted so as to not adversely impact on the remains of the Mouquet Farm.

It is anticipated that the NRPP project will have little impact on non-indigenous heritage items within the study area.

Urban Design, Landscape and Visual Amenity

The local landscape character along the pipeline route and surrounding the pump station and control building sites is characterised by a mixture of degraded riparian forest and woodland interspersed with exotic plant communities along the eastern bank of the Nepean River, bare ground and disturbed grassland associated with the Penrith Valley Industrial Area near Cassola Place, and quarrying areas on the southern part of the Scheme site. The Nepean River flanks the southern and western boundaries of the Scheme. Two minor watercourses, Peach Tree Creek and Boundary Creek flow across the southern part of the study area, approximately 200 metres and 300 metres north of Penrith Weir respectively. Views from the Penrith Weir are framed by 10 to 15 metre high riverbanks of the

Nepean River to the west and east, and the long views along the Nepean River channel which extend north and south.

On the high bank of the Nepean River there is a strong visual contrast between the urban and industrial areas to the east and the natural river environment and Blue Mountains escarpment beyond to the west. The built form is typically two to three storey high commercial buildings with front and side access and parking areas.

Inside the Scheme boundary the landscape is dominated by the quarrying activities and largely comprises a cleared and highly modified landform, predominantly devoid of vegetation. This contrasts with the natural character of adjacent water bodies such as the Rowing Lake, Warm-up Lake and Duck Pond. Castlereagh Road delineates the Scheme site passing through the southern portion before heading north and intersecting West Wilchard Road to the north of the Scheme.

Impacts on the local landscape and visual amenity will largely occur during and for a period after construction of the pipeline, pump station, control building and intake structure. There is likely to be some temporary and minor impacts on the visual amenity at Weir Reserve and along the short stretch of the Nepean River's eastern bank for recreational users at this locality during the construction of the control building, pump station and vehicular access.

Once the pipeline has been installed and reinstated, the permanent effects of the NRPP project will be attributed to introduction of aboveground structures (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 at intervals along the pipeline route, and some temporary change to the existing vegetation structure and pattern within the revegetated/reinstated areas along the pipeline route.

Topography, Geology and Soils

Terrain along the pipeline route is characterised by gently undulating topography. Ground elevations along the length of the pipeline are generally between 20 and 25 metres Australian Height Datum (AHD).

The geomorphology along the pipeline route and at the sites of the control building and pump station comprise landforms such as water bodies (Nepean River and associated tributaries), floodplain, and disturbed terrain, including quarry areas on the Scheme site.

The NRPP project is located on floodplain, where extensive commercial quarrying of sand and gravel has occurred. The current landform within the site has been largely modified and created as a result of backfilling quarried land with overburden soils and /or settled fines from quarrying operations. A number of creeks previously crossed the site (e.g. Cranebrook Creek) but have since been diverted by quarrying operations.

A groundwater plume has been identified to the east of the pipeline alignment in the vicinity of Cassola Place. Previous environmental site assessment results indicate the plume is contained within an underlying aquifer and is progressing west toward the Nepean River. General depth of the plume is approximately six metres. Maximum depth of construction work for the NRPP project in the vicinity of the plume is anticipated to be 3.5 metres and therefore it is considered that the construction activities will not significantly intercept the groundwater plume.

Areas of known or potential soil salinity hazard have been identified in parts of Cranebrook Creek and its floodplain within the Scheme, however, these areas are relatively isolated and are unlikely to be disturbed by the NRPP project.

Soil erosion and runoff hazards are considered to be a primary potential impact during the construction phase. These impacts will be mitigated through the development of a Soil and Water Management Plan (SWMP) including an Erosion and Sediment Control Plan (ESCP) prior to the commencement of construction works.

Once the NRPP is installed and rehabilitation activities have been completed, potential impacts to the topography, geology and soils of the area resulting from the operation of the NRPP are expected to be negligible.

Noise and Vibration

Noise sensitive receivers in proximity to the NRPP project include an industrial/commercial area; Weir Reserve; Nepean Rowing Club; Nepean River Caravan Park; McCarthy Senior School; Avoca Street, Penrith; Sydney International Regatta Centre; locality of Emu Heights; Emu Heights Correctional Facility.

Noise levels generated during the construction of the pump station and the control building are predicted to exceed construction noise criteria at Weir Reserve and marginally exceed construction noise criteria at sensitive receivers across the Nepean River (Nepean River Camping Ground and McCarthy Senior School).

Construction noise levels from pipeline construction are predicted to exceed construction noise criteria at the Residence, Church accommodation and Church on Castlereagh Road and at Weir Reserve. There is also a marginal exceedence predicted to occur at the Nepean River Camping Area.

These exceedances would only occur when pipeline construction is adjacent to the receiver for a period of between two and four weeks.

The only noise sources likely to result in operational noise impacts are from the pump station adjacent to the Nepean River and the control building located in Weir Reserve. Assuming the transmission loss of the building elements, reverberant levels within the building structures, and the anticipated sound power levels, a noise level of less 50 dBA $L_{Aeq,\ 1hour}$ at 10 metres would appear to be achievable for the pump station and the control building.

Air Quality and Climate

The principal air pollutant of concern associated with the NRPP project would be attributed to the generation of wind blown dust during the construction works. The nature of the impact would be short-term and temporary in nature associated mainly with soil disturbance and movement activities during preparatory earthworks and pipeline trench excavation, backfilling, and reinstatement. Potential air quality impacts generated by construction activities can be controlled through the implementation of appropriate air quality control and dust suppression measures.

The operation phase of the NRPP project will not generate any significant air quality impacts. The potential for air emissions from pumping equipment can be effectively mitigated through a programme of routine maintenance and inspection, which is recommended to be included as part of the NRPP project's routine environmental inspection requirements.

Waste

Construction activities associated with the NRPP project have the potential to generate waste materials such as pipe laying building waste, general building waste, general waste from construction workers, green waste, excavated material, human waste and maintenance waste.

Potential impacts associated with the generation of waste during the construction phase of the NRPP project may be minimised through the implementation of a Resource and Waste Management Plan, correctly classifying wastes to accurately identify management, transportation and disposal requirements, and handling, storage and transport of hazardous materials and waste in accordance with the National Code of Practice and the relevant Material Safety Data Sheet for the product.

It is envisaged that negligible waste would be generated once the pipeline is operational.

Land Use

Land use within the study area is characterised by open space and recreational facilities, riparian forest and woodland, the Nepean River, undeveloped industrial lands and quarrying.

Construction of the NRPP project will require the establishment of a 15 metre wide working width along the majority of the pipeline route, subject to the construction techniques employed at specific locations, such as watercourse and road crossings, where slightly larger or smaller working areas may be required.

Construction will occur progressively along the length of the pipeline and as such construction crews and temporary compounds will be mobile as pipe trenching, laying and backfilling takes place. On this basis the majority of impacts on existing land use activities and patterns will be temporary.

The clearing and removal of native vegetation (i.e. trees and shrubs) from the initial 400 metres of the pipeline route and the disturbance to open space areas at Weir Reserve is unavoidable. The pipeline route and location of the aboveground structures (i.e. control building and pump station) and hardstand areas have been selected to minimise such impacts.

There will be some minor, temporary disruption to recreational users of Weir Reserve and the GRW (when constructed). Appropriate measures will be implemented to maintain access and mobility at Weir Reserve, with the majority of this area remaining open to the public.

Permanent land use impacts associated with the NRPP project will be attributed to the loss of around 225 m^2 of open space at Weir Reserve due to the introduction of aboveground structures such as the control building and hardstand areas for vehicle access. An additional 43 m^2 area will be required for the roof structure of the pump station, which will be mainly built into the riverbank and be buried below ground level. The roof structure will provide the opportunity to create a viewing platform for the public, and will also 'tie-in' with the GRW. Seating will be provided so that users of the GRW can 'rest' and 'relax' by the river.

Draft Statement of Commitments

In accordance with the DGRs issued by the Director-General for Planning, a draft SoC has been included within this EA. The draft SoC provides a list of commitments that PLDC is prepared to make to minimise or avoid the environmental impacts of the NRPP project. A number of mitigation measures that will be considered have been included.

The SoC will form the basis of a CEMP that will be prepared prior to the commencement of construction of the NRPP project. The draft SoC will be finalised following consideration of the feedback received during the public exhibition of the EA.

1. Introduction

1.1 Background

Penrith Lakes Development Corporation (PLDC) is proposing to develop a water pipeline and associated pump infrastructure to provide a secure long-term water supply to the Penrith Lakes Scheme development (the Scheme) in western Sydney (refer to **Figure 1.1**). This would involve the construction of a new 4.3 km, 900 mm, pipeline from a point upstream of the Penrith Weir to the Scheme site.

The Scheme is located on land associated with the Nepean River floodplain near Penrith, approximately 55 km to the west of the Sydney Central Business District (CBD). Over the past 25 years, the combined efforts of Boral, Readymix and Hanson have coordinated the extraction of sand and gravel, and the rehabilitation of floodplain areas along the eastern bank of the Nepean River from the Scheme area. The Scheme currently supplies up to 75 per cent of Sydney's sand and gravel requirements. Ultimately, the Scheme will involve the staged development of residential / commercial, open space and lake precincts. A key component of the Scheme's development will be the formation and construction of an interconnected lakes system to satisfy future recreational needs in western Sydney.

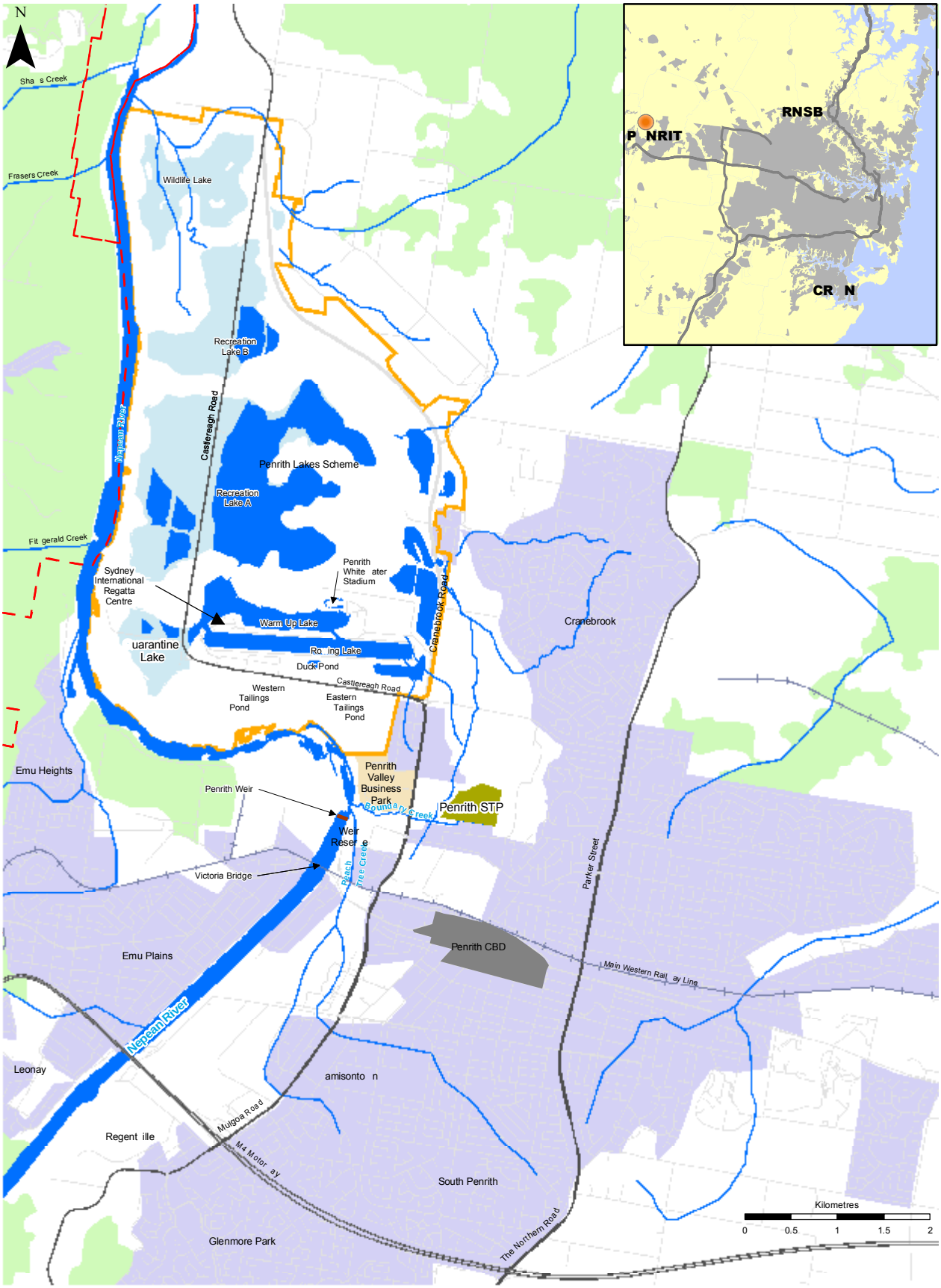
The Scheme is to be developed in accordance with the provisions of a Deed of Agreement (the Deed) between PLDC and the NSW Government (Minister for Planning et al) that was made in 1987. Under Part 7 of the Deed, PLDC is required to design and construct a pump and pipeline to extract water from the Nepean River at a point immediately upstream of Penrith Weir to facilitate the initial filling and long-term water supply of the lakes within the Scheme.

Maunsell Australia Pty Ltd (Maunsell) has been appointed by PLDC to prepare an Environmental Assessment (EA) for the Nepean River Pump and Pipeline (NRPP) project and to identify all relevant approvals and permits that may need to be acquired. Particular focus has been given to the key issues identified by the Director-General for Planning in the Director-General Requirements (DGRs). A copy of the DGRs is provided in **Appendix A**.

This EA has been prepared in accordance with the requirements of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). The NRPP project is subject to assessment under Part 3A of the EP&A Act, and as such approval is being sought by PLDC (the proponent) from the Minister for Planning before any pipeline and pump works are carried out. Pursuant to the requirements of Part 3A of the EP&A Act this EA has been prepared to:

- Conform with the requirements of the EP&A Act including satisfying specific requirements issued by the Director-General for Planning.
- Provide sufficient information so that the Minister for Planning can make a determination on the NRPP project.
- Identify any other approvals that may need to be acquired as a result of the project proceeding.
- Inform the community and stakeholders about the project and describe the consultation activities undertaken.

By satisfying the above, the EA will assist in fulfilling the requirements of Section 111 of the EP&A Act that PLDC have examined and taken into account the fullest extent possible, all matters affecting or likely to affect the environment by reason of the proposed pump and pipeline works.



Penrith Lakes Scheme Site Boundary
Existing Water ay
Proposed Water ay
Main Road
Local Road
Rail ay Line
Vegetated Area
Local Go ernment Areas
Built up Area
Penrith CBD
Penrith Weir
Penrith STP
Business Park

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NEPEAN RIVER PUMP AND PIPELINE

FIGURE 1.1: REGIONAL LOCATION PLAN

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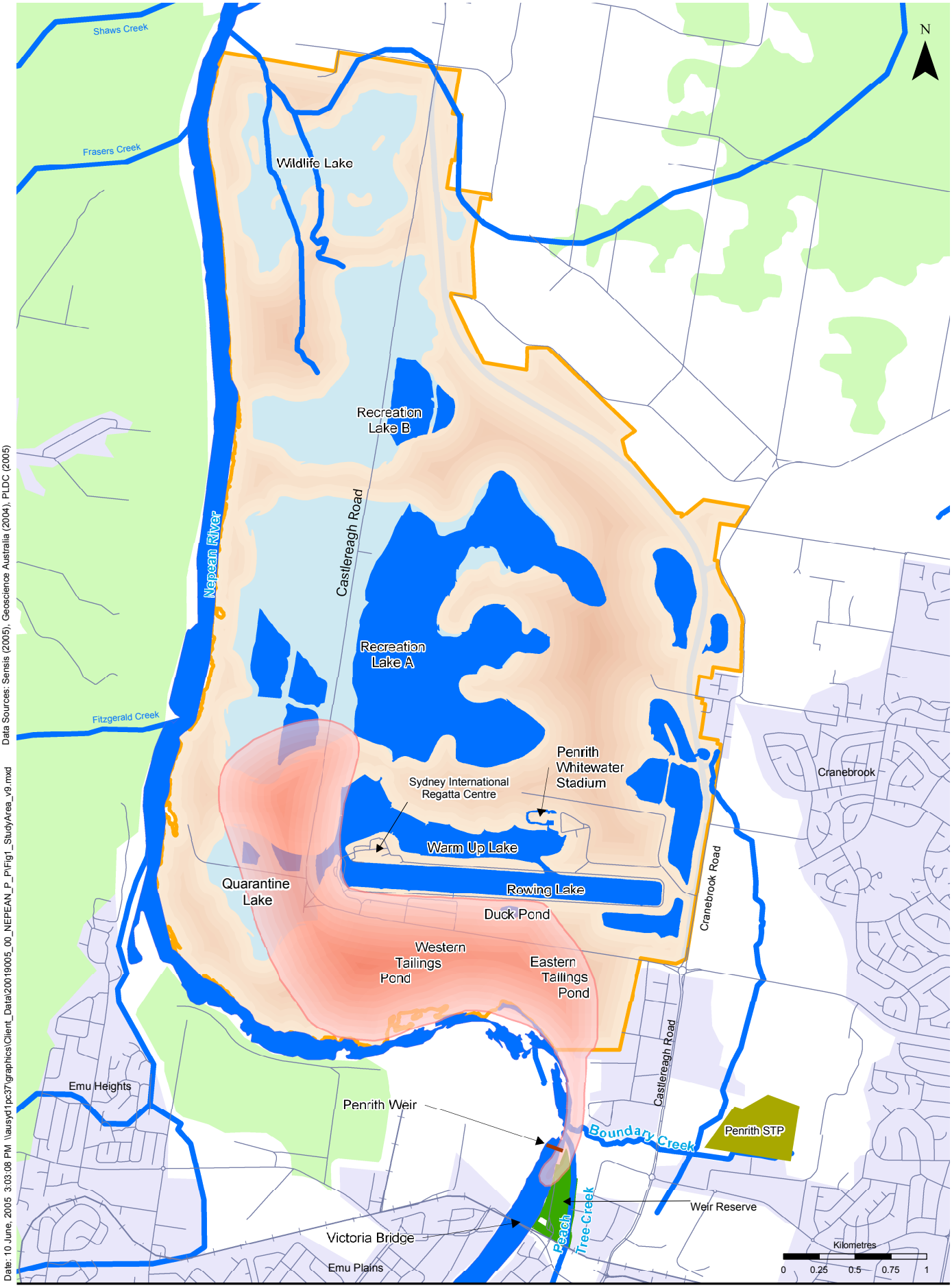

Data Sources: Sensis (2005), Geoscience Australia (2004), PLDC (2005)

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- Study Area
- Penrith Lakes Scheme Site Boundary
- Existing Waterway
- Future Waterway
- Local Road
- Main Western Railway Line
- Penrith Weir
- Vegetated Area
- Built-up Area
- Pipeline Intake Point
- Weir Reserve
- Penrith STP

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NEPEAN RIVER PUMP AND PIPELINE

FIGURE 1.2: STUDY AREA

1.2 Penrith Lakes Scheme

The Scheme area is located on the Nepean River floodplain approximately three km north west of the Penrith town centre and 55 km west of the Sydney CBD (refer to **Figure 1.1**). It occupies an area of approximately 2,000 hectares and is bound by the Nepean River to the south and west, Cranebrook Road and rural residential properties to the east and Smith Road and West Wilchard Road to the north.

The Penrith Lakes Scheme development is aiming to 'create a unique Penrith Valley Landscape, delivering opportunities for a quality lifestyle' (PLDC, 2000). Ultimately, the Scheme will be divided by three main development precincts as follows:

- 400 hectares of residential/commercial development.
- 900 hectares of parkland and open space.
- 725 hectares of lakes.

The lakes precinct will comprise five major lakes including a Wildlife Lake, two recreation lakes, a Warm-up Lake and a Rowing Lake. The average depth of the lakes will be around five metres with a total storage capacity of 35,000 ML. The Warm-up and Rowing Lakes have already been constructed and are operational. A quarantine lake will also be established as an extension to the Warm-up Lake. The Wildlife Lake will be located in the northern part of the Scheme and will provide a sanctuary for local and migratory birds. The two recreation lakes (Recreation Lakes A and B) will be used for water based recreation. The quarrying and rehabilitation to create the lakes and landforms (including the Quarantine Lake) has been approved by the Minister for Planning in previous development approvals.

A number of water based recreational facilities currently operate at the Scheme including the Sydney International Regatta Centre and the Penrith Whitewater Stadium. Both facilities were venues for the rowing and kayaking events at the Sydney Olympic Games in 2000. There is currently 15 km of public cycle and walking paths within the Scheme boundary. A total of 55 km of lake foreshore is proposed for the completed Scheme development, including some foreshore public access tracks.

A number of educational and cultural facilities are located in the southern part of the Scheme site, including Muru Mittigar, an Aboriginal Cultural Centre, and the Penrith Lakes Environmental Education Centre. Muru Mittigar is open to the general public and the education centre caters for students from kindergarten to tertiary levels.

There is a series of smaller lakes located on the eastern part of the Scheme site. These smaller lakes act as detention basins, collecting urban runoff from surrounding catchments and supplying it to the Scheme. Once the Scheme is developed these smaller lakes will continue to provide a natural water source and assist in maintaining water levels within the lake system.

The proposed layout of the Scheme development is shown in **Figure 1.2**.

1.3 Project Objectives

The following objectives have been developed specifically for the NRPP project.

- To resolve the long term water supply issue for the 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 for lake filling by Scheme completion.
- To integrate the pipeline route with the Great River Walk (GRW).
- To minimise environmental impacts and work towards sustainable outcomes.

1.4 Study Area

The study area selected for the investigation and development of the NRPP project is depicted in **Figure 1.2**. It covers a total area of 350 hectares and extends from a point approximately 110 metres upstream of the existing Penrith Weir to a discharge location at the southern boundary of Recreation Lake A within the Scheme boundary.

The study area comprises land wholly within the Penrith Local Government Area (LGA).

Terrain within the study area is characterised by relatively flat floodplain and gently undulating ground, which in part has been modified by quarry operations (i.e. land within the Scheme site). Two minor creek systems, Peach Tree Creek and Boundary Creek flow in an east-west direction across the southern part of the study area prior to their confluences with the Nepean River. The high riverbank areas rise at 45 degree angles from a low riverside terrace to heights of around 15 metres from the main river channel and support densely vegetated slopes of exotic weeds/grasses interspersed with alluvial woodlands and riparian forest.

Key attributes of the study area, which will influence the location, and design of the NRPP project and associated infrastructure include:

- Weir Reserve and associated recreational facilities.
- The route of the proposed GRW.
- Infrastructure such as the Penrith Weir, Castlereagh Road, and internal circulation roads within the Scheme site.
- Active quarry areas and recreational facilities with the Scheme site such as the existing rowing and warm-up lakes, parkland and barbecue/picnic areas.
- The Nepean River, associated tributaries such as Peach Tree Creek and Boundary Creek, and areas of floodplain.
- Areas of archaeological and cultural heritage significance and known items of non-indigenous heritage interest.
- Areas of River-flat Eucalypt Forest (RFEF) which is a listed Endangered Ecological Community (EEC) under Schedule 1 (Part 3) of the *Threatened Species Conservation Act 1995* along the eastern bank of the Nepean River.
- Areas of aquatic habitat interest and fish passage corridors.

1.5 The EA Process

1.5.1 Scope of the EA

An overview of the methodology adopted for the preparation of this EA is presented in **Figure 1.3**. This EA has considered the key issues associated with the development of the NRPP project in conjunction with concerns and feedback provided by relevant stakeholders throughout the environmental assessment process. It has been structured to present the findings of the environmental assessment and consultation processes employed during the planning stage of this project. Section 8 of this EA includes an environmental assessment, which is broken down for each environmental element considered as follows:

- Description of the existing environment.
- Presentation of relevant guidelines and/or policy requirements (as appropriate).
- Assessment of potential impacts during construction and operation.
- Recommendations of mitigation measures during construction and operation.

1.5.2 Key Issues

The key environmental issues associated with the development of NRPP project include:

- Water management – impacts associated with the extraction (ML/day) and pumping (m^3/s) of water from the Nepean River on environmental flows and water levels within the Scheme's lakes.
- Water quality – impacts associated with the discharge of extracted river water on lake water quality within the Scheme boundary and proliferation of aquatic weeds via the transmigration of seed provenance and weed litter from the Nepean River to the Scheme's lakes system.
- Aquatic ecology – impacts associated with the installation and operation of pipeline intake and discharge structures on aquatic and riparian habitats, threatened species (i.e. macro-invertebrates and fish) and fish movements within the Nepean River.
- Terrestrial ecology – impacts associated with the clearance and disturbance of native vegetation communities within the riparian zone and loss of threatened flora and fauna species, habitats and listed EECs.
- Aboriginal heritage and archaeology – impacts associated with the loss and disturbance of sites and artefacts of indigenous heritage significance that may remain buried and in-situ along the pipeline route.
- Noise and vibration – impacts associated with construction noise and the operation of noise generating plant such as the pump and control building equipment on surrounding sensitive areas.
- Landscape and visual identity – impacts associated with reinstatement of the pipeline route and the introduction of aboveground structures on the local landscape character and visual setting of Weir Reserve and the GRW.

The existing environmental and physical conditions, potential impacts and recommendations for mitigation and offsets are discussed in this EA in accordance with DGRs.

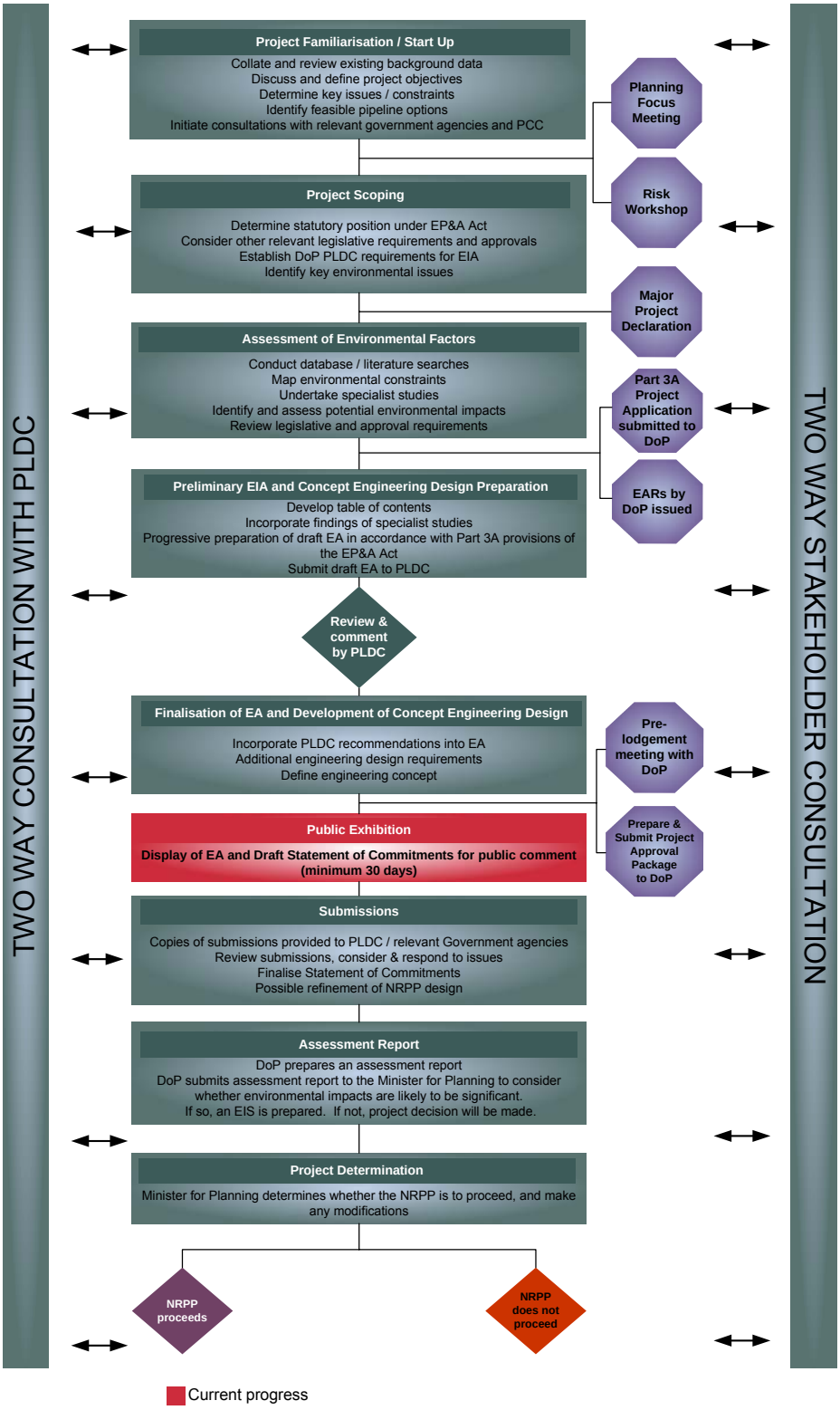
1.5.3 Specialist Studies

The following specialist studies have been conducted to supplement the information presented in this EA:

- Water balance and water quality modelling undertaken by Water Research Laboratory.
- Aquatic Weed Transfer and Water Quality Assessment carried out by Australian Wetlands.
- Terrestrial and Aquatic Flora and Fauna Impact Assessment carried out by Biosis Research.
- Aboriginal Cultural Heritage Assessment carried out by Biosis Research.
- Environmental Noise Assessment carried out by Wilkinson Murray.

Full copies of these reports are included in **Appendices B** to **G**.

Figure 1.3: Overview of EA Methodology



Source: Maunsell 2005

1.6 EA Structure

The EA has been structured into 13 chapters as follows:

- **Section 1** provides the background context for the NRPP project, outlines the project objectives, describes the key attributes of the study area and presents an overview of the EA process.
- **Section 2** describes the project and addresses the need and justification for the NRPP project, including the 'do nothing' alternative.
- **Section 3** details the requisite statutory controls and approvals process relevant to the NRPP project.
- **Section 4** discusses the consultation process and activities undertaken during the preparation of the EA.
- **Section 5** describes the pipeline route options assessment process.
- **Section 6** describes the main components of the NRPP project's design. Other key design and constructability issues are also detailed.
- **Section 7** outlines the anticipated main construction activities and processes involved in the development of the NRPP project.
- **Section 8** describes the existing environment, outlines potential environmental impacts resulting from the construction and operation of the NRPP project, and presents appropriate mitigation measures to avoid or ameliorate potential impacts.
- **Section 9** evaluates environmental matters for consideration identified by the Director-General in the DGRs, matter listed under the Sydney Regional Environmental Plan (SREP) No.11 and matters of National Environmental Significance (NES) as prescribed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
- **Section 10** provides a description of PLDC's draft Statement of Commitments (SoC) for the NRPP project.
- **Section 11** provides an outline Construction Environmental Management Plan (CEMP) that would be prepared for the construction phase of the NRPP project.
- **Section 12** presents the key findings and conclusions of this EA.
- **Section 13** lists all literature and internet links sourced during the preparation of this EA report.
- **Appendix A** provides a copy of the Director-General for Planning's Environmental Assessment Requirements.
- **Appendix B** provides a water balance and water quality modelling assessment prepared by Water Research Laboratory for the NRPP project.
- **Appendix C** provides an Aquatic Weed Transfer and Water Quality Assessment prepared by Australian Wetlands for the NRPP project.
- **Appendix D** provides a Terrestrial and Aquatic Flora and Fauna Assessment prepared by Biosis Research for the NRPP project.
- **Appendix E** provides an Aboriginal Cultural Heritage Assessment prepared by Biosis Research for the NRPP project.
- **Appendix F** provides an Environmental Noise Assessment prepared by Wilkinson Murray for the NRPP project.

2. Project Description and Justification

2.1 The Project

The NRPP project will involve the construction and operation of a new water supply pipeline, intake/discharge pipework and structures, pump station and instrumentation equipment, and a constructed wetland and Quarantine Lake (refer to **Figure 2.1**). Approval for the quarrying, construction of the lakes and landforms has been previously granted. Operation of the lakes and associated water management plans are part of the contractual arrangement between PLDC and the Minister for Planning (through the 1987 Deed of Agreement). The NRPP project is limited to the pump and pipeline infrastructure construction and operation for the water supply to the lakes.

The route of the pipeline will traverse land wholly within the Penrith LGA including land both inside and outside the Scheme's boundary. The pipeline will be designed, installed and operated to meet the requirements of all relevant standards for water supply pipelines. The new water supply pipeline will be approximately 4.3 km long and 900 mm in diameter.

The proposed 'intake' point for the new pipeline is located 110 metres upstream of Penrith Weir, approximately one km to the south of the Scheme's boundary. The intake structure will be installed on the bed of the Nepean River approximately 70 metres from the eastern bank where the water depth is around two metres. It will comprise two submersible pumps fitted with fine-mesh screens and connected to a pump station via twin 70 metre long, 630 mm diameter pipes buried under the bed of the Nepean River.

The pump station will be submersed within the eastern bank of the Nepean River, upstream of the Penrith Weir with the control building located above the 100 year Average Recurrence Interval (ARI) flood event on the high riverbank area within Weir Reserve (refer to **Figure 2.2**). Water extracted from the Nepean River will be pumped at a maximum flow rate of 1.0 m^3/s. Pumping limits for the extracted river water will range between a low flow limit of 350 ML/day and an upper flow limit of 2,500 ML/day. Pumps will only activate when the flow within the Nepean River reaches approximately 500 ML/day over Penrith Weir.

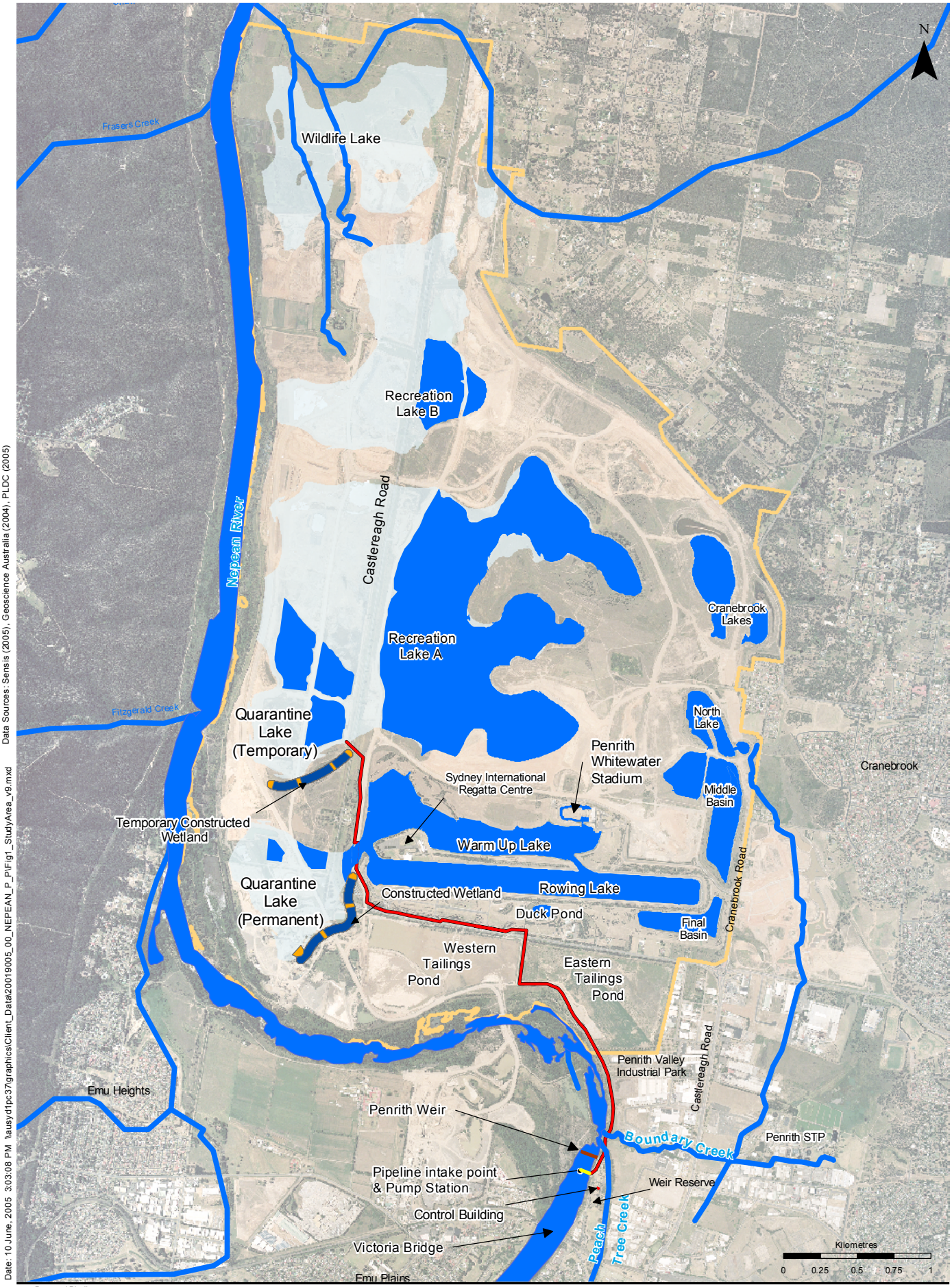
River water will pass through a fine-mesh screen fitted at the intake structure prior to being transferred through the main pipeline system. The fine screen would be designed to free river water of aquatic weeds, large to medium size sediments and other debris. Discharged river water would be conveyed through the pipeline to the Scheme site.

From the pump station the pipeline will travel in a predominantly north-east direction along the eastern bank of the Nepean River before diverting north under Castlereagh Road toward a temporary discharge point into a temporary constructed wetland and Quarantine Lake prior to entering Recreation Lake A on the Scheme site. Once quarrying operations on the western part of the Scheme site have ceased, water extracted from the Nepean River will be permanently discharged into a constructed wetland and Quarantine Lake (an extension of the Warm-up Lake) prior to entering the Scheme's lake system.

Terrain along the pipeline route is characterised by gently undulating ground associated with the Nepean River floodplain. The pipeline route crosses two minor creeks (i.e. Peach Tree Creek and Boundary Creek) which flow directly into the Nepean River.

The majority of native vegetation along the pipeline route has been modified as a result of past and current land clearing and development activities. Remaining remnants of native vegetation are mainly

restricted to thin lineal belts along the banks of the Nepean River. The mix of plant communities and ground cover along the pipeline route comprises a mixture of bare ground, disturbed areas with native and introduced species, riparian forest and woodland with a degraded under-story supporting exotic grasses and weeds and scattered shrubs. Vegetation tends to be highly degraded and dominated by a cover of exotic grasses and herbaceous weed species away from the riverbank areas.



Data Sources: Sensis (2005), Geoscience Australia (2004), PLDC (2005)

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- Proposed Pipeline
- Constructed Wetland
- Existing Waterway, i.e. River, Creek, Dam (Outside Scope of the NRPP Project)
- Proposed Waterway (Outside Scope of the NRPP Project With the Exception of the Quarantine Lakes)
- Penrith Weir (Existing)
- Penrith Lakes Scheme Site Boundary
- Control Building
- Pipeline Intake Point

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NEPEAN RIVER PUMP AND PIPELINE

FIGURE 2.1: AREA SUBJECT TO THE NRPP PROJECT

2.2 Project Need

The completion of the Scheme will seek to enhance local visual amenity and provide an interconnected system of lakes not present elsewhere on the Cumberland Plain in western Sydney. The Scheme has been gazetted as a Specified site under State Environmental Planning Policy (Major Projects) 2005. A fundamental component of the Scheme is the formation and construction of an interconnecting system of lakes that can satisfy the recreational needs of western Sydney. Adequate water supply to the lakes is essential for the completion and long term viability of the Scheme's development. The NRPP project, together with rainfall and stormwater runoff within the local catchment area will provide the mechanisms to fill the lakes and maintain long-term water levels.

2.3 Long Term Water Supply

On an annual average basis the stormwater runoff is adequate to supply the top-up water for the lakes to offset evaporation losses, however, due to the variability of local climatic conditions, particularly rainfall, this water source is considered not to be adequate to maintain the lake's water levels within acceptable operating ranges. The Scheme design is based upon the lakes being maintained within normal operating ranges 90 per cent of the time reducing the reliance on rainfall in the local catchment area to maintain the supply.

Without an additional water supply to the Scheme the main recreational lakes (i.e. Lakes A and B) will be in the order of two metres below operating water levels 50 per cent of the time (WRL 2006), which is significantly outside the desired operating range (+-0.5 metres 90 per cent of the time, DIPNR June 2005). Constructing a new water supply pipeline and associated infrastructure to convey water from the Nepean River during high flows to the Scheme's lake system would deliver a maximum of 86.4 ML/day of water.

A number of alternative water supply options for the Scheme were assessed by the Independent Expert Panel (IEP) for the Hawkesbury Nepean River on behalf of the Penrith Lakes Water Committee[1]. The IEP recommended that the Nepean River be used as the long-term, sustainable water supply for the Scheme's lake system including establishment of a specific receiving lake (i.e. Quarantine Lake) to receive the river water (DIPNR June 2005).

2.4 Initial Lake Filling

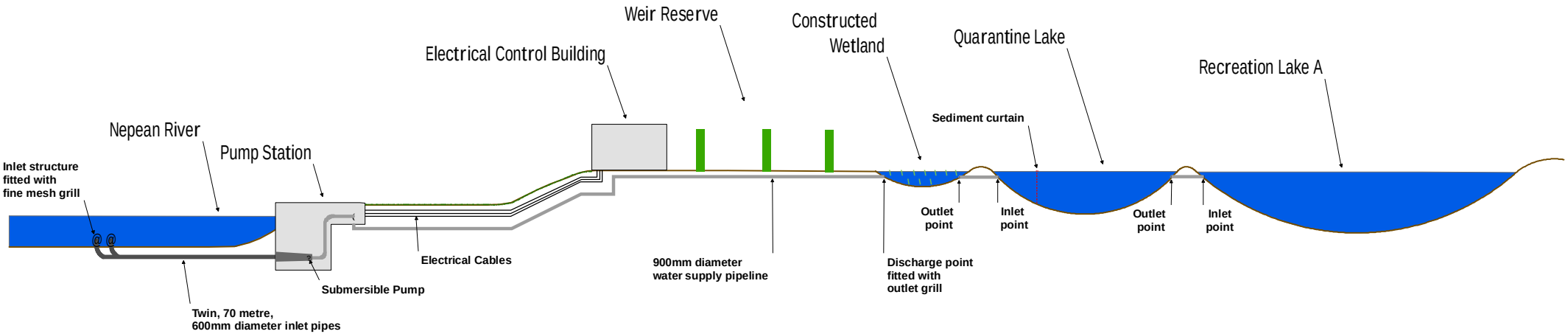
Once completed, the lakes will hold approximately 35,000 ML of water. Currently around 5,000 ML is stored on site. Relying on stormwater runoff from the catchment alone could take decades to fill the lakes. Water extracted from the Nepean River will provide the 30,000 ML of water required to fill the lakes. Based on flow records from 1909 to 1995, Water Research Laboratory (WRL, 2006) has estimated that it may take less than one year to in excess of 13 years to fill the lakes. Timing of the completed Scheme will be dependent on the adopted pumping rules and climatic conditions. The median time to fill the lakes is predicted to be between two and three years.

It is on this basis that the NRPP project is proposed for construction in late 2006 to allow for sufficient time to fill the lakes, in accordance with the rehabilitation program for the Scheme, and to provide the required water volumes to maintain the completed lakes within the desired operating ranges.

[1] In the absence of an on-going parkland management authority, the Penrith Lakes Water Committee, comprising representatives of key stakeholders, was established in 2004 to assist the NSW Government and PLDC in the development of comprehensive sustainable policies, strategies and processes for the Penrith Lakes waterways.

2.5 "Do-Nothing"

The 'do-nothing' alternative would involve the provision of no water supply pipeline and associated infrastructure as part of the overall Scheme development. This would contravene the requirements set out under Part 7 of the Deed. The viability of the Scheme development is dependent on a river water supply from the Nepean River and therefore a 'do-nothing' alternative is not feasible.



Note: Not To Scale

PENRITH LAKES DEVELOPMENT CORPORATION

NEPEAN RIVER PUMP AND PIPELINE

FIGURE 2.2: SCHEMATIC OF NRPP PRO ECT

3. Statutory Requirements

3.1 Commonwealth Environmental Assessment Process

3.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) regulates actions that may have a significant impact on matters of National Environmental Significance (NES), which include:

- Nationally threatened species and ecological communities.
- Australia's World heritage properties.
- Ramsar wetlands of international importance.
- Migratory species listed under the EPBC Act (species protected under international agreements).
- Commonwealth marine areas.
- Nuclear actions, including uranium mining.
- National heritage.

Actions likely to impact on matters of NES require approval from the Commonwealth Minister for Environment and Heritage under Part 6 of the EPBC Act.

Potential impacts associated with the development of the NRPP project have been assessed against these matters of NES, and no negative adverse impacts have been identified. Referral under Section 68 of the EPBC Act to the Commonwealth Minister for Environment and Heritage to determine whether or not the project will have such an effect is therefore not necessary. Formal consideration of matters of NES and also Commonwealth Land are detailed in **Section 9.2**

3.1.2 Native Title Act 1993

The *Native Title Act 1993* administers processes relating to the recognition, protection and determination of native title and dealings with native title land.

Native title is concerned with the rights and interests of Aboriginal and Torres Strait Islander peoples in relation to land and water in Australia and its territories. The Commonwealth Department of Environment and Heritage (DEH) administers this Act. At the time of preparing this EA there were no native title claims applicable to the NRPP project.

3.2 NSW Environmental Assessment Process

The EP&A Act and the EP&A Regulation jointly provide the statutory framework for the regulation of development within NSW. The NRPP project is being assessed in accordance with the provisions under Part 3A of the EP&A Act and is subject to approval from the Minister for Planning (the determining authority).

The EP&A Act is supplemented by a number of Environmental Planning Instruments (EPIs) including State Environmental Planning Policies (SEPPs), Regional Environmental Plans (REPs) and Local Environmental Plans (LEPs). EPIs relevant to the construction and operation of the NRPP project are described in this section.

3.2.1 State Environmental Planning Policy (Major Projects) 2005 (SEPP MP)

State Environmental Planning Policy (Major Projects) 2005 (SEPP MP) was gazetted on 25 May 2005 principally to classify development which will require assessment and approval under Part 3A of the EP&A Act, and for which developments are defined as 'specified sites' and require consent from the Minister for Planning.

SEPP MP consolidates the development assessment process administered by the Minister for Planning, and specifies clear criteria for which developments are classed as 'specified sites'. Aims of the policy are:

a) *to identify development to which the development assessment and approval process under Part 3A of the Act applies,*
b) *to identify any such development that is a critical infrastructure project for the purposes of Part 3A of the Act,*
c) *to facilitate the development, redevelopment or protection of important urban, coastal and regional sites of economic, environmental or social significance to the State so as to facilitate the orderly use, development or conservation of those State significant sites for the benefit of the State,*
d) *to facilitate service delivery outcomes for a range of public services and to provide for the development of major sites for a public purpose or redevelopment of major sites no longer appropriate or suitable for public purposes,*
e) *to rationalise and clarify the provisions making the Minister the approval authority for development and sites of State significance, and to keep those provisions under review so that the approval process is devolved to councils when State planning objectives have been achieved.*

Schedule 2 Clause 6 of SEPP MP defines development *'for the purpose of extraction, rehabilitation or lake formation (including associated infrastructure located in or outside that area)*' as development to which the development assessment and approval process under Part 3A of the EP&A Act applies. The NRPP project is deemed associated infrastructure that is required to facilitate the initial filling of the lakes and the long term maintenance of lake water levels.

The Minister for Planning has determined that this project will be determined under Part 3A of the EP&A Act.

3.2.2 State Environmental Planning Policy No 19 (Bushland in Urban Areas)

State Environmental Planning Policy No 19 (Bushland in Urban Areas) (SEPP 19 Urban Bushland) applies to urban bushland in Sydney and includes bushland located in the Penrith area. The general aim of this SEPP is to protect and preserve bushland within urban areas, particularly in public open space zones and reservations, and to provide that bushland preservation is given a high priority when LEPs are prepared for urban development. The Penrith LGA is listed under Schedule 1 of SEPP 19.

Bushland is defined in this SEPP as 'land on which there is vegetation which is either a remainder of the natural vegetation of the land or, if altered, is still representative of the structure and floristics of the natural vegetation'. The policy does not apply to land administered under the NSW National Parks and Wildlife Act 1974 or the Forestry Act 1916.

Clause 6(1) of SEPP 19 states that '*a person shall not disturb bushland zoned or reserved for public open space purposes without the consent of the council'.* Such consent would be sought under Part 4 of the EP&A Act. However, as per Clause 75R(1) of Part 3A of the EP&A Act, Parts 4 and 5 of the Act do not apply to or in respect of an approved project. As the NRPP project will be subject to

determination under Part 3A of the EP&A Act by the Minister for Planning, the provisions under SEPP 19 will not apply in this instance.

3.2.3 Sydney Regional Environmental Plan No 10 (Blue Mountains Regional Open Space)

Sydney Regional Environmental Plan No 10 (Blue Mountains Regional Open Space) (SREP 10) applies to land within the Blue Mountains LGA. The principal aim of this plan is to set aside certain land of regional significance for acquisition by the State NSW Government for regional open space.

Although the SREP does not apply to the land traversed by the NRPP project, it is important to acknowledge an aim of the SREP to *'enhance and protect the unique natural and scenic environment of the Blue Mountains'* in the area adjacent to the site.

3.2.4 Sydney Regional Environmental Plan No 11 (Penrith Lakes Scheme)

Sydney Regional Environmental Plan No 11 (Penrith Lakes Scheme) (SREP 11) was gazetted on 21 November 1986 with the aim of permitting the implementation of the Scheme. Land to which the SREP applies is shown on **Figure 3.1** and is consistent with the Scheme boundary referred to in this EA.

Particular aims of the SREP 11 are as follows:

a) to provide a development control process establishing environmental and technical matters which must be taken into account in implementing the Penrith Lakes Scheme in order to protect the environment,

b) to identify and protect items of the environmental heritage,

c) to identify land which may be rezoned for urban purposes, and

d) to permit interim development in order to prevent the sterilisation of land to which this plan applies during implementation of the Penrith Lakes Scheme.

Clause 8(4) of SREP 11 provides a list of matters that the DoP shall take into account in determining an application to develop the NRPP project as part of the scheme's implementation. A number of these are environmental considerations specific to the Scheme, and compliance of the NRPP project with these environmental matters is addressed in **Section 9** of this EA.

Clause 9 of SREP 11 states that development may be carried out within the Scheme *'for any other purpose, with development consent, if the consent authority is satisfied that the carrying out of development for that purpose will not adversely affect the implementation of that scheme, pending the completion of the Penrith Lakes Scheme in, and the use as a public recreational lake system'.* As the NRPP project will provide the primary mechanism to initially fill the lakes as well as the long term supply of water for the Scheme, it is considered that it is vital infrastructure to enable implementation of the Scheme. The NRPP project is therefore considered justifiable under the provisions of SREP 11.

Part 3 of the SREP details controls to protect environmental heritage within the study area and advises that should any of the six items of heritage impact listed within Schedule 3 of the SREP be impacted, development approval would be required. It is anticipated that no items of environmental heritage would be impacted as part of this NRPP project, and this is detailed in **Section 8.**

Clause 15 of the SREP states that consent should not be granted to development in the vicinity of an item of the environmental heritage unless an assessment has been made of the impact of the NRPP project on:

> *'the historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance of the item and its setting.'*

It is anticipated that the NRPP project would not have a negative impact on an item as described in Clause 15 of the SREP and this has been detailed in **Section 8**.

This EA has been written in accordance with Schedule 2 of SREP 11 that provides matters to be included in an EA for proposals within and outside the Scheme boundary.

3.2.5 Sydney Regional Environmental Plan No 20 - Hawkesbury – Nepean River

The *Sydney Regional Environmental Plan No. 20 – Hawkesbury-Nepean River (No 2 – 1997)* (SREP 20) applies to certain land within the Penrith LGA (one of 15 LGA's listed within the SREP). Land to which SREP 20 applies is shown on **Figure 3.1**, however Clause 2, subclause 2 states that the SREP does not apply to land to which SREP 11 applies. The southern part of the NRPP project lies outside the Scheme boundary and, therefore, provisions of SREP 20 apply to this section of the NRPP project.

SREP 20 provides a regional planning framework for development in the Hawkesbury-Nepean River catchment. The aim of the SREP is namely to:

> *'protect the environment of the Hawkesbury-Nepean River system by ensuring that the impacts of future land uses are considered in a regional context.'*

With additional planning considerations listed under Clause 5 of the SREP as:

a) the strategies listed in the Action Plan of the Hawkesbury-Nepean Environmental Planning Strategy, and

b) whether there are any feasible alternatives to the development or other proposal concerned, and

c) the relationship between the different impacts of the development or other proposal and the environment, and how those impacts will be addressed and monitored.

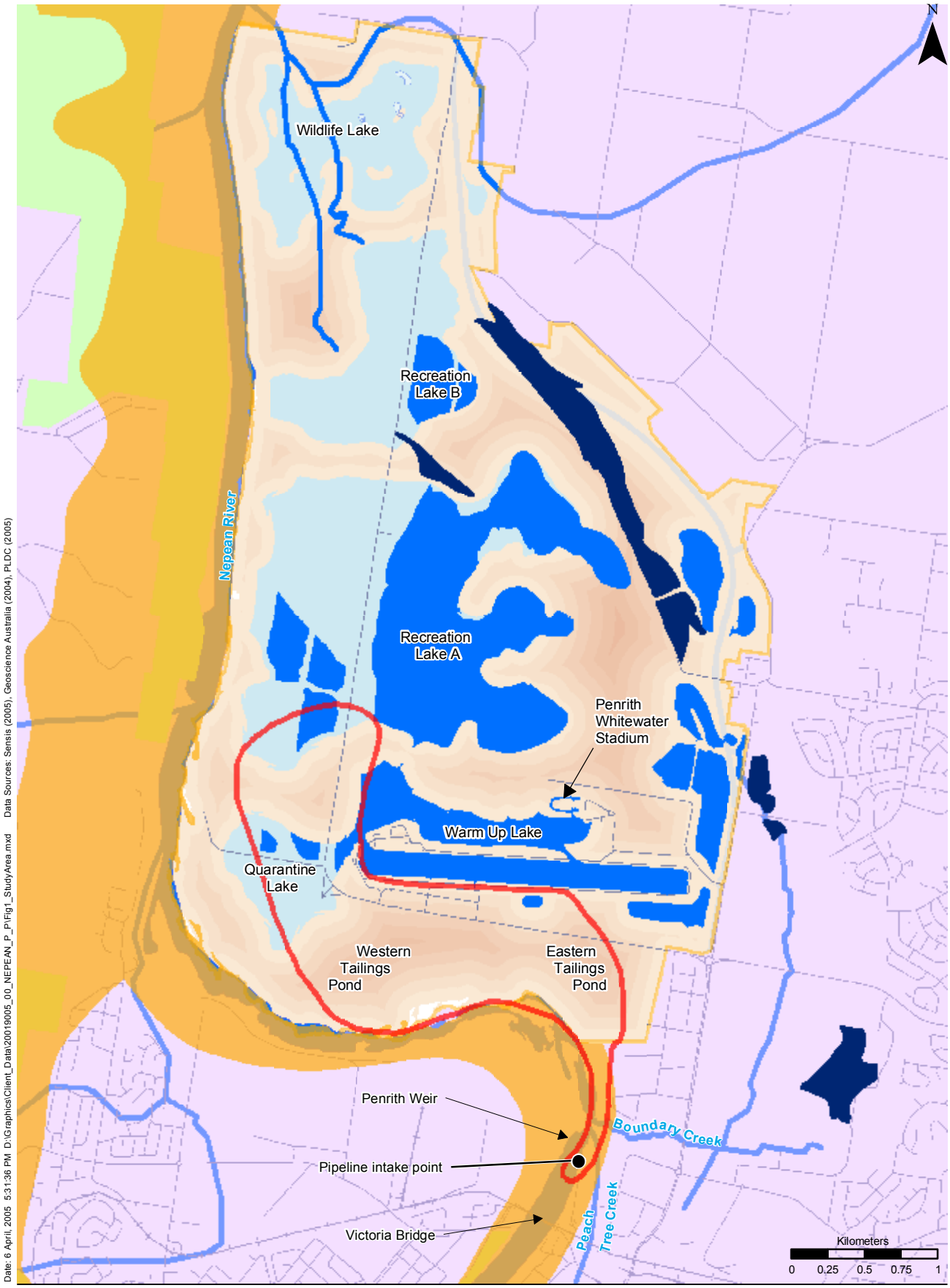
Clause 6 of the SREP lists specific planning policies and recommended strategies with regard to the management of development, such as the NRPP project, in the Hawkesbury-Nepean River Catchment Area. Where applicable, the requirements of these policies should be considered by DoP when considering this EA (see **Table 3.1**).

Table 3.1: SREP 20, Clause 6 Planning Policies and Recommended Strategies

Policy	Response
(1) Total catchment management is to be integrated with environmental planning for the catchment.	The impact of the NRPP project on the local water catchment environment has been considered within **Section 8.1**.
(2) The environmental quality of environmentally sensitive areas must be protected and enhanced through careful control of future land use changes and through management and (where necessary) remediation of existing uses.	Environmentally sensitive areas as defined under Clause 6(2) of the SREP are: *the river, riparian land, escarpments and other scenic areas, conservation area subcatchments, national parks and nature reserves, wetlands, other significant floral and faunal habitats and corridors, and known and potential acid sulphate soils.* The NRPP project may impact upon a listed Endangered Ecological Community along the eastern bank of the Nepean River.
(3) Future development must not prejudice the achievement of the goals of use of the river for primary contact recreation (being recreational activities involving direct water contact, such as swimming) and aquatic ecosystem protection in the river system. If the quality of the receiving waters does not currently allow these uses, the current water quality must be maintained, or improved, so as not to jeopardise the achievement of the goals in the future. When water quality goals are set by the Government these are to be the goals to be achieved under this policy.	Water quality has been addressed in **Section 8.2**.
(4) Aquatic ecosystems must not be adversely affected by development which changes the flow characteristics of surface or groundwater in the catchment.	Potential impacts on aquatic ecosystems are discussed in **Section 8.2 and 8.2**.
(5) The importance of the river in contributing to the significance of items and places of cultural heritage significance should be recognised, and these items and places should be protected and sensitively managed, and if appropriate, enhanced.	Potential impacts on cultural heritage are discussed in **Sections 8.4 and 8.5**.
(6) Manage flora and fauna communities so that the diversity of species and genetics within the catchment is conserved and enhanced.	Potential impacts on flora and fauna are discussed in **Section 8.3**.
(7) The scenic quality of the riverine corridor must be protected.	Appropriate reinstatement and revegetation treatments will be implemented to restore the pipeline route as close as possible to its pre-existing condition.
(8) Agriculture must be planned and managed to minimise adverse environmental impacts and be protected from adverse impacts of other forms of development.	N/A
(9) Rural residential development should not reduce agricultural sustainability, contribute to urban sprawl, or have adverse	N/A

Policy	Response
environmental impacts (particularly on the water cycle or on flora and fauna).	
(10) All potential adverse environmental impacts of urban development must be assessed and controlled.	N/A
(11) The value of the riverine corridor as a significant recreational and tourist asset must be protected.	The pipeline route is being developed in accordance with consideration of the GRW. Any impact to the GRW will be reinstated following construction of the pipeline.
(12) Development should complement the vision, goal, key principles and action plan of the Metropolitan Strategy.	To conform to the requirements of this subclause, impacts on water quality, air quality and waste avoidance have been addressed in **Section 8.10**.

Source: SREP 20, response by Maunsell Australia Pty Ltd, 2005



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SREP 20 Hawkesbury-Nepean
SREP 11 Penrith Lakes Scheme (overrides SREP20)
SREP 20 Hawkesbury-Nepean Wetland
SREP 10 Blue Mountains Open Space
SREP 20 Hawkesbury-Nepean Scenic Quality

Proposed Landform Design

Open Space (Lake)
Open Space (Parkland)
Road Reserve

Study Area
Existing Waterway

PENRITH LAKES DEVELOPMENT CORPORATION

NEPEAN RIVER PUMP AND PIPELINE

FIGURE 3.1: REGIONAL PLANNING CONTROLS

3.2.6 Local Environmental Planning Controls

Land traversed by the NRPP project is subject to the zoning controls administered by Penrith City Council (PCC) zoned under various LEPs and Development Orders. The relevant EPI regulating the development of land within the study area (in part) is the *Penrith (Urban Lands) LEP 1998*. The relevant land zonings within the Penrith (Urban Lands) LEP 1998 are described in **Table 3.2** and illustrated in **Figure 3.2**.

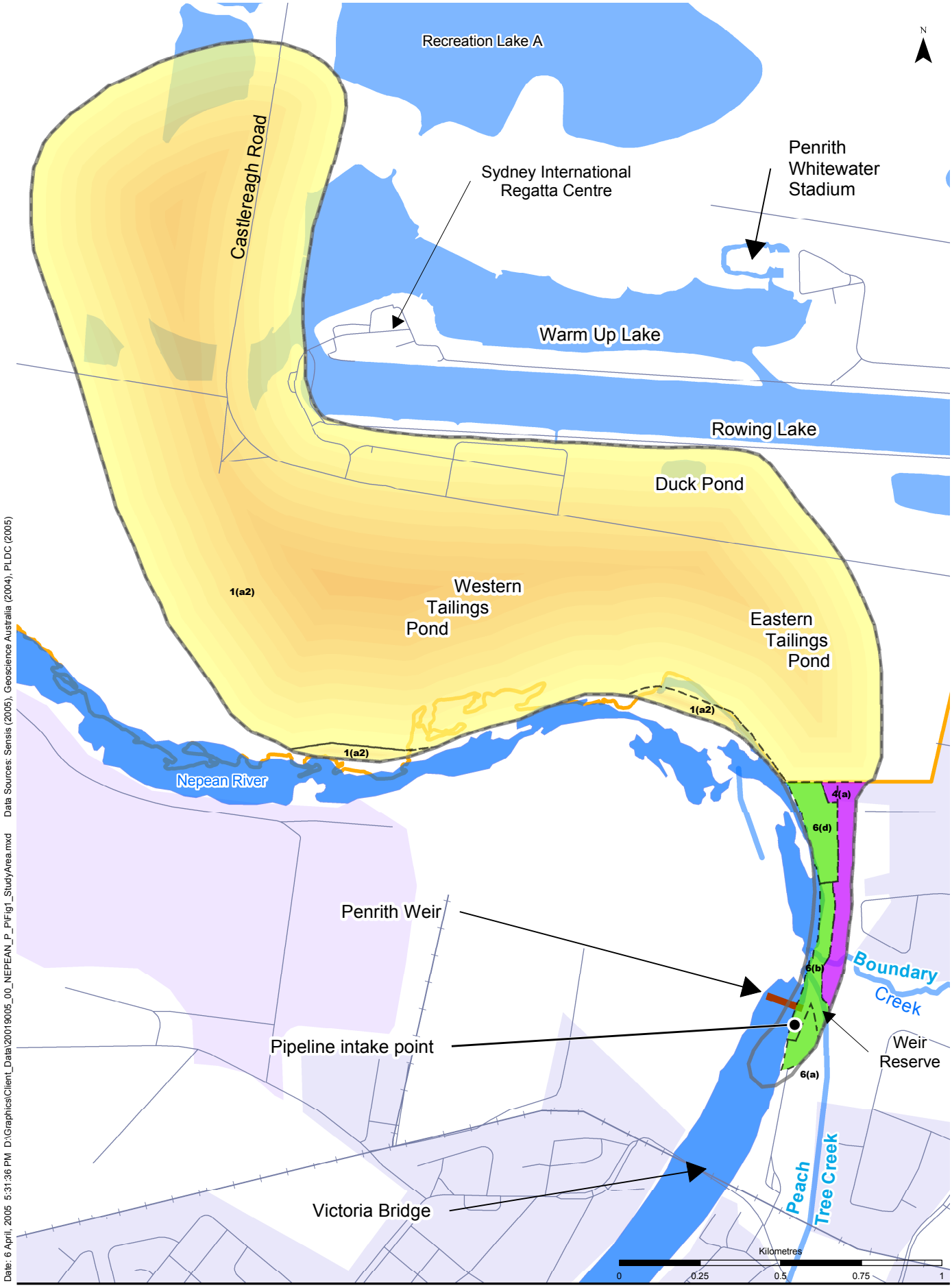
Table 3.2: Relevant LEP Zonings

Zone	Relevant LEP	Objectives of Zone[2]
1(a2) Rural 'A2'	*Interim Development Order No.93 – Penrith*	None specified.
4(a) General Industry Zone	*Penrith LEP 1996 – Industrial Lands*	*To encourage a diversity of industrial employment generating activities.* *To promote development which observes responsible, and environmentally sound, management practices.* *To promote development which makes efficient use of industrial land.*
6(b) Proposed Public Recreation and Community Uses	*Penrith LEP 1998 – Urban Lands*	*To reserve land for a variety of open space, recreational and community pursuits.*
6(d) Regional Open Space	*Penrith LEP 1998 – Urban Lands*	*To reserve land for regional open space.* *To ensure that development:* *a) Is for a purpose that promotes or is related to the use and enjoyment of open space;* *b) Does not substantially diminish public use of or access to open space; and* *c) Does not adversely affect the natural environment, any items or areas of heritage significance or the existing amenity of the area.*

Source: *Interim Development Order No.93 – Penrith, Penrith LEP 1996 – Industrial Lands, Penrith LEP 1998 – Urban Lands*. Interpretation by Maunsell, 2005.

Development of the NRPP project on land zoned 6(b) – Proposed Public Recreation and Community Uses and 6(d) – Regional Open Space is prohibited under the local legislation. Consultations held with representatives of PCC during May and June 2005 confirmed this interpretation. As described in **Section 3.2.1** under SEPP MP the NRPP project has been declared as 'Major Infrastructure Development' and will be assessed under Part 3A of the EP&A Act which provides assessment of the Scheme within 'prohibited' zoning.

[2] Not all objectives of each zones are listed here.



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Study Area
Penrith Lakes Scheme Site Boundary
Existing Waterway
Vegetated Area
Built-up Area
Local Road
Main Western Railway Line
Penrith Weir
Pipeline Intake Point
Rural: 1(a2)
Industrial: 4(a)
Open Space/Recreation: 6(a), 6(b), 6(d)

PENRITH LAKES DEVELOPMENT CORPORATION

NEPEAN RIVER PUMP AND PIPELINE

FIGURE 3.2: LEP ZONINGS

3.2.7 Penrith City Council Landscape Development Control Plan 2002

Landscaping principles contained within PCC's *Landscape Development Control Plan 2002* will be acknowledged to assist in the rehabilitation of areas disturbed by the NRPP project. The Development Control Plan provides advice on matters such as plant species intrinsic to the LGA, and weed species, which should not be used in any replanting scheme.

3.2.8 Environmental Planning & Assessment Act 1979

Approval is being sought under the EP&A Act for the construction and operation of the NRPP project as follows:

- A 4.3 km, 900 mm diameter pipeline that will convey water from the Nepean River to the Scheme site.
- Pump station comprising two submersible pumps built into the eastern bank of the Nepean River, each with a capacity of 500 litres per second.
- Inlet and discharge pipework connected to the intake structure and submersible pumps.
- A control building which will house electronic instrumentation equipment and cabling at Weir Reserve and connections to the pump station.
- Earthworks associated with the establishment of working areas, pipe trench excavation and backfilling, landscaping and reinstatement.
- Constructed wetland and Quarantine Lake (including temporary and permanent systems) at the pipeline discharge point within the Scheme boundary.

Former Approvals Process (Assessment under Part 4 of the EP&A Act)

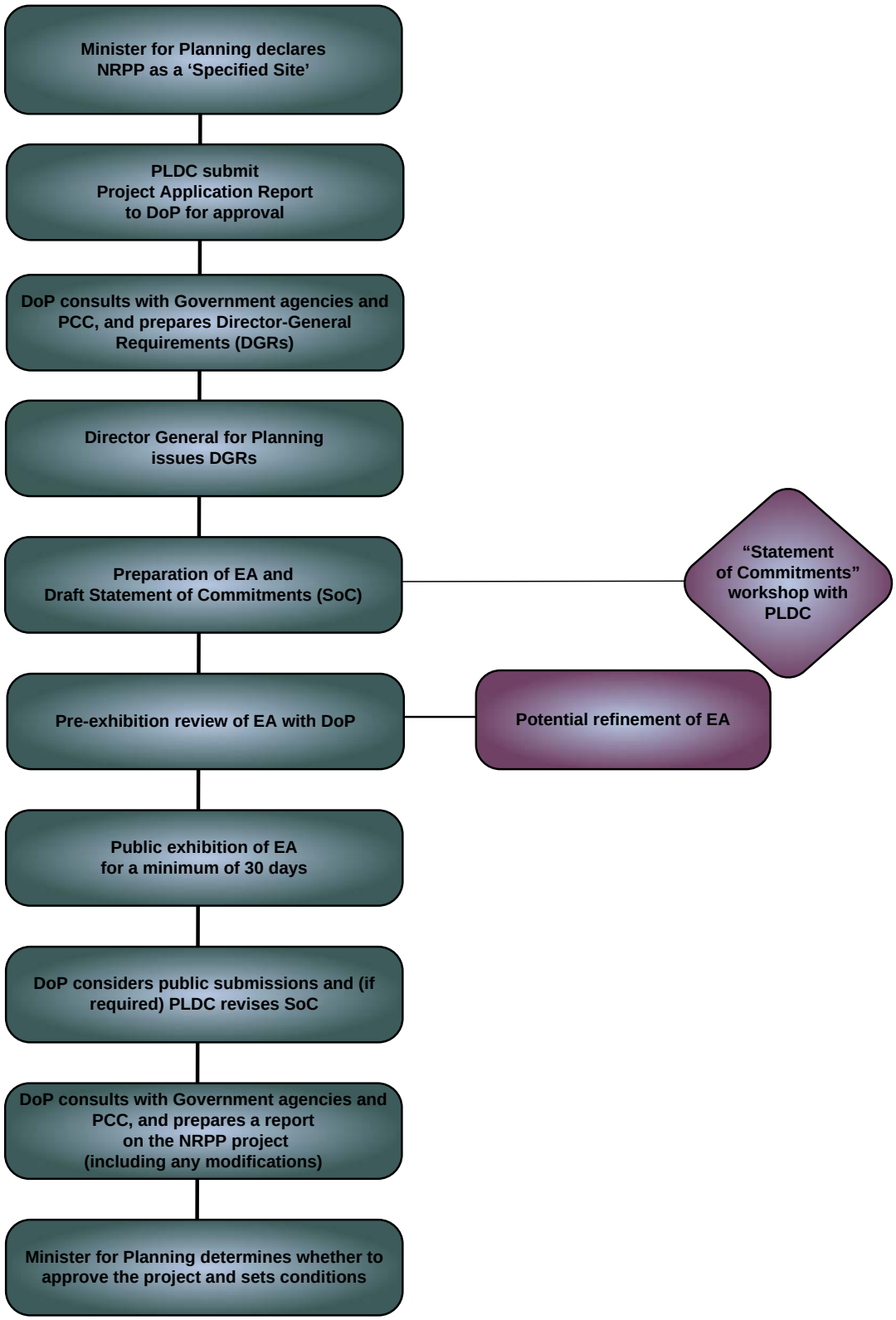
The environmental impact assessment process for the NRPP project commenced in April 2005. A Statement of Environmental Effects (SEE) was initially prepared to accompany the lodgement of a Development Application under Part 4 of the EP&A Act. Supplementary to this process consultations were held with PCC and formerly Department of Infrastructure, Planning and Natural Resources (DIPNR) to clarify whether the NRPP project would be declared a 'specified development' pursuant to Section 76A of the EP&A Act. This declaration was made by DoP (formerly DIPNR) with the former Minister for Infrastructure and Planning being the determining authority.

New Approvals Process (Assessment under Part 3A of the EP&A Act)

The *Environmental Planning and Assessment Amendment (Infrastructure and Other Planning Reform) Act 2005* (EP&A Amendment Act) amended the EP&A Act by introducing a new Part 3A of the EP&A Act. The new Part 3A commenced on 1 August 2005 to assess and approve major infrastructure and other projects that would have otherwise required an Environmental Impact Statement (EIS) under Part 5 of the EP&A Act, most development previously classified as 'State Significant' and other projects and/or plans declared by the Minister for Planning.

Under Part 3A, the NRPP project is classified as a 'major project', and requires the approval of the Minister for Planning. The approvals process under Part 3A is captured in **Figure 3.3**.

Figure 3.3: Environmental Approvals Process under Part 3A of the EP&A Act



Pursuant to clause 75F of the EP&A Act, the Director-General for Planning has issued DGRs on 14 December 2005 to be adopted by the NRPP project. A copy of the DGRs is provided in **Appendix A**.

The NRPP project will be subject to development assessment under Part 3A of the EP&A Act and this EA has been prepared accordingly.

Under Section 75H of the EP&A Act, PLDC (the proponent) is required to submit an EA to the Director-General to carry out the project. The Director-General must make the EA publicly available for a minimum of 30 days. During this period, written submissions and feedback will be accepted.

Part 4A Certification of Development (General) under the EP&A Act

Prior to commencing any construction works, a construction certificate will be obtained for any work that has been granted development approval (except where a complying development certificate is in place). Once construction has been completed a Compliance Certificate will be obtained.

Application for a Construction Certificate

Section 109C, sub clause (1)(b) describes a construction certificate as being *'a certificate to the effect that work* [is] *completed in accordance with specified plans and specifications'.* It is proposed that a construction certificate be obtained alongside issue of a development approval and prior to the commencement of construction works for the NRPP project. An application for a construction certificate can be submitted at the same time project approval under Part 3A is being sought.

Full detailed designs are not required at this stage, however the certifier (the consent authority, the local council or an accredited certifier) must be provided with sufficient information to ensure that the development will comply, e.g. the information in engineering plans and specifications, with the draft SoC and proposed methods of compliance must be sufficient.

A construction certificate may be issued by the consent authority, the local council or an accredited certifier. Once development approval consent has been granted and a construction certificate issued, developers must:

- Appoint a principal Certifying Authority to oversee the work.
- Advise the certifier of the proposed start date for construction.

Application for a Compliance Certificate

Section 109C, clause (1), sub clause (b) describes a 'compliance certificate' as:

'being to the effect that specified building work:

(i) specified building work or subdivision work has been completed as specified in the certificate and complies with specified plans and specifications, or

(ii) a condition with respect to specified building work or subdivision work (being a condition attached to a development consent or complying development certificate) has been duly complied with, or

(iii) a specified building or proposed building has a specified classification identified in accordance with the Building Code of Australia, or

(iv) any specified aspect of development complies with standards or requirements of any other provisions prescribed by the regulations, or

(v) any specified aspect of development (including design of development) complies with standards or requirements specified in the certificate with respect to the development.'

PLDC propose to apply for a compliance certificate post construction with the intention of obtaining approval for the detailed design and construction process in accordance with the provisions of Section 109C of the EP&A Act. A compliance certificate may be issued by the consent authority, the local council or an accredited certifier.

3.3 Other Licences and Statutory Approvals

Other statutory approvals that may be required to construct and operate the NRPP project are presented in **Table 3.3** below.

Table 3.3: Summary of Other Relevant Statutory Requirements

Legislation (Approval Authority)	Relevant Provisions	Approval/Licence Required
Protection of the Environment Operations Act 1997 *((DEC) EPA)*	The principal aim of this Act is to protect, restore and enhance the environment in the context of ESD guiding principles by regulating specific activities and development that have the potential to pollute air, water and land. It provides a single piece of legislation that integrates the approach to pollution control.	Under Section 48 of this Act, activities listed under Schedule 1 would require an Environment Protection Licence (EPL). Other non-scheduled activities which may require licensing under the POEO Act include the: • Discharge of pollutants into water from temporary sediment basins and permanent water quality control ponds.
Roads Act 1993 ***(DoP with delegated powers to the RTA and relevant local councils)***	This Act aims to protect public roads through regulating traffic, as well as works, structures and activities that may interfere with a public road and results in closures. It sets out a series of requirements for members of the public travelling along public roads and it also provides for declaration by the RTA and other public authorities acting as road authorities (i.e. PCC) for both 'classified' and 'unclassified' roads.	Approval under section 138 will be required to bore underneath Castlereagh Road as part of the pipeline construction works.

Note: As the NRPP project is being assessed under Part 3A of the EP&A Act, if approval is granted by the Minister for Planning, then an application under Section 138 of the Roads Act 1993 to carry out works on, under or over a public road cannot be refused if it is necessary for the development of the NRPP project.

3.3.1 Summary of Other Approval Requirements

Under Part 3A of the EP&A Act, DoP is responsible for consulting with all relevant Government agencies to obtain their requirements for determination of the EA and other requisite approvals and/or licences. As the development of the NRPP project requires approval under Part 3A of the EP&A Act, it is not required to obtain approvals under the following statutes:

- *Heritage Act 1977* - approvals under Part 4 or an excavation permit under Section 139 to discover, expose or move a relic.

- *National Parks and Wildlife Act 1974* - permit under Section 87 for preliminary research on any potential archaeological deposits or consent under Section 90 to disturb or destroy any archaeological sites or remains.
- *Threatened Species Conservation Act 1995* – license under Section 91 for development impacting upon a threatened species, population or ecological community.
- *Fisheries Management Act 1994* and *Fisheries Management Amendment Act 1997* - permits under Section 199 for reclamation works, Section 205 for removal or harm to marine vegetation or Section 219 for obstruction of fish passage within a watercourse.
- *Native Vegetation Conservation Act 2003* - authorisation referred to in Section 12 of the Act (or under any Act to be repealed by the Act) to clear native vegetation.
- *Water Management Act 2000* - water use approval under Section 89, a water management approval under Section 90 or an activity approval under Section 91.
- *River and Foreshore Improvement Act 1948* - permit under Part 3A (PLDC is not exempt from other requirements of this Act and will therefore be required to operate within the bounds of this statute) for construction activities undertaken within 40 metres of a watercourse.

4. Stakeholder Involvement

4.1 Overview

Stakeholder involvement has been an integral component in the preparation of this EA. This Section describes how key stakeholders have been involved in the NRPP project to date, by detailing forums and activities that have taken place and by summarising the key issues raised during the consultation activities.

Stakeholder involvement activities outlined in the following sections have been implemented in a coordinated manner by PLDC and Maunsell personnel. Key stakeholder involvement activities conducted to date include:

- A Risk Management Workshop held with representatives from PCC, DoP and DNR (formerly DIPNR).
- A Planning Focus Meeting held with representatives from PCC, DoP and DNR (formerly DIPNR).
- Individual meetings with PCC, local Aboriginal community representatives, the NSW Department of Environment and Conservation (DEC), Department of Primary Industries (DPI-Fisheries), Department of Natural Resources (DNR) (formerly DIPNR), the Hawkesbury-Nepean Catchment Management Authority, and the Hawkesbury-Nepean Water Users Association.
- Discussions with key affected landowners.
- A pre-lodgement meeting with representatives of DoP.
- A Stakeholder Briefing Session held prior to the lodgement of the EA to DoP.

4.2 Risk Workshop

A Risk Workshop was held at PLDC's offices, Penrith on Thursday, 7 April 2005. The Risk Workshop was attended by participants from DoP (formerly DIPNR), PCC, PLDC and Maunsell. The purpose of this workshop was to identify potential areas and categories for the project to develop appropriate risk mitigation and control measures. A Risk Management Plan was established at the workshop, and a set of treatment options identified that would reduce the risk exposure on the NRPP project. The principle aim was that early identification of the project risks would enable resolution during the design development process.

4.3 Planning Focus Meeting

A Planning Focus Meeting (PFM) was held at PLDC's offices at Penrith on Thursday, 14 April 2005. The meeting was attended by representatives from DoP and DNR (formerly DIPNR), PCC, PLDC and Maunsell.

Invitations were also extended to representatives from DPI (Fisheries), DEC (NPWS and EPA) and Hawkesbury-Nepean Catchment Management Authority. No representatives from these organisations attended the PFM.

The PFM provided the forum to brief attendees on the project, examine the planning and approval process and to consider key issues to be addressed during the preparation of the EA.

The key aims of the PFM were to:

- Define a clear approvals process regarding:
  - Design of pump and pipeline infrastructure.
  - Application for project approval and the EA.
  - Construction methods, timing and staging.
- Agree on the approvals timeline.
- List agency concerns/requirements.
- Establish stakeholder involvement requirements.
- Identify relevant licences and permits.
- Agree a preferred communications protocol:
  - Workshop forums.
  - Other.

4.4 Consultation with Government Agencies and Other Stakeholders

A series of initial letter requests were issued to representatives from the following Government agencies and stakeholder groups seeking their requirements for the environmental assessment process:

- DoP and DNR (formerly DIPNR).
- DPI (Fisheries).
- DEC (NPWS and EPA).
- Hawkesbury-Nepean Water Users Association.
- PCC.

Supplementary to these letter requests, a series of individual stakeholder meetings and telephone discussions were conducted to discuss a range of issues specific to their respective areas, particularly:

- Watercourse crossings.
- Erosion and sediment control.
- Native vegetation clearance.
- Fisheries.
- Aquatic weed control.
- Sites of Aboriginal heritage significance and cultural significance.
- Pollution control and water quality.
- Land reinstatement.
- Construction staging and timing.
- Landscaping and visual amenity.
- Access.

Specific issues that have been raised during these discussions include:

Issue	Integration with Pipeline and Associated Infrastructure Development
Feasibility of locating intake pipes beneath a gravel bed to provide an extra barrier and deterrent to weed fragments and fish from being extracted with Nepean River water and imported to the Scheme.	This would not be feasible due to the possibility of the gravel bed filling up with silt and clogging the intake pipes. Furthermore the intake pipes have been designed to backwash any debris on the screens with an air purging system. This would not work sufficiently if the pipes were located in a gravel bed.
Intake structure to be located approximately 100 metres upstream of the existing boom, thereby requiring placement of a further boom upstream and in turn restricting area of river available for use for recreational activities.	A localised floating buoy system will be erected in the vicinity of the intake pipes thereby reducing the amount of river that is restricted.
Layout of the control building is not suitable to PCC.	At the time of writing PLDC and PCC were engaged in negotiations about the layout of the control building.
Replacing the upstand wall surrounding the hardstand area adjacent to the pumping station with a bollard/handrail system (due to the possibility of vandalism).	An upstand wall is necessary to provide a suitable vehicle barrier. The wall will be coated with graffiti proof finish.
Potential for lowering the outlet pipe to Peach Tree Creek to reduce the risk of scour to the creek bed level.	The outlet pipe will protrude the riverbank with a flap valve to prevent any back flow. The riverbank will be protected with a geotextile that will be pinned to the bank with rock protection on the river bed to prevent scour. The level of the outlet will need to be above the water level within the creek to ensure it will operate as a free discharge point.
Replacing the hard treatments along the Nepean River with a more 'natural' edge.	A soft treatment would require significant encroachment of the vehicle turning area into the Nepean River. To provide the structure reliability of the riverbank to provide a safe working area for maintenance, a hard engineering solution would be required. Suitable riparian vegetation would be incorporated within the design of the surrounding areas to soften the impact of the pumping station/hardstand area.
Impact of the cofferdam (that will be required during construction of the intake structure) on the flow rate within the Nepean River.	River velocities are expected to marginally increase in the vicinity of the cofferdam. There is potential for bank scour and this will be monitored during the construction phase.
Potential for capping the cofferdam in order to allow flood waters to flow over the top of the cofferdam.	The cofferdam would be backfilled. The possibility of capping the cofferdam (and the design) would be addressed by the construction contractor.
The pipeline route restricts the potential to plan above the pipeline or in the easement on the high bank of the Nepean River.	The pipeline has not been designed to enable planting of large trees within the 6m easement. Revegetation and easement maintenance will require the easement vegetation to be restricted to locally endemic species consistent with what is currently located within the area.

Issue	Integration with Pipeline and Associated Infrastructure Development
Potential for locating the pipeline beneath the Great River Walk.	Consultation with PCC regarding the Great River Walk has been undertaken throughout the EA process, and all possible locations for co-location of the pipeline and the Great River Walk have been considered.
The potential for retrofitting the scheme to include water reuse from Penrith Sewerage Treatment Plant.	Presently, the quality of treated effluent from Penrith STP is not acceptable.
A noise buffer zone of 10 metres may impact on the recreational amenity of Weir Reserve.	The control building has been relocated adjacent to the existing amenity block and therefore should minimise the impact on park users.
The potential for recycling stormwater within the Scheme (to reduce reliance on other water sources).	The Scheme presently utilises all stormwater sources onsite.
Impact on fish migration in Nepean River during construction of intake structure.	Construction work in the Nepean River will be scheduled to occur outside the fish migration period between July and October.
Potential for constructing a pipeline to extract water from the Nepean River to the immediate west of the Scheme (to reduce length of pipeline and potential impacts).	Prior to the commencement of the NRPP project, the location of the water extraction point was determined as a result of a number of factors including: • Requirements of the Deed. • Previous studies of suitability of water quality and quantity at various locations in the Nepean River.

Additionally, consultation with three local Aboriginal groups (Deerubin Local Aboriginal Land Council, Darug Tribal Aboriginal Corporation and Darug Custodian Aboriginal Corporation), together with representatives from the Muru Mittigar Aboriginal Cultural Centre (located at Penrith Lakes) was undertaken as part of the Indigenous Heritage Assessment's preparations Contact details for each of the stakeholder representatives that have been consulted during the preparation of this EA are provided in **Table 4.1**.

Table 4.1: Stakeholder Contact Details

Agency	Contact
DoP	Terry Doran Team Leader, Sydney South West Neville Osborne Manager, Energy and Water, Major Infrastructure Assessment Rebecca Newman Senior Environmental Planning Officer Major Infrastructure Assessment
DNR	Doug Rhodes Manager – Metro Water Sharing Planning
	Paul Bourne Senior Natural Resource Officer (Resource Access)
DPI (Fisheries)	Lesley Diver Conservation Manager (Central)

Agency	Contact
DEC (NPWS and EPA divisions)	Ross Carter Director, Metropolitan Environment Protection and Regulation Division Lou Ewins Manager, Planning and Aboriginal Heritage Kevin Roberts Acting Manager, Metropolitan Infrastructure Raymond Fowke Conservation Planning Officer Mark Villa Senior Regional Operations Manager
DEUS	Adrian Amey Manager, Energy Network Performance Policy
Deerubin Local Aboriginal Land Council	Phil Khan
Darug Tribal Aboriginal Corporation	Gordon Morton Celestine Everingham
Darug Custodian Aboriginal Corporation	Leanne Wright
Muru Mittigar Aboriginal Cultural Centre	Tom Newman Ellie Miller
Penrith City Council	Paul Battersby Senior Environmental Planner (Strategic Division) Karen Schicht Landscape and Urban Design Supervisor (Great River Walk) Craig Ross (Great River Walk)
Hawkesbury Nepean Water Users Association	Paul Rasmussen Chairman

4.5 Director-General for Planning's Requirements

The Director-General for Planning issued the DGRs for the NRPP project on Wednesday 14 December 2005 (refer to Appendix A).

4.6 Public Exhibition

This EA, including PLDC's draft SoC, will be publicly exhibited for a minimum 30 day period. During the exhibition the community will have the opportunity to review the document and lodge written submissions to DoP for consideration in its assessment of the project.

For more information about the NRPP project or to make a submission on the EA, contact the DoP or visit the DoP website at www.planning.nsw.gov.au or the PLDC website at www.penrithlakes.com.au.

All written submissions received by DoP and/or other interested parties may be forwarded onto PLDC for consideration as part of the determination of the NRPP project.

5. Route Options Assessment

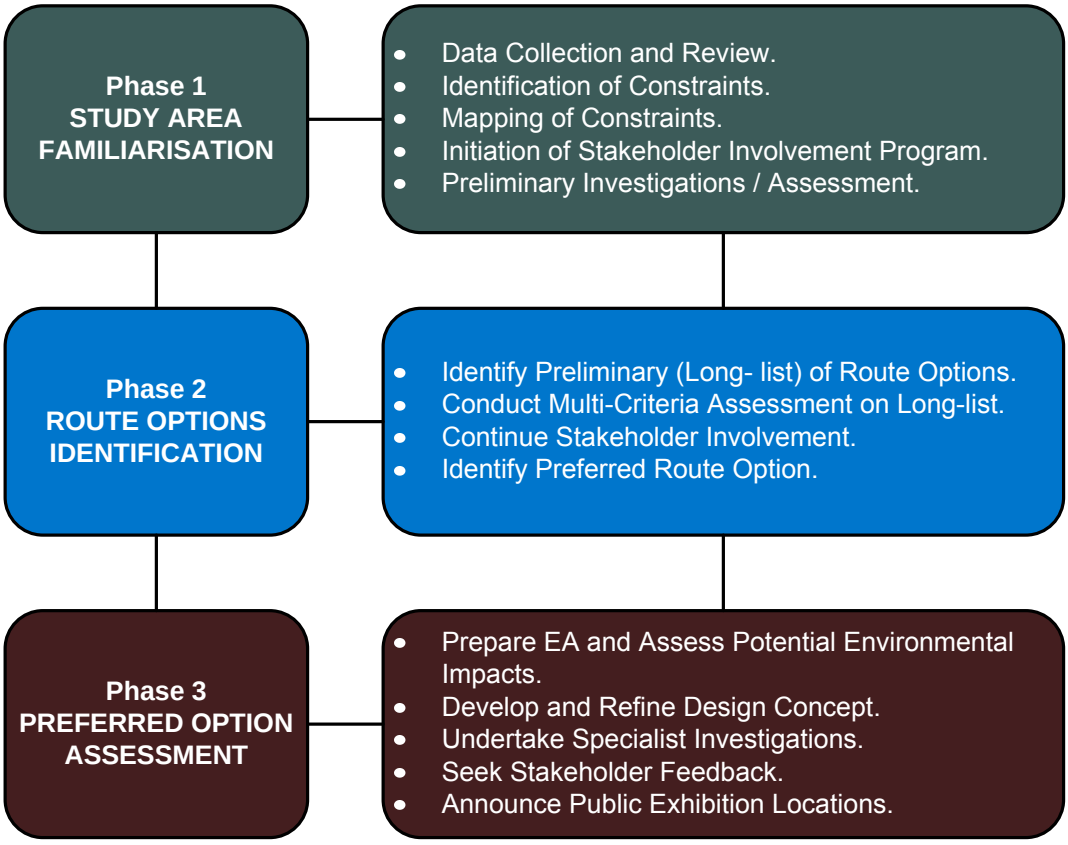
5.1 Approach to Route Options Development and Assessment

The approach to the identification and evaluation of pipeline route options involved the consideration of engineering and environmental issues, together with input from key stakeholders consulted during the preparation of this EA. Three feasible pipeline route options were identified for the NRPP project based on the following:

- Requirements of the 1987 Deed of Agreement between PLDC and the NSW Government (i.e. the (then) Department of Planning).
- Project specific objectives outlined in **Section 1.3**.
- Need for the NRPP project in relation to the overall viability of the Scheme development.
- Identification and mapping of a range of environmental attributes and constraints that exert influences on the type and location of the pipeline route.

An overview of the pipeline route options development process is illustrated in **Figure 5.1**.

Figure 5.1: Overview of Route Options Development Process



5.2 Route Option Selection

The pipeline route alignment, pump station and control building locations and associated infrastructure are influenced by a range of environmental, planning and engineering factors. Consultation with Government agencies such as DoP and DNR (formerly DIPNR), DPI (Fisheries), DEC, PCC and representatives from the local Aboriginal community were an integral part of this selection process.

A number of environmental elements located within or immediately adjacent to the study area influence the location and design of the NRPP project and have been investigated. These investigations have comprised a review of existing background data, field surveys and analysis to provide a more thorough understanding of the physical, social and economic aspects of the development. Key factors considered during the investigative work have included:

- Terrain profile and ground conditions.
- Areas of cultural significance and archaeological potential.
- Native vegetation areas, habitats and threatened species (flora and fauna).
- Watercourse crossing techniques.
- Hydrology, water quality and aquatic habitats including fish passage issues.
- Development proposals in terms of approved and pending approval.
- Existing major utilities and service infrastructure.
- Land ownership.
- Pipeline constructability issues.

Specialist studies conducted to supplement the investigations carried out for the NRPP project have comprised:

- Cultural heritage (indigenous / non-indigenous).
- Ecology (terrestrial / aquatic).
- Noise and vibration.
- Geotechnical.
- Aquatic weed transfer.
- Hydrology, hydraulics and water quality.

5.3 Pipeline Route Options

Three different route options were initially considered during the early stages of the project development and these are shown in **Figure 5.2**. A description for each of the three options is provided below.

5.3.1 Option 1

Option 1 runs from a point located 110 metres upstream of the Penrith Weir along the eastern bank of the Nepean River before diverting northwards, traversing land between the eastern and western tailings ponds which frame the southern Scheme boundary. It continues northwards crossing Castlereagh Road before ultimately discharging to the existing Rowing Lake via the Duck Pond. The total length of Option 1 is approximately 2.1 km.

5.3.2 Option 2

Option 2 follows the Option 1 alignment from the intake point to a location between the western and eastern tailings ponds where it continues in a south westerly direction before diverting north-west to follow the existing main haul road. This option would discharge to the proposed Warm-up Lake extension. A temporary discharge would be provided to Lake A until the Warm-up Lake extension is completed which is expected to be some time in 2010/2011. Option 2 is approximately 4.4 km in length.

5.3.3 Option 3

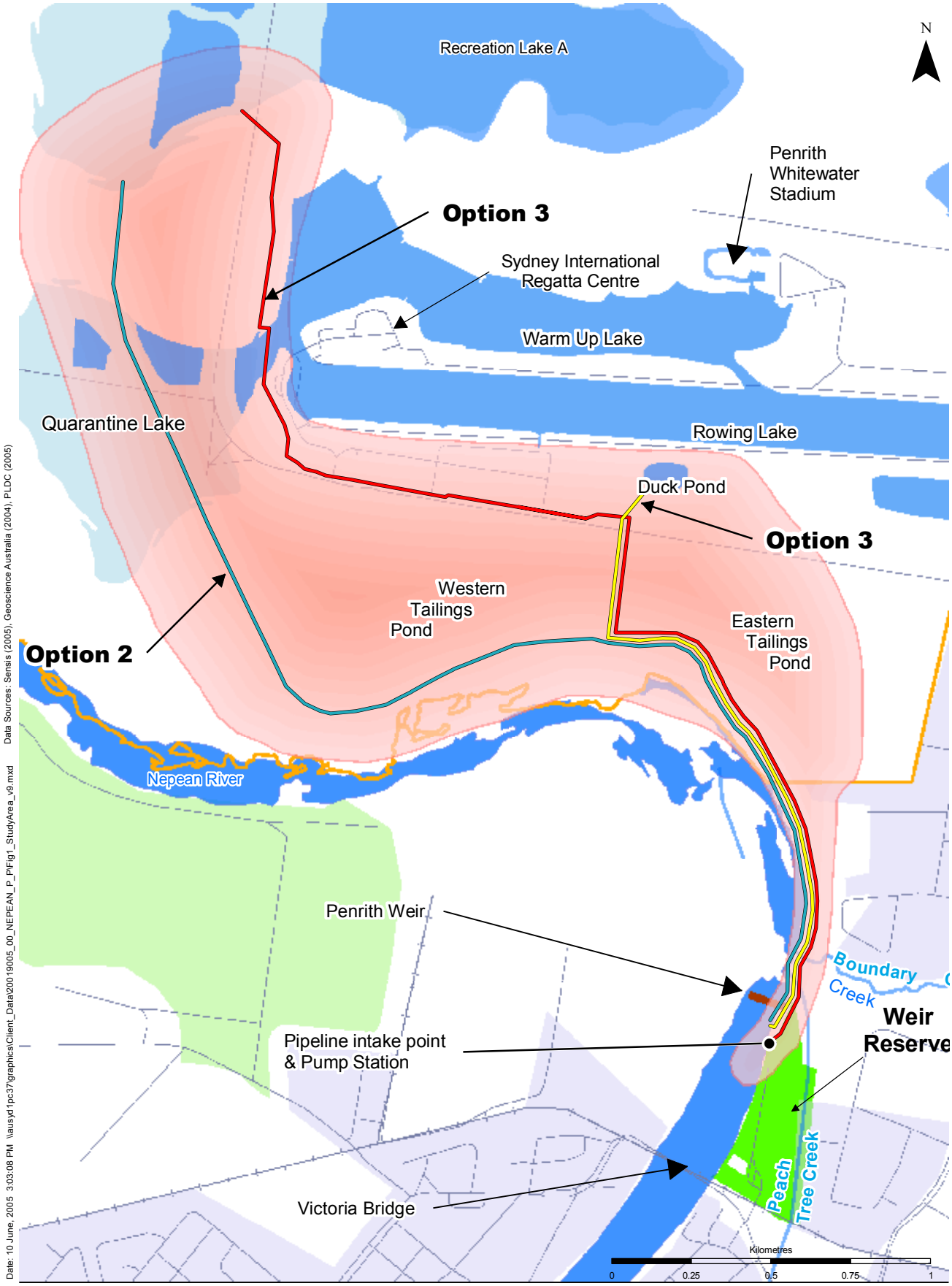
Option 3 also follows the Option 1 alignment to Castlereagh Road before diverting westwards and eventually north to follow the haul road that passes between the western and eastern tailings ponds and beneath Castlereagh Road. The route crosses back over Castlereagh Road before discharging into a temporary Quarantine Lake and subsequently Lake A. This option would comprise an extension along Castlereagh Road to permanently discharge into the proposed extension of the Warm-up Lake. The total length of Option 3, including a temporary extension of 0.9 km, is 4.3 km.

Option 3 has been presented as an alternative to Option 2 predominantly to avoid the active quarry areas located on the south-western part of the Scheme site during construction.

During the concept design development process, a comparative analysis of feasible route options was conducted by Maunsell to assist PLDC in their negotiations with DoP and DNR (formerly DIPNR) over the preferred pipeline route option. This included focussing on the following issues:

- Location and configuration of the pipeline intake structure and pump station.
- Preferred route option alignment.
- Location of the discharge point.
- Sizing and configuration of the Quarantine Lake.

A summary of the three route options against a set of evaluation criteria is provided in **Table 5.1**. A number of environmental and engineering constraints are common to all three options as they all run along the eastern bank of the Nepean River for the initial 400 metres of the pipeline route.



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NEPEAN RIVER PUMP AND PIPELINE

FIGURE 5.2: PIPELINE ROUTE OPTIONS

Table 5.1: Route Options Comparison Matrix

Issue	Option 1	Option 2	Option 3
Engineering Constraints			
Overall Length (km)	2.1	4.4	4.3
Water crossings (number)	All options will involve two watercourse crossing (i.e. Peach Tree Creek and Boundary Creek)		
Road crossings (number)	2 (Castlereagh Road and one haul road)	At least two haul roads	4 (Castlereagh Road twice and two haul roads)
Final Discharge Location	Duck Pond	Quarantine Lake (extension of Warm-up Lake)	Quarantine Lake (extension of Warm-up Lake)
Temporary Discharge Location	Duck Pond	Temporary Quarantine Lake adjacent to Lake A	Temporary Quarantine Lake adjacent to Lake A
Obstructions (Utility Crossings)	Option 1 crosses fibre optic cables located along the northern side of Castlereagh Road.	Option 2 crosses fibre optic cables and electricity services to the Readymix operations, particularly between Ch 3210 to 3725	Option 3 crosses fibre optic cables located along the northern side of Castlereagh Road at Ch 2440.
Hydraulics (Pumping Requirements)	Duty point for two pumps together will be 1000 litres per second at 16.6 metres. Power consumption approximately 203kW	Duty point for two pumps together will be 1000 litres per second at 23 metres. Power consumption approximately 277kW	Duty point for two pumps together will be 1000 litres per second at 20.5 meters. Power consumption approximately 247kW
Access and Maintenance	Access will be limited, particularly at the two watercourse crossings located along the initial section of the pipeline route. Vehicular access will need to be provided along the working width for this section	As per Option 1. Access difficulties for the pipeline section along the main haul road when in operation, particularly the area which traverses the Readymix operations	As per Option 1. Access difficulties likely between Ch 3013 and Ch 4054 due to haul road operations
Impact on Existing Lake Operations (e.g. Rowing Lake)	This option discharges to the Rowing Lake via the Duck Pond. Potential surcharging which could affect rowing activities of this lake during river pumping	Both Options 2 and 3 will discharge temporarily to Lake A and permanently to the extension of the Warm-up Lake. This will provide greater control over water levels in the Rowing Lake, minimising the potential impact on rowing activities.	

Issue	Option 1	Option 2	Option 3
Ability to Provide Necessary Water Treatment and Weed Control via Quarantine Lake	Discharges to the Duck Pond before entering the lake system. The Duck Pond would act as a quarantine lake to control the spread of aquatic weeds and to treat river water. Potential issues associated with capacity of the Duck Pond to provide adequate retention and treatment for river waters	Water treatment and aquatic weed control will be provided via installing a constructed wetland and quarantine lake for both Options 2 and 3	
Construction Staging Issues	None identified	The Warm-up Lake extension will not be completed until 2009/10 and as such a temporary discharge point is required to Recreation Lake A. Option 2 runs through the Readymix quarry area. The area around the temporary section of the pipeline will be excavated after the pipeline is constructed. Co-ordination with Readymix will be necessary to ensure that the pipeline is constructed at appropriate levels and the excavation works do not impact the operation of the pipeline	The Warm-up Lake extension will not be complete until 2009/10 and as such a temporary discharge point is required to Recreation Lake A
Environmental Constraints			
Water Levels and Water Quality	Due to the relatively small size of the Duck Pond there is less control over water levels and water quality	Water levels and water quality will be controlled through the provision of and adequately sized and designed constructed wetland and quarantine lake facility for both Options 2 and 3	
Native Flora	All native vegetation communities located along each route option have been subject to significant levels of disturbance and exhibit varying concentrations of exotic weeks and herbaceous species. Each Option traverses a listed EEC area of RFEF for the initial 400 metres		
Native Fauna	Potential habitat for five threatened fauna species listed on the TSC Act and two threatened and five migratory animal species listed on the EPBC Act may be impacted by each of the proposed route options		
Aquatic Ecology	One threatened aquatic species listed under the EPBC Act and FM Act (Macquarie Perch) has limited potential habitat near the Penrith Weir. The proposed pumping regime has the potential to impact downstream habitats and fish passage for all options		

Issue	Option 1	Option 2	Option 3
Visual Amenity	The NRPP project will introduce new aboveground structures on the eastern bank of the Nepean River and at Weir Reserve (i.e. pump station and control building). Vegetation clearing will be required to facilitate pipeline construction and establish the working width. Construction plant and vehicles will move along the working width during pipeline construction		
Heritage (Indigenous)	One Aboriginal heritage site is located at Weir Reserve that may impact upon the location of the control building	As per Option 1. There is also an Aboriginal heritage site located south-west from the corner of Castlereagh Road	As per Options 1 and 2
Heritage (Non-indigenous)	One site of historical interest (not a listed item), the Mouquet farmhouse is located along the eastern bank of the Nepean River	One site of historical interest (not a listed item) the Mouquet farmhouse is located along the eastern bank of the Nepean River. This option crosses the Castlereagh Area (an 'indicative' place on the RNE) for approximately 1.2 km	One site of historical interest (not a listed item) the Mouquet farmhouse is located along the eastern bank of the Nepean River. The Methodist Church, Church Hall and cemetery are all indicative places on the RNE and are located within 100 metres of Option 3. The Chapel and Hall are also 'Items of environmental heritage' protected under SREP 11
Land Use Conflicts	Potential conflict (during construction only) with the GRW and associated rehabilitation, and recreational uses at Weir Reserve exist for all options		

Source: Maunsell Australia Pty Ltd, 2005

5.4 Route Option Selection

A comparative analysis of the three route options has been carried out by the study team with the positive and negative aspects of each option presented in **Table 5.2**.

Table 5.2: Positive and Negative Aspects

Option	Positive Outcomes	Negative Outcomes
1	• Shortest length of pipeline. • Lowest cost option. • No temporary section or staging of pipeline construction required. • Minimal impact on quarry operations during construction. • No additional infrastructure required.	• Issues related to discharging into the Duck Pond, particularly in terms of capacity. • Impact on lake operations (i.e. rowing activities), particularly the Rowing Lake. • Limited ability to provide necessary water treatment and weed control due to sizing / capacity constraints of the Duck Pond. • Impact on recreational activities at Weir Reserve during construction and operation. • Crosses the GRW – temporary impacts during construction.
2	• Control of water quality and levels will be provided by the construction of a quarantine lake. • No impact on Rowing Lake operations. • Minimises the potential environmental impacts on the Scheme's lakes.	• Highest cost option. • Impact on Readymix quarry operations during pipeline construction. • Additional infrastructure would be required to segregate the Warm-up Lake extension for flow control and weed/water quality management. • A temporary section of pipeline for discharge to Lake A. • Impact on recreational activities at Weir Reserve during construction and operation. • Crosses the GRW – temporary impacts during construction.
3	• Control of water quality and levels will be provided by the construction of a quarantine lake. • Minimal impact on quarry operations during construction. • No impact on Rowing Lake operations. • Minimises the potential environmental impacts on the Scheme's lakes.	• More expensive than Option 1 but less expensive than Option 2. • Higher capital costs due to longer pipeline length. • Additional infrastructure would be required to segregate the Warm-up Lake extension for flow control and weed/water quality management. • A temporary section of pipeline is required to discharge into a temporary quarantine lake adjacent to Lake A. • Impact on recreational activities at Weir Reserve during construction and operation. • Crosses the GRW – temporary impacts during construction.

Source: Maunsell Australia Pty Ltd, 2005

Based on the outcome of the route option comparative analysis tabulated above, Option 3 was selected as the preferred option due to its overall good relative performance against the other options on most issues. Where optimum performance is not achieved, there are measures that can be implemented to mitigate potential adverse impacts.

Option 3 forms the basis for the development of the concept engineering design and environmental impact assessment conducted in this EA.

5.5 Project Cost Estimate

A preliminary cost estimate has been developed for the project. At this stage, the cost estimate incorporates a contingency factor of 20 per cent. The estimate of the cost of the project is approximately $10 million (in 2006 Australian dollars).

Quantities were calculated for the major cost items based on the investigations and drawings prepared at the concept design and preliminary environmental impact phases of the project. This estimate has been developed by a qualified quantity surveyor with prices for specific items such as pumps, valves, pipes and electrical works obtained from contractors and suppliers.

6. Engineering Design Features

Key design features of the NRPP project are described in this section.

6.1 Intake Structure and Pipework

The intake structure comprises 2 No. cylindrical, fine mesh screens (i.e. Johnson Screens) and twin 630 mm diameter polyethylene (PE) pipelines. The intake screens will be submerged in a minimum of two metres of water within the Nepean River. From a detailed survey of the river bed upstream of the Nepean Weir, the general depth of the Nepean River ranges between one metre and 1.5 metres. It was determined from this data that the most suitable location for the intake screens was approximately 70 metres from the eastern riverbank and 110 metres upstream of the Nepean Weir.

The two intake screens will prevent weed fragments and other debris from being transferred to the Scheme from the river (via the pipeline), and to protect the pumps from inhibited flows and damage. The screens will comprise a matrix of fine spaced bars measuring between 1.5 and three mm apart to prevent objects and debris from becoming lodged within the bars of each screen.

The intake structure will operate as a low flow device to minimise the potential for impacts on fish, recreational users, and to reduce the entrainment of sediment and weed fragments on the screens. The designed maximum surface velocity across the face of the intake screens will be 0.15 m/s. An uninterrupted flow of 1.0 m^3/s will be conveyed from the intake screens to the pump station via two, 630 mm diameter, pipelines buried under the river bed of the Nepean River. These structures will not be visible above the water surface, except for a 'bubble' plume associated with the intermittent backwashing of screens via an air purging system to remove accumulated debris.

6.2 Pump Station

The pump station will be built into the eastern bank of the Nepean River, approximately 110 metres upstream of Penrith Weir. It is necessary to locate the pump station in the bank of the river to provide adequate vehicular access around the pump station for maintenance. The location of the pump station was finalised after consideration of various factors including:

- Adequate depth of Nepean River to accommodate intake screens.
- Minimise the length of the pipework between the pump station and the intake screens.
- Minimise the extent of the pumping station access road.
- Minimise the impact on existing trees.
- Minimise impact on the existing fish ladder.

The pump station will be constructed below ground with the roof structure and the wall adjacent to the Nepean River the only parts of the pump station visible above ground. The structure will be approximately 43 m^2 in area. An area of hardstand comprising an access road and vehicle turning area will be constructed between Weir Reserve and the pump station so that routine maintenance checks can be carried out during operation. The total hardstand area is approximately 426 m^2 (**Figure 6.1**).

The pump station will be designed to withstand inundation from a 100 ARI flood event without damage. When fully operational it will provide a flow to Recreation Lake A of 1.0 m^3/s, whenever the flow in the Nepean River exceeds 350 ML/day (low flow pumping limit). The pump station will operate two submersible pumps, each with a capacity of 500 litres per second when operating in parallel.

The pump station will comprise a 'wet well' arrangement with submersible pumps mounted on guide rails. The 'wet well' arrangement will have advantages for noise attenuation, maintenance access, security, and for reducing potential visual intrusion within the Nepean River corridor.

The inlet pipework will discharge into the 'wet wells', rather than being connected directly to the pumps. The pumps will be submerged within the wet well and will draw water directly into the pump casing. This will reduce noise emissions generated by the pumps.

By using two smaller pumps rather than one large pump, a degree of redundancy is provided. A single unit can pump 500 litres per second and would be used for topping up the lakes after the initial filling, or during filling when one pump requires maintenance.

6.3 Instrumentation, Control and Automation

The operation of the pump station will be fully automatic, with provision for monitoring and overriding control from the PLDC offices. A programmable logic controller (PLC) located within the pump station will be programmed with the agreed pump control philosophy including monitoring flow over Penrith Weir, Nepean River water quality and the Scheme's lake levels. The PLDC offices will be provided with monitoring and control facilities from where status checks on critical pump system elements can be conducted and overriding control to stop, or permit, the operation of the pumps can be executed. In the event of a fault at the pump station (such as pump failure, loss of power, intruder alarm trigger) the Global System for Mobile Communications would be programmed to send text messages to mobile phones, or to facsimile machines at other designated locations (such as to a pump maintenance officer).

6.4 Control Building

6.4.1 Location

The location of the control building was initially determined by the extent of the 100 year ARI flood level. As per the Project Brief and the Water Services Association Sewage Pumping Station Code of Australia, WSA 04-2001, the location of the control building is required to be at least 100 mm above the 100 year ARI flood level. Various options were identified within the Weir Reserve area, above the 100 year ARI flood level, which considered the utilisation of the parks existing access and utility services and the preferred location of the pumping station. The visual impact of the proposed location of the building on Weir Reserve and its users was also considered. The preferred location is adjacent to the existing public amenity building immediately to the west of the existing car park at Weir Reserve. This location minimises the visual impact of the building on Weir Reserve and utilises the existing access road and utility services.

The control building will be approximately 75 m^2 in area and up to 3.8 metres in height (i.e. ground level to the top of the roofline). The design will incorporate the style of existing buildings within Weir Reserve and the external finishes and colours of the control building will be designed to integrate into the existing visual setting at Weir Reserve, subject to providing a secure structure and meeting the Integral Energy and plant maintenance requirements. No external lighting will be provided for the control building.

6.4.2 Electrical Supply and Utilisation

The principal electrical power requirement for the NRPP project will be located across both the pump station and control building, where the pumps, the intake screens cleaning compressor and the control system will be located. A transformer and substation will be housed as a pad mounted unit adjacent to the control building.

All electrical equipment located at the pump station, including the pumps, cabling, and instrumentation, would be situated below the 100 year ARI flood event and would therefore be suitable for immersion in water. In general the equipment would operate at 415V three phase, 230V single phase, with instrumentation and equipment controls at extra-low voltage, i.e. below 50V a.c. or 120V d.c.

Since the water transfer system is a long time scale operation, and interruptions to the pumping for short periods would not adversely affect the strategy, standby power supplies are unnecessary and no provision would therefore be made for either permanent or standby generators or uninterruptible, power supply units.

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Legend

- Purge Lines
- Cable Pits
- Pipeline
- Structures
- Control Building
- Pump Station
- Hardstand and Access Road
- Cadastre Boundary

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NEPEAN RIVER PUMP AND PIPELINE

FIGURE 6.1: PUMP PIPELINE INFRASTRUCTURE ARRANGEMENTS AT INTAKE LOCATION

6.5 Pipeline

6.5.1 Pipeline Alignment and Materials

The pipeline will be installed below ground level for its entire length of 4.3 km. It will be 900 mm in diameter and river water will be pumped at a maximum flow rate of 1.0 m^3/s to a pressure break tank at a high point where the pressure pipeline will discharge into the gravity main. The break pressure tank will be located below ground and will be fitted with an open grate to allow sufficient venting and to maintain adequate atmospheric pressure. The lengths of the pressure and gravity fed pipeline sections are as follows:

- 1.25 km of High Density Polyethylene (HDPE) pressure pipeline.
- 3.05 km of Reinforced Concrete Pipe (RCP) gravity pipeline.

Studies undertaken by Maunsell and its subconsultants determined that a maximum pump rate of 1.0 m^3/s would minimise the potential for impacts on the Nepean River's aquatic ecology, downstream water users and the environmental flows within the river while providing for adequate water supply to the Scheme's lakes.

The length of the temporary extension for the pipeline is 930 metres of 900 mm diameter RCP.

6.5.2 Pipe Grade and Cover Requirements

The minimum cover that is required for the pressure pipeline is 450 mm in non-trafficable locations, which comprise the majority of the proposed route. For the proposed creek crossings, a minimum cover of one metre is provided to the bed level. The actual depth of cover provided for the pressure pipeline ranges between 600 mm and 3000 mm.

For the gravity pipeline, a minimum cover requirement for non-trafficable areas is 600 mm, 900 mm for general roadways and 1,200 mm for major roadways (Castlereagh Road) or unsealed roads (PLDC Haul Road). The actual depth of cover provided for the gravity pipeline ranges between 700 mm and 5,400 mm.

The gravity pipeline has been graded to ensure that sedimentation will be minimised, which will in turn reduce the extent of maintenance required. The permanent gravity pipeline will have a minimum grade of 1 in 500 (or 0.2 per cent). One section of the temporary gravity pipeline will be laid at zero grade. Sedimentation within this section of the pipeline is a possibility, however due to the proposed flow conditions and the quality of water being transferred, the risk of sedimentation occurring within this section of the pipeline is considered to be minimal.

6.6 Constructed Wetland and Quarantine Lake

The transferred Nepean River water will pass through multiple barriers prior to discharge in the Quarantine Lake, and in turn the lakes within the Scheme. The multiple barrier approach includes the following elements:

- Johnson Screens on the intake pipes (refer to **Section 6.1**).
- Constructed wetland.
- Rock rip rap at the inlet of the wetland.
- Floating silt curtain.
- Quarantine Lake.

The constructed wetland will be developed at the pipeline discharge location to act as a 'biological filter' to capture and retain weed fragments and seeds transported from the Nepean River via the pipeline. The wetland will also function as a water quality control mechanism to settle out suspended sediment and will aid in nutrient removal in conjunction with the Quarantine Lake. The primary functions of the wetland are outlined in **Section 8.2.**

The wetland will be located along the eastern boundary of the Quarantine Lake and will comprise a lineal system of three interconnected wetland cells in a north-south direction (refer to **Figure 6.2**). The approximate dimensions of the wetland cells are as follows:

- Wetland Cell A – 3900 m^2 in area with a storage volume of 780 m^3.
- Wetland Cell B – 4500 m^2 in area with a storage volume of 4500 m^3.
- Wetland Cell C – 3150 m^2 in area with a storage volume of 630 m^3.

The objectives of the wetland are to create an environment that is unfavourable for weed growth, will provide competition for weed species by the presence of robust native macrophytes and will aid in the removal and recycling of nutrients through a series of biochemical and physical processes.

The wetland configuration was determined to maximise treatment for water quality, in addition to weed control, and will consist of alternating shallow and deep wetland cells. Total detention time within the wetland will be 100 minutes.

The constructed wetland will feature two shallow wetland cells (i.e. Wetland Cells A and C) with an average water depth of no greater than 0.2 metres. These cells will be densely planted with native submerged macrophytes such as *Baumea articulata* and *Schoenoplectus mucronatus*, to aid in the assimilation and removal of nutrients. This depth is optimal for plant growth.

Wetland Cell B will feature deep open water zone up to one metre in depth and plantings of native submerged macrophytes such as Vallisnersia. This cell will provide additional water quality treatment by providing a physical barrier to flows and allowing suspended sediment to settle out of the water column and/or attach onto 'biofilm' that forms on the leaves.

The wetland cells will be interconnected via concrete box culverts installed within the earth berm between the cells. Wetland batters will be designed to have a maximum slope of 1:4 for public safety.

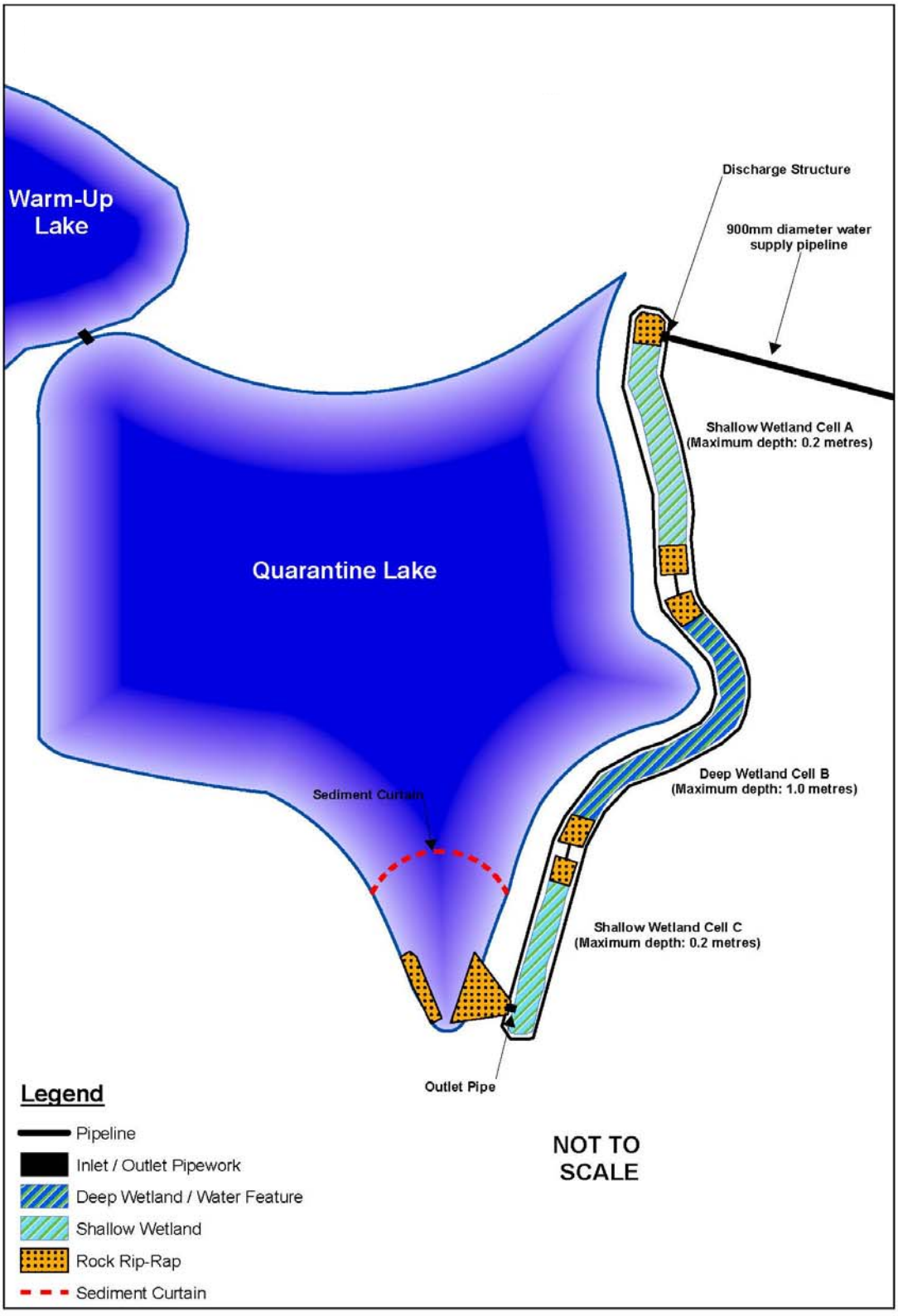
Rock rip rap structures comprising a mix of sandstone aggregates between 300 to 500 mm in diameter with coarse gravel and underlain by a geotextile will be installed at the inlet and outlet points of each wetland cell. These rip rap structures will be primarily designed to act as energy dissipaters to flows and to reduce the risk of erosion at the inlet points and potential damage to the wetlands.

A floating silt curtain comprising geocomposite material attached to a buoyancy float will hang vertically within the water column and span 100 metres across the Quarantine Lake in the vicinity of the wetland discharge point (refer to **Figure 6.2**). The silt curtain will function as a containment measure for turbid waters discharged from the constructed wetland and act as a physical barrier to trap any remaining weed fragments in the extracted river water.

The location and size of the Quarantine Lake will be formed from the proposed quarrying operations within the Scheme. The proposed volume of the Quarantine Lake will be approximately 2100 ML with a surface area of 449,701 m^2. The detention time within the Quarantine Lake for the proposed flow rate of one m^3/s will be approximately 24 days. During this period nutrients will be reduced to meet

the water quality guidelines required by PLDC, by a combination of physical, chemical and biological processes.

Figure 6.2: Indicative Constructed Wetland and Quarantine Lake Arrangement



6.7 Urban Design and Landscaping

The key urban design and landscaping principles to be considered as part of the NRPP project are:

- Provision of a reinstatement/rehabilitation program that is responsive and integrates with the landscape.
- Provision of a planting schedule that contains native vegetation species endemic to the local areas and is robust to local climatic conditions.
- Provision of an appropriate urban design solution for the aboveground structures (i.e. the control building and pump station) at Weir Reserve and on the eastern bank of the Nepean River.
- Incorporate the Great River Walk within the design of the pumping station access road and hard-standing area, including a seating/rest area.
- Incorporate a 4.5 metre cantilevered fishing/viewing platform within the design of the pumping station structure.
- The design of the control building is to incorporate the style of the existing buildings within the Weir Reserve.

6.8 Other Design Influences

A range of other influences including environmental attributes, land ownership and specific design standards also need to be incorporated into the pipeline design development process, including:

- Provision of access for pipeline maintenance.
- Reduce disruption to traffic on the local road network during construction.
- Geotechnical considerations.
- Soil erosion and stability issues.
- Segregation of stripped topsoil and sub soil.
- Minimise the footprint of the working width to reduce any potential adverse impacts on habitat areas and native vegetation.
- Avoid areas of cultural sensitivity and/or Aboriginal archaeological artefacts.
- Requirements of key Government agencies.
- Minimise disruption to ongoing quarrying operations.
- Construction and operation access.
- Aesthetics of above ground structures.
- Construction and operation noise.
- Topographical considerations.
- Operational and maintenance issues.
- Health and safety of the public, contractors and operational staff during construction and operation of the scheme.
- Great River Walk footpath and creek crossings.
- Ease of construction.
- Flood Levels.
- Cost.
- Construction materials.

6.8.1 Road Crossings

The pipeline route will be located within the haul road between Ch 1700 and Ch 2003. This section of the haul road, located between the Eastern and Western Tailings Ponds, will need to be closed during the construction of the pipeline. Refer to **Figure 6.3**

The pipeline route crosses Castlereagh Road en route to the discharge point at two locations (i.e. Ch 2015 and Ch 4275). Castlereagh Road carries local and regional traffic.

The pipeline crossing at Ch 2015 will be thrust bored under Castlereagh Road, which removes the need for any road closure. The latter crossing at Ch 4275 is located across a section of Castlereagh Road that is to be relocated along the eastern boundary of the Scheme, west of Cranebrook. The new section of Castlereagh Road is due to open to traffic by mid-2007. Subsequently it is anticipated that Castlereagh Road will have been relocated by the time the pipeline is constructed at Ch 4275. The pipeline crossing at Ch 4275 will be coordinated with quarrying operations in that area.

At Ch 3210 the pipeline crosses the haul road which will require partial road closure to enable construction of the pipeline.

6.8.2 The Great River Walk

The GRW is planned to extend 570 km along the length of the Hawkesbury Nepean River, from the estuary at Broken Bay to its headwaters in the Southern Highlands. PCC is planning to construct a section of the GRW from Penrith Weir to Cassola Place, Penrith during mid to late 2006.

Between Ch 0 and Ch 600 the pipeline will cross the GRW at three locations. The GRW comprises a two metre wide asphalt pathway for the majority of the route, with a steel boardwalk across Peach Tree Creek and a steel bridge across Boundary Creek. The pipeline route will cross the GRW at Ch 248 (under the boardwalk at Peach Tree Creek), Ch 325 and Ch 578 at the top of the high riverbank.

Consideration will be given to minimising the extent of re-building required for sections of the GRW removed during construction of the pipeline. Ongoing consultation with PCC regarding the GRW and the NRPP project has been an integral component in the development of the pipeline alignment to date and this will continue through to the commissioning of the NRPP project.

6.8.3 Draft Plan of Management, Weir Reserve, Penrith

A draft Plan of Management for Weir Reserve was published in late April 2006. Based on stakeholder consultation undertaken by Penrith City Council during the development of the plan, Weir Reserve is important to the community for a wide range of reasons including; natural and cultural riparian setting, indigenous and cultural heritage, environment and biodiversity, and public recreation.

The plan presents five main desired outcomes for future management of Weir Reserve. Connections between the NRPP project and desired outcomes for the management of Weir Reserve have been listed in the following table:

Table 6.1: NRPP Project and Desired Outcomes for Management of Weir Reserve

Desired Outcome for Management of Weir Reserve	Influence of NRPP Project
1. To establish guidelines for assessing development proposals and impacts in compliance with requirements for Community Land categorised as park, general community use and natural area – watercourse.	The pipeline and associated infrastructure has been designed to be similar and complimentary to existing structures within the reserve. The above ground structures will be finished with graffiti resistant paint to preserve the current high scenic

Desired Outcome for Management of Weir Reserve	Influence of NRPP Project
	value and quality of the recreational setting.
2. To establish guidelines for authorising leases, licences and other estate in compliance with requirements for Community Land categorised as park, general community use and natural area – watercourse.	The NRPP project has no impact on this desired outcome.
3. To further investigate and protect any Aboriginal and archaeological sites/relics and Non-Aboriginal heritage places and items of significance.	Local Aboriginal groups attended a site walkover along the initial 400m of the pipeline route alignment in July 2005 (i.e. in vicinity of Peach Tree and Boundary Creek) and no artefacts were encountered.
4. To protect, manage and enhance environmental quality, scenic character, stream health and biodiversity values.	It is stated within the plan that 'exotic weed species dominate most of the Peachtree Creek and Boundary Creek riparian corridors and the steep riverbanks along the Nepean River…these dense weed thickets of exotic vines and tall shrubs severely inhibit natural recruitment of native riparian plant species and reduce opportunities for greater biodiversity' (Page 45, Section 4.5). It is envisaged that the application of the mitigation measures outlined within Section 8.3 will reduce the potential for impacts of the project and in the longer term will enhance the riparian vegetation strip along the eastern bank of the Nepean River.
5. To develop and maintain appropriate water-based recreational infrastructure and to enhance public access, linkages and passive recreational facilities.	A new fishing and viewing platform will be constructed as part of the intake structure for the NRPP project. The significance of the Great River Walk and its ability to link the reserve to other existing recreational opportunities such as the Sydney International Regatta Centre and Penrith Lakes Scheme is recognised within the plan. Construction of the NRPP is fundamental in facilitating the filling of the Scheme.

Therefore, it is considered that the NRPP project and associated infrastructure is consistent with the management strategies and actions outlined within the plan.

6.8.4 Utilities

Telstra and Integral Energy have services infrastructure that traverses the study area. The location of these services has been taken into account during the development of the pipeline route. In particular, fibre optic cables run along the northern section and parallel to Castlereagh Road. Fibre optic cables also run to the Readymix quarry site.

6.8.5 Haul Road and Readymix Operations

The construction and operation of the pipeline could potentially interfere with the operation of the main haul road running in a west and north westerly direction within the Readymix quarry.

During detailed design, consideration will be given to vehicle loading on the pipeline in areas where the pipeline crosses beneath haul roads.

Pipeline Alignment

Study Area

N

0 0.5 1 1.5

Kilometres

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NEPEAN RIVER PUMP AND PIPELINE

FIGURE 6.3: PIPELINE LENGTH INTERVALS

6.8.6 Construction Staging

The staging of the quarry excavation works and lake construction with the NRPP project construction program is an integral aspect of project development. The Warm-up Lake extension will not be completed until 2009/10 and as such, a temporary pipeline is required to the discharge point to Recreation Lake A.

Co-ordination with the quarrying operations will be required to ensure the pipeline is constructed at appropriate levels and that the excavation works do not impact on the operation of the NRPP project.

7. Construction Issues

7.1 Overview of Construction Activities

The NRPP project construction comprises a series of sequential steps and specialist activities. The sequence of construction activities and rate of progress are dependent on local terrain and ground conditions, presence of major crossings, environmentally sensitive areas and prevailing weather conditions.

Prior to the commencement of the construction works, the contractor will produce a series of 'construction method statements' covering the range of construction activities to be carried out, including the construction techniques proposed to install the intake structure and lay the pipework in the Nepean River, cross watercourses, roads and major utility infrastructure. A CEMP and appropriate operating / maintenance manuals will also be produced by the construction contractor to assist in the implementation of environmental management controls, monitoring programmes, construction activities, incident reporting and emergency response.

The following construction activities would be involved in the NRPP project:

- Site Establishment:
  - Pipeline route surveying and centre line 'pegging'.
  - Erection of temporary fencing and signage around working areas at Weir Reserve, along the lower riverbank of the Nepean River and the pipeline route.
  - Vegetation clearance – initial site clearing and grubbing works.
  - Topsoil stripping and working width preparation.
  - Site establishment (i.e. working width) and preliminary works at control building and pump station sites.
  - Establishment of site compound area including pipe laydown areas as required.
  - Installation of temporary erosion, sediment and water quality controls.
  - Establishment of site access and internal haul routes.
- Main Construction Works:
  - Bulk earthworks including the excavation of the Nepean River bed for the intake structure and pipework, riverbank area for the pump station, at Weir Reserve for the control building and the pipe trench.
  - Pipe delivery and stringing.
  - Pipe laying.
  - Pipe trench backfilling.
  - Erection of pipeline markers.
  - Construction of control building.
  - Formation of constructed wetland and Quarantine Lake.
- Reinstatement and Aftercare:
  - Respreading of subsoil / topsoil.
  - Revegetation and earth re-profiling.
  - Finishing treatments.
  - Ongoing maintenance of pipeline, pump station, intake structure and control systems.

7.2 Site Establishment

During the pre construction phase, contractors will conduct a ground survey and 'peg-out' the centre line of the pipeline route to determine the precise location of the alignment. This is of paramount importance given the land restrictions along the bankside areas of the Nepean River, the presence of known areas of Aboriginal archaeology, known items of non-indigenous heritage and distribution of riparian habitat. A photographic record of the land condition will supplement the ground survey.

The majority of Weir Reserve will be unaffected by the construction of the NRPP project and will remain open and accessible to the public. Only the working areas at the control building and pump station sites and at the offtake section of the pipeline will be secured and out of bounds to the public in the interest of safety.

7.3 Temporary Fencing and Access

As part of the pre construction work phase, temporary fencing and access points will be defined and agreed with relevant landowners. The entrances to the working width (i.e. Weir Reserve and the discharge point within the Scheme boundary) will be secured with temporary gates to restrict unauthorised or inadvertent entry of vehicles and people onto the working width. The construction contractor will conduct appropriate maintenance to maintain the site fencing and gates. The entrance gates will remain closed outside normal working hours or during holiday periods.

7.4 Topsoil Stripping

As required, topsoil will be stripped to subsoil level across the working width by specialised plant. The topsoil will be stored to one side of the pipe trench to prevent it mixing with the subsoil or being damaged by compaction.

A temporary access road will be established along the pipeline route to enable construction plant and vehicles to transport workers and/or materials along the working width. This road will comprise gravel aggregate laid on a geotextile membrane and will provide for one-way traffic movements only.

7.5 Working Width Preparation

The working width will generally be a 15 metre wide fenced strip of land within which all construction activities will take place. The working width area may need to be increased where the pipeline route crosses watercourses, or major infrastructure items such as Castlereagh Road, to facilitate safe working, vehicle access and material storage. In the event that the pipeline route passes through areas of sensitive habitat the working width could also be reduced to minimise the potential ecological footprint and zone of potential disturbance.

7.6 Intake Structure and Pump Station Construction

The construction of the intake structure and inlet pipework and the pump station will be built from the eastern riverbank in a temporary, sheet-piled cofferdam/caisson, which will progressively extend up to 70 metres into the main channel of the Nepean River.

All works associated with the installation of the intake structure and laying of inlet pipes under the bed of the Nepean River will be contained within a sediment curtain fitted outside the cofferdam. The cofferdam will be 15 metres wide and it will be filled/excavated as required to enable pipe laying with standard plant and equipment. Due to shallow water depths (i.e. ranging between one to two metres in depth) large mounted techniques will not be employed. The installation works will begin at the

intake screens and progress back to the riverbank. These works will also be scheduled outside of the fish migratory season which extends between July and October. As sections of the inlet pipework are completed, the sheetpiling will be gradually removed to reduce the time, as far as reasonably practicable, that this structure is in place in the river.

7.7 Pipe Trench Excavation

The preferred pipeline construction method is an open trenching technique. The pipe trench will be excavated by specialised plant to a depth of approximately 1.8 metres deep by 1.5 metres wide. The normal depth of cover to the top of the pipe will vary between 0.6 to 0.8 metres. This depth may be increased at watercourse and major utility crossings to accommodate existing land drainage patterns. Dewatering of the pipe trench and the subsequent discharging of this water may be required during construction to maintain a 'water-free' trench. Dewatering and discharging activities will be carried out in accordance with the requirements of NSW DEC (EPA).

7.8 Pipe Laying

Pipe sections will be lowered into the trench using specialist side-boom tractors/tracked cranes in a continuous operation. A sand aggregate will be installed around the pipe to act as a protective 'blanket' from any potential damage.

7.9 Backfilling

The pipe trench will be backfilled, where appropriate, with the material taken from the trench. Tamping or rolling will consolidate the backfilled material. Any surplus material from the pipe trench excavation works will be spread within the working width.

Transverse land drainage networks intercepted by the pipeline construction works will be reconnected across the pipe trench as part of the backfilling operations and reinstatement activities.

7.10 Plant and Equipment

It is anticipated that standard construction machinery and earthwork equipment and plant would be required for the construction works. Typical equipment and plant would include but not be limited to:

- Tracked excavators and cranes.
- Pipe drilling plant.
- Loaders, backhoes and graders.
- Side booms.
- Dozers and compacters.
- Trucks.
- Water cart(s).

7.11 Temporary Site Compound / Pipe Laydown Area

There will be a main compound site established at Weir Reserve for the duration of the construction work.

The main compound site would provide full site services including:

- Offices and meeting rooms for site personnel.
- Reception and general administration area.
- Amenity and first aid facilities.
- Storage areas for pipe sections, construction plant and equipment and tools.
- Materials and fuel storage areas.
- Communication facilities and parking areas.

Additionally there will be at least two pipe laydown areas established for the pipeline installation. One pipe laydown area will be established in Weir Reserve for the laying of the pipe sections in the vicinity of Penrith Weir including the two creek crossings. A second pipe laydown area will be established on the high bank of the Nepean River within the of the Scheme boundary.

7.12 Construction Workforce and Working Hours

It is anticipated that the workforce required to construct the NRPP project would comprise around 80 to 100 personnel. It is envisaged that construction work trains will extend over an active spread between 100 and 150 metres including excavation, bedding, laying and backfilling operations. Construction progress along the pipeline route is anticipated to be about 100 meters per week.

Proposed construction working hours outside the Scheme boundary are:

- Weekdays (i.e. Monday to Friday): 7 am to 6 pm.
- Saturday: 8 am to 1 pm.
- No construction work is to be carried out on Sundays or Public Holidays or during night-time hours, with the exception of that required for quarry haul road crossings. Should work be required outside of NSW DEC (EPA) recommended hours, prior approval will be required and the community and PCC will need to be consulted.

Within the Scheme boundary the normal working hours are in accordance with existing quarry operation EPL conditions and are as follows:

- Monday to Saturday: 7 am to 7 pm.

7.13 Haulage Routes and Traffic Impacts

It is envisaged that a number of truck movements would be required to transport pipe sections, specialist construction plant and equipment, construction materials, and staff to / from the site. The primary haulage routes to and from the site are:

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

Traffic generation will include private vehicles for construction workers, trucks for pipe and concrete transportation. General estimates for traffic generation during the construction phase is summarised in **Table 7.1**

Table 7.1: Traffic Generation

Vehicle Type	Vehicle Movements per day
Construction workers - private vehicles	80-100
Pipe haulage trucks	20
Concrete trucks	5
Total vehicles	**105-125**

Based on the general estimates provided above the project is expected to generate between 105 and 125 vehicle movements per day. As the project will be completed in a staged approach the vehicles will be spread across approximately three to 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).

The 2002 RTA Traffic volume data publication was used to compare estimated private vehicle and truck movements for the NRPP construction phase with annual average daily traffic (AADT) for roads in the Penrith area. The comparison is discussed below:

Weir Reserve, Bruce Neale Drive

There is no traffic volume data available for Bruce Neale Drive within the 2002 RTA publication. Closest monitoring stations comprise a location at Victoria Bridge along the Great Western highway (approximately 250 metres north west of Bruce Neale Drive) and Castlereagh Road immediately north of the Castlereagh Road and Great Western Highway junction (approximately 500 metres east). AADT data indicates daily vehicle movements in 2002 were in excess of 25,000 per day.

Cassola Place

As with Bruce Neale Drive there is no traffic volume data available for Cassola Place within the 2002 RTA publication. The closest monitoring station is along Castlereagh Road which indicates the AADT is in excess of 33,000 vehicle movements per day.

PLDC

There is no traffic volume data available for Castlereagh Road within the 2002 RTA publication. The closest monitoring stations are located along Andrews Road (an extension of Castlereagh Road to the east) and the Richmond Road further east (approximately 3 kilometres east of the PLDC entrance). AADT data for Andrews Road and Richmond Road is 6,708 per day and 27,679 per day respectively.

Based on the comparison given above it is anticipated that the additional private vehicle and truck movements associated with construction of the NRPP will have negligible impact on the existing traffic volume and flow in the Penrith area.

Increased traffic movements at Weir Reserve will be managed via a Traffic Management Plan (TMP) that will be developed as a subplan to the CEMP.

7.14 Construction Timing and Staging

Construction of the NRPP project is expected to be sequenced over a twenty month period, the breakdown of the major items are as follows:

Works Plans and Approvals	Month 1 to month 5
Procurement Commitment	Month 3 to Month 14
Works – Intake, PS and Control Building	Month 4 to Month 19
Pipeline – Pressure	Month 8 to Month 16
Pipeline – Gravity	Month 5 to Month 12
Quarantine Lake	Month 6 to Month 7
Commissioning	Month 20

The impact on stakeholders (such as users of Weir Reserve and the Nepean River) will occur between month 4 to month 19.

8. Environmental Impact Assessment

An environmental impact assessment on the NRPP was undertaken with a particular focus on key environmental issues identified within the DGRs, namely:

- Water management.
- Water quality.
- Aquatic ecology.
- Terrestrial ecology.
- Aboriginal heritage and archaeology.
- Noise and vibration.
- Landscape and visual identity.

Other environmental issues covered within this EA include:

- Topography, geology and soils.
- Air quality and climate.
- Waste.
- Land use.

8.1 Hydrology

Water Research Laboratory (WRL) undertook an assessment on the adequacy (both quantity and quality) of the Nepean River to supply water to the Scheme. Pumping rules were derived based on the assessment of varying pumping scenarios, environmental flows and extractions in the Nepean River, and water balance needs for the Scheme's lakes. A copy of the WRL assessment is provided in **Appendix B**.

8.1.1 Existing Environment

The interrelationship between the Nepean River and the Scheme in relation to the proposed pump and pipeline has been outlined within this section. Operational procedures and functionality of the Scheme, as well as hydrological characteristics of the Nepean River have been detailed.

The local catchment characteristics and surface water features in the study area are illustrated in **Figure 8.1**.

Hawkesbury Nepean River Catchment Area

The NRPP project is located within the Hawkesbury-Nepean River Catchment Area, which drains an area of 22,000 km^2 extending from Goulburn in the south, to Lithgow in the west and Broken Bay to the north of Sydney. The Hawkesbury-Nepean Catchment Area is characterised by a diverse range of landforms, including undulating hill and valley systems and deeply cut floodplains. Land use within the catchment comprises a mixture of native bushland and National Parks, agriculture and rural lands, urban and industrial development, transport corridors and utility infrastructure.

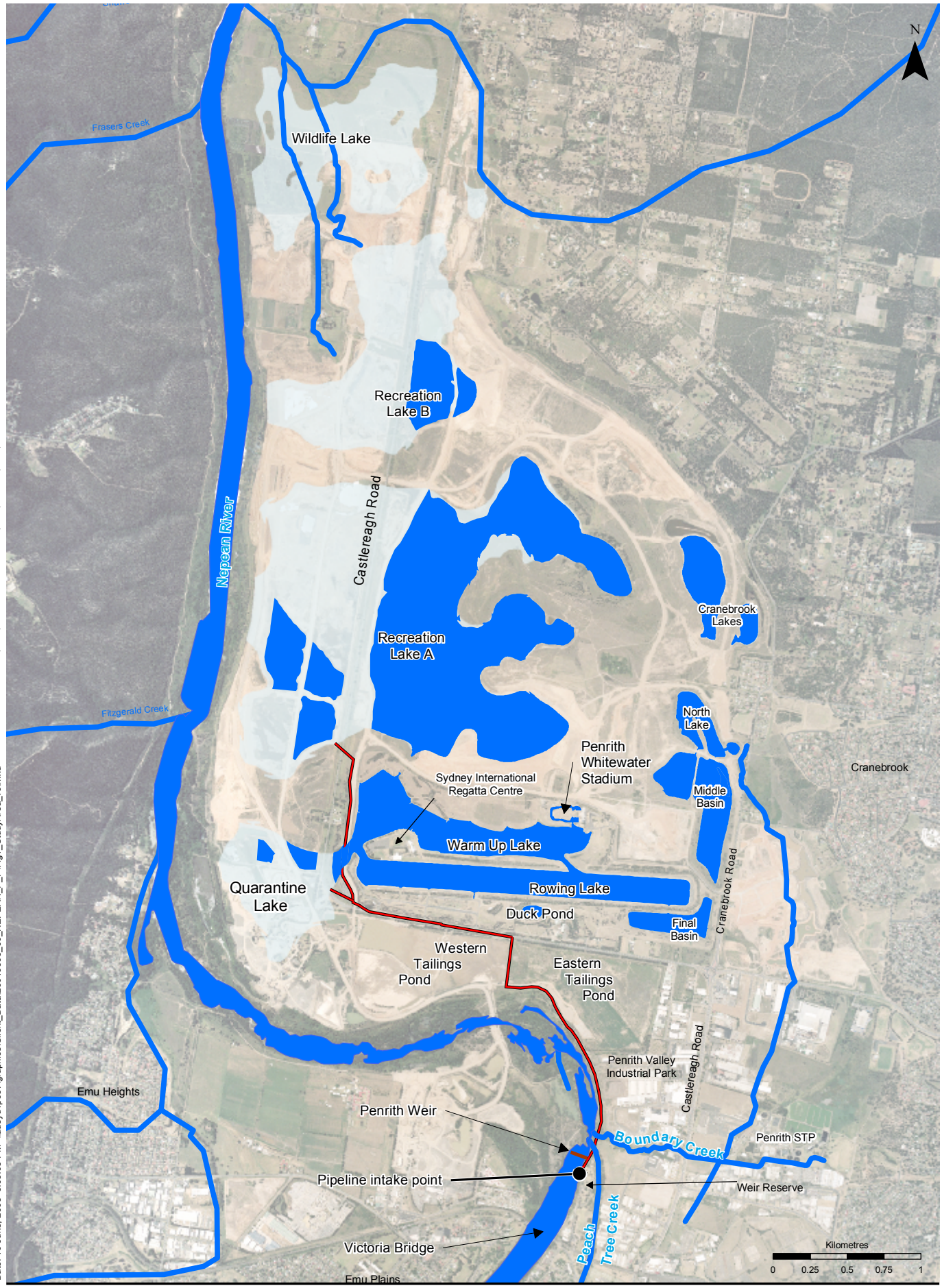
The NRPP project is located on a floodplain which straddles the main channel of the Nepean River. The floodplain is gently undulating with elevations varying between 25 metres to 28 metres AHD.

To the west of the study area the steep slopes and ridgelines of the Blue Mountains escarpment flank the floodplain rising to an elevation of approximately 220 metres at Mt Riverview. A dendritic system of land drains, gullies and creek lines incise these slopes conveying surface waters to the Nepean River. To the south and east of the study area, surface waters enter the local catchment from the urban and industrial areas of Cranebrook and Penrith.

Nepean River

The Nepean River is the principal watercourse in the study area. It flows in a predominantly northerly direction from its headwaters to the south of Goulburn prior to its confluence with the Grose River at Agnes Bank. At this point the river forms the Hawkesbury River and it continues to flow in a predominantly easterly direction before discharging into Broken Bay and ultimately the Pacific Ocean. The river provides valuable environmental and economic benefits to the Sydney region including provision of water for a range of domestic uses and irrigation purposes.

Within the study area the Nepean River forms an 'S-type' bend as it meanders in a northerly direction, downstream from Penrith Weir. It continues to flow westwards along the Scheme's southern boundary before turning north and flowing along the Scheme's western boundary (refer to **Figure 8.1**).



Data Sources: Sensis (2005), Geoscience Australia (2004), PLDC (2005)

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- Existing Waterway (River, Creek, Dam)
- Proposed Waterway
- Penrith Weir
- Pipeline Intake Point
- Proposed Pipeline

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NEPEAN RIVER PUMP AND PIPELINE

FIGURE 8.1: SURFACE HYDROLOGY

Minor Watercourses

All creeks and drainage channels in the study area are tributaries of the Nepean River. There are two minor watercourses that flow in the study area (see **Figure 8.1**), namely:

- Peach Tree Creek – flows from Surveyors Creek under Jamieson Road in a northerly direction along the eastern side of Panthers Cable Ski Park and Ladbury Avenue. It is culverted under the Great Western Highway and Main Western Railway Line before flowing in a north-westerly direction prior to its confluence with the Nepean River, approximately 100 metres downstream of Penrith Weir. The main channel of the creek is less than one metre wide and is framed by high banks. The creek is characterised by low water flow over a cobble silt base. The water depth is generally less than 0.3 metres with good water clarity (see **Plate 1**).
- Boundary Creek – flows across the southern part of the study area and discharges into the Nepean River approximately 25 metres downstream of Peach Tree Creek. The creek is around one to two metres wide. Water in this creek is fast flowing which is largely attributed to a constant discharge of treated effluent from the Penrith Sewage Treatment Plant. Water within the creek is slightly discoloured and odorous. The median discharge flow is estimated to be around 25 ML/day (Bishop, 2005). The creek channel is contained by steep sided banks (see **Plate 2**).

Plate 1 - Peach Tree Creek

Plate 2 - Boundary Creek

Existing Nepean River Flows at Penrith Weir

Flow data recorded between 1909 and 2004 at Penrith Weir for the Nepean River was reviewed by WRL (WRL, 2006) to determine median flows, and those flows experienced during periods of drought and heavy rainfall. Generally, peak flows are experienced in the river in autumn through to winter and smaller flows occur during the summer and spring months. The median flow during periods of drought (early 1940's and between 1999 and 2004) was approximately 145 ML/day. During times of heavy rainfall (generally 1950 to 1980) the median flow was in the order of 300 ML/day, with 10 per cent of flows exceeding 12,000 ML/day. The overall median flow for the Nepean River over the Penrith Weir based on records between 1909 and 2004 was 205 ML/day.

Nepean River Environmental Flows

Environmental flow requirements refer to the amount of water that is required to maintain the natural flows of the river. Ultimately this may impact on the ecological and water quality status of the river. A key issue for the NRPP project is therefore to protect environmental flows within the Nepean River whilst extracting the appropriate volume of water to supply the Scheme.

It is necessary therefore to consider the impact of extracting water for use in the Scheme on the Nepean River and to determine if the 170 ML/day cease to pump rule (as specified in PLDC current water abstraction licence) is appropriate to the needs of the Nepean River.

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 ML/day, assuming that there are no extractions upstream. Current environmental flow release volumes from upstream sources to Penrith Weir are listed in **Table 8.1**.

Table 8.1: Environmental Flow Release Sources to Penrith Weir

Location	Current Environmental Flow Release (ML/day)
Pheasants Nest Weir	10.5
Broughtons Pass Weir	1.7
Warragamba Dam	33.3
Total Flow at Penrith Weir	**45.5**

Source: WRL Technical Report 2005/16, March 2006

Extractions from the Nepean River

Water is extracted from the Nepean River to supply town, agricultural and industrial water requirements. A network of weirs, including Penrith Weir, has been installed along the Nepean River to regulate water flows within the catchment. The installation structures in the river, such as weirs, and other demands, such as pumping, have significantly reduced the base flows.

Under the provisions of the Deed, PLDC are required to apply for a licence in order to abstract water from the Nepean River. PLDC has subsequently been issued with a licence for water abstraction from the Nepean River, under the provisions of the *Water Act 1912*. The licence permits the pumping of water when environmental flows in the river exceed 170 ML/day from a point within 500 metres upstream of Penrith Weir.

Water Balance within the Scheme

The existing water balance within the Scheme is an important aspect for the NRPP project, as the pumping regime must interrelate and take into consideration the existing interconnectivity of the Scheme lakes.

The existing flow paths between the lakes are as follows (reference should also be made to **Figure 8.1)**:

- Water from the Stilling Pond flows over a fixed crest weir into the North Pond.
- Water from quarry pits is pumped into the North Pond (dewatering).
- North pond flows into the Middle Basin (through a pipe and fixed crest weir arrangement).
- Middle Basin flows into Final Basin through a three metre by 1.8 metre box culvert under McCarthys Lane.
- Final Basin flows into the Rowing Lake via a three metre by 1.8 metre box culvert with a flow regulating, manually operated sluice gate.
- The Rowing and Warm-up Lake flow into Lake A via a 1.5 metre diameter reinforced concrete structure (with trash racks).
- Main Lake A also receives water from quarrying dewatering operations located along the southern and western extremities of the PLDC boundary (Arup, 2004).

It should be noted that the Rowing Lake and Warm-up Lake are the one water body with an island running east west through the centre. In addition, the Penrith White Water Stadium draws water from the Warm-up Lake and cycles the water back into the Lake (Arup, 2004).

Lake Operating Levels within the Scheme

The predetermined operating levels of the lakes within the Scheme are an important parameter for the design of the NRPP as maintenance of the levels influence pump and flow scenarios.

The Deed specifies that operating levels for the lakes within the Scheme should be in the order of plus or minus 0.5 metres, to be exceeded for only five percent of the time (i.e. the 95th percentile drawdown). The exception to this is the Rowing Lake, which is to have an operating level of 15 metres with operational variation between 14.75 and 15.4 metres (Independent Expert Panel, 2004). Normal and lower operating water levels for each of the lakes within the Scheme are presented in **Table 8.2**.

Table 8.2: Lake Operating Water Levels

Lake	Normal Operating Level (RL m AHD)	Lower Water Level (RL m AHD)
Recreation Lake A	14	13.5
Recreation Lake B	12	11.5
Rowing Lake	15	14.75
Wildlife Lake	10	9.5
Cranebrook Lake	18	n/a
Boyces Lake	18	n/a
North Pond	16.5	n/a
Middle Basin	15.9	n/a
Final Basin	15.45	n/a

Source: WRL Technical Report 2005/16, March 2006

It should be noted that based on the WRL assessment and water balance model, drawdown criteria as specified by the Deed (i.e. greater than 0.5 metres for only five per cent of the time) cannot be achieved. It can therefore be expected that alternative water supplies may be required in the future to supplement the top-up water supply. The only reliable alternative water supply for the Scheme in the longer term is the use of treated effluent from the Penrith Sewage Treatment Plant (PLWC, 2005). The investigation of alternative future sources of water to the Scheme is being progressed however is outside the scope of this assessment.

Flooding

The Scheme's lakes are interconnected via a series of culverts, lake-to-lake weirs and lake-to-river weirs. The weirs are designed to overtop during certain flood conditions. Lake-to-river weirs overtop during flood events greater than the 20 year ARI only, with the exception of the Wildlife Lake which overtops during the five year ARI flood event.

The 100 year ARI flood event for Recreation Lake A is predicted as being a reduced level (RL) of 21.4 metres AHD, with the adjacent Nepean River levels being 21.6 metres AHD. Given a longer duration peak flow condition, it can be expected that Recreation Lake A levels would equalise with adjacent Nepean River levels. It should be noted that flow velocities within Recreation Lake A during the 100 year ARI flood event were calculated as being low, i.e. up to a maximum of 0.25 metres per second.

Another flood modelling study undertaken in 2001 calculated the design flood levels for the 100, 200 and 500 year ARI flood events in the Nepean River. Results from this study are outlined within **Table 8.3**.

Table 8.3: Design Flood Levels for Locations Inside and Outside the Scheme

Location	Design Flood (metres AHD)		
	100 yr ARI	200 yr ARI	500 yr ARI
Victoria Bridge (Nepean River)	25.1	26.2	28.1
Downstream of Victoria Bridge (Nepean River)	24.8	26.0	27.5
Recreation Lake A	21.4	23.1	25.5

Source: Patterson Britton and Partners: 2001

8.1.2 Potential Impacts

The following section examines potential impacts on hydrology based on the construction, installation and operation of the intake structure, pipework and pump station.

Construction

Potential impacts on the Nepean River, Peach Tree Creek, and Boundary Creek during construction will include:

- Disturbance to the lower terrace of the eastern riverbank of the Nepean River (for approximately 400 metres).
- Disturbance of the Nepean River channel bed during construction of the pump station and installation of the intake structure and pipework.
- Disturbance of the stream beds of Peach Tree Creek and Boundary Creek.
- Temporary alteration to the channel flow regimes of Peach Tree Creek and Boundary Creek.
- Increased suspended sediment loads downstream.
- Increased scour in the vicinity of Penrith Weir.
- Interruption of fish passage.
- Bank instability.
- Altered flow regimes upstream in the event of a flood event.
- Temporary alteration of overland flow paths, which may concentrate and redirect overland surface water flows.

Operation

If environmental flows are not maintained within the Nepean River (through over extraction of Nepean River water) there may be potential hydrological impacts on the ecological and water quality status of the river downstream.

Fish Passage

PLWC has suggested that fish passage is the limiting factor for extraction of water from the Hawkesbury Nepean (PLWC, 2005). A cease to pump limit of 170 ML/day (as stated in the Deed) is considered likely to reduce fish passage, particularly between the tidal barrier riffle at Yarramundi and

Penrith Weir. Moreover, a three kilometre stretch downstream of Penrith Weir was identified as particularly depth limiting for larger fish.

In order to investigate this further, a field assessment of the fish barriers in the Nepean River downstream of the Penrith Weir was carried out by WRL on 1 June and 7 December 2005, when the Nepean River flow levels were 70 ML/day and 580 ML/day respectively (based on SCA's gauging station at Penrith Weir). Seven sets of rapids were assessed. Based on the field investigations, it would be expected that 170 ML/day would provide passage for all of the rapids other than a rapid identified as Rapid 3 (WRL, March 2006). Rapid 3 currently presents the greatest barrier to fish movement upstream.

Flooding

Some infrastructure associated within the NRPP project, such as electrical equipment contained within the control building, has the potential to malfunction if inundated with water (i.e. in a flood event).

8.1.3 Mitigation Measures

Construction

Nepean River

Intake pipe work would be laid under the bed of the Nepean River for approximately 70 metres to connect the intake structure with the pump station. The intake structures would be supported on concrete plinths on the river bed. These works would be confined within a sheet-piled cofferdam. A sediment curtain would be fitted around the cofferdam to manage and control releases of sediment generated during the construction works. The temporary sheet pile coffer dam within the Nepean River would be designed so as not to exacerbate flooding and to minimise the disruption to the flow regime and geomorphology of the watercourse corridor. This would be achieved by ensuring that:

- The sheet pile is of an adequate height to accommodate river level fluctuations during storm events.
- The coffer dam retains the Nepean River for as minimal length as possible.
- Where possible, plant used for excavations and works at the intake structure would be bank side, to minimise the area of disturbance within the Nepean River corridor.

Peach Tree Creek and Boundary Creek

Temporary flow diversions at Peach Tree Creek and Boundary Creek crossings may include in-river bunding (sheet piling) or piping of the creeks. Where possible, drainage would be attenuated so as not to introduce scouring or erosion at the outlet points for the diversion. This may be achieved through the temporary construction of an attenuation pond, which would facilitate the reduction in the diverted creek flows prior to discharge into the Nepean River.

Surface Water Runoff

The existing land drainage pattern and overland flow paths along the pipeline route will be temporarily altered to accommodate the pipeline construction works. A number of appropriate soil and water controls and temporary drainage diversions will be installed at key intervals along the pipeline route to maintain transverse drainage flows. This may include temporary detention ponds at pre-determined intervals and locations along the pipeline route. On completion of the construction works the natural drainage networks will be reinstated as far as reasonably practicable to their pre-existing patterns.

Stumps of trees that are required to be felled will be retained insitu for as long as possible to retain bank structure and minimise instability.

Operation

Water Balance

To optimise extraction from the Nepean River a dynamic water balance model of the Scheme was configured to devise a pumping regime that would:

- Meet the environmental flow requirements to maintain the health of the Nepean River.
- Maintain the operating levels in the Scheme, without compromising water quality.
- Determine whether the Nepean River is an adequate and reliable long-term water source for the Scheme's lakes.

The water balance model was run for a number of different pumping capacity and pumping rule scenarios in order to determine the impact that these scenarios would have on the Schemes water levels and flushing flows. 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 i.e. the Rowing Lake, Recreation Lake A, Recreation Lake B and the Wildlife Lake. In addition, a treatment lake (Quarantine Lake) for extracted river water was included in the model design.

Based on the results of the water balance model, it was concluded that a pump rate of 1.0 m^3/s be used to extract water from the Penrith Weir Pool. This is less than the pumping rate of 1.7 m^3/s as specified in the Deed. It was concluded from the water balance model that a 1.7 m^3/s pump rate compared with a 1.0 m^3/s pump rate provides only minor improvement to drawdown levels. Further, it is recommended that pumping should only be used for water balance, which would further reduce impacts on the Nepean River.

Pumping Rules Summary

A pumping rate of 1.0 m^3/s has been devised to mitigate potential hydrological impacts on the Nepean River (i.e. through maintaining Nepean River flows for ecological health) and to maintain the Scheme operating levels. Pumping will commence when flows exceed 500 ML/day over the weir and will cease when flows fall to 350 ML/day. Further expanding this rule to pumping only when required for water balance would further reduce any impacts on the Nepean River.

Fish Passage

Potential impacts related to fish movement (i.e. barriers) may be reduced through maintenance of natural flows in the Nepean River via the implementation of the pumping rules.

Based on field investigations undertaken by WRL in 2005, it would be expected that 170 ML/day would provide passage for all of the rapids other than Rapid 3. Rapid 3 is expected to require between 350 ML/day and 500 ML/day in order to provide passage, however further investigation pertaining to the lower range of these flows (i.e. 350 ML/day) is highly recommended (WRL, March 2006).

Flooding

A wet well submersible pump will be constructed within the eastern riverbank of the Nepean River adjacent to Penrith Weir. The wet well pump configuration proposed will always be inundated with water, and is therefore not susceptible to flooding.

The control building will be located above the 100 year ARI flood event, on top of the high bank within Weir Reserve in an attempt to protect the contents from water inundation during all flood events smaller than the one per cent ARI.

Monitoring of Water Levels

The operation of the pump station would be fully automatic, with provision for monitoring and overriding control from the PLDC offices. A PLC located within the pump station would be programmed with the agreed pump control philosophy including monitoring flows over Penrith Weir and water levels in the Scheme's lakes. Refer to **Section 6.0** for further details regarding instrumentation, control and automation.

8.2 Water Quality

WRL undertook an assessment in May and December 2005 on the environmental flows of the Nepean River (WRL, March 2006). The assessment considered a number of scenarios relating to pumping capacities and rules (refer to **Section 8.1**). Water quality modelling was also conducted and assessed against water quality requirements for the Scheme's lake system. A full copy of the WRL Assessment Report is provided in **Appendix B**.

Australian Wetlands carried out an assessment in November 2005 on aquatic weed transfer and water quality within the Quarantine Lake. A copy of this report is provided in **Appendix C**.

8.2.1 Existing Environment

Currently the Scheme contains three recreational lakes, Rowing Lake, Warm-up Lake and Main Lake. The lakes are used for whole body contact (primary) and incidental contact (secondary) recreation including activities such as rowing, canoeing and swimming.

The Scheme's lakes operate as a 'closed system' with the major water sources to the Scheme comprising overland flows, stormwater runoff within the local catchment, rainfall discharges from quarry pits and tailings dams and groundwater recharge. Overland flow from local catchment is pretreated by detention basins located in the east of the Scheme prior to entering the lakes.

The pipeline will transfer water from the Nepean River to the Scheme's lakes via a constructed wetland and a Quarantine Lake to form an extension of the Warm-up Lake.

8.2.2 Relevant Water Quality Guidelines

Schedule 7 of the Deed specifies certain 'end uses' for each of the Scheme's lakes (refer to **Table 8.4**). Water quality levels in each of the lakes must satisfy their respective end user requirements.

Table 8.4: Water Quality Requirements for Penrith Lakes

Lake	Water Quality Requirements Specified in the 1987 Deed of Agreement
Recreation Lakes A & B	Secondary Contact Aesthetic
Sydney International Regatta Centre Lakes (Rowing Lake and Warm-up Lake)	Primary Contact Aesthetic

Lake	Water Quality Requirements Specified in the 1987 Deed of Agreement
Quarantine Lake	Water Management
Wildlife Lake	Wildlife Habitat Aesthetic
Detention Basins	Water Management Aesthetic

Source: Penrith Lakes Water Committee

In Australia, there are no mandatory water quality requirements imposed on recreational water uses. However, water quality guidelines (Guidelines for Managing Risks in Recreational Water) have been developed by the National Health and Medical Research Council (NHMRC) to provide best practice for management of recreational water quality. The guidelines aim to protect human health during recreational activities and prevent deterioration of the aesthetic value of water bodies.

The NHMRC guidelines and the Australia and New Zealand Guidelines for Fresh and Marine Water Quality (2000) have been adopted by PLDC in setting trigger values for the Scheme's lakes. These trigger values are presented in **Table 8.5**.

Table 8.5: Recommended NHMRC and ANZECC Water Quality Guidelines for Penrith Lakes

Indicator	Trigger Value	
Chlorophyll-a	5 µg/L	
Total Phosphorous	10 µg/L	
Filterable Reactive Phosphorus	5 µg/L	
Total Nitrogen	350 µg/L	
Oxidised Nitrogen	10 µg/L	
Ammonium	10 µg/L	
Dissolved Oxygen	90-110% saturation	
pH	6.5 – 8.0	
Turbidity	1 – 20 NTU	
Health Relate	Primary	Secondary
Intestinal enterococci	≤ 40 / 100 ML 95th Percentile (for secondary use)	≤ 200 / 100 ML 95th Percentile

Sources: ANZECC (2000) Water Quality Guidelines for Slightly Disturbed Freshwater Lakes and Reservoirs; NHMRC Australian Guidelines for Recreational Use of Water

Accordingly, water that enters the lakes that are designated for primary and secondary recreational activities would be required to comply with these guideline values.

8.2.3 Water Quality Monitoring Results

The Scheme's Lakes

A water quality monitoring program has been undertaken by PLDC for the three southern detention basins (Final Basin, Middle Basin and Stilling Basin), the Rowing Lake, Warm-up Lake, and Recreation Lake A on the Scheme site since 1995. Results from the monitoring program indicate that the detention basins have reduced turbidity, nutrients and bacteria in the source water prior to

discharging into the Scheme's lakes. However, following large storm events, when catchment water quality is very poor, guidelines have been exceeded in the Rowing Lake and Warm-up Lake (ERM Australia, 2001). Furthermore, cyanobacteria (blue-green algae) tend to reach unacceptable levels during dry weather when nutrients, especially phosphorus, and sunlight penetration are high. Algae blooms have been recorded during February in the Scheme's lakes since monitoring began in 1995. Subsequently, elevated bacterial levels and blue-green algae plumes have been identified as the key water quality issues within the Scheme's lakes.

Nepean River

Water quality in the Nepean River (when flow conditions range between 170 ML/day and 1000 ML/day) has been compared with water quality from Farrell's Creek and Scopes Creek, and an area identified as Catchment 88, to assess the potential effects that water pumped from the Nepean River water will have on existing water quality levels within the Scheme's lakes (refer to **Table 8.6**). On average Nepean River water quality appears to be of a higher quality than water from surrounding catchments.

Table 8.6: Comparison of Water Quality from Different Sources

Water Quality Parameter (Average)	Nepean River (170 – 1000 ML/day)[1]	Farrell's/Scope Ck Station[2]	Catchment 88[2]
Total Nitrogen (mg/L)	0.399	1.88	1.93
NO_2 (mg/L)	0.181	0.65	0.36
Total Phosphorous (mg/L)	0.018	0.180	0.180
Turbidity (NTU)	7.4	12.9	490
EC (mS/cm)	0.182	0.077	0.021

Source: *1. Keogh (2004a); 2. Keogh (2003)*

Moreover, water quality samples have been collected by Sydney Catchment Authority (SCA) at Penrith Weir for 20 years between 1984 and May 2005. The sampling results are summarised in **Table 8.7**. Median values reveal that the quality of water in the Nepean River is approximately equal to or slightly higher than recommended ANZECC and NHMRC trigger values and on average will exceed these guidelines for approximately 50 per cent of the time.

Table 8.7: Water Quality Sampling Results from Penrith Weir

Analytes	Trigger Value	Maximum	Minimum	Median	95th Percentile
Chlorophyll-a (µg/L)	5	35.98	0	3.4	11.8
Phosphorus Total (mg/L)	0.01	0.44	0	0.013	0.054
Phosphorus Filterable (mg/L)	0.005	0.27	0.001	0.005	0.016
Nitrogen Total (mg/L)	0.35	1.65	0	0.37	0.79
Nitrogen Oxidised (mg/L)	0.01	1.8	0	0.12	0.48
Nitrogen Ammoniacal (mg/L)	0.01	0.28	0	0.01	0.08
Dissolved Oxygen (%Sat)	90-100	159	34	95	119
pH (field)	6.5-8.0	9.6	6.19	7.75	9.3
Turbidity field (NTU)	1-20	30.7	0.7	1.9	7.2
Enterococci	95 percentile $\leq$ 200/100 ML	2600	0	63	348

Source: Raw monitoring data collected between 1984 and 2005 obtained from the Sydney Catchment Authority.

In order to identify periods when water quality was poor in the Nepean River, WRL analysed correlations between water quality, seasonality and flow using all available data. The analysis found little correlation between water quality, the season, and the amount of flow (WRL, 2006). Nevertheless, analysis of the correlation of flow and pollutant levels from 24 hour sampling at Penrith Weir between June 1991 and 1992 showed that water quality was generally at its lowest and unsuitable for pumping when water levels were rising (first flush) prior to the peak flow generated by a storm event (ERM Australia, 2001).

8.2.4 Potential Impacts

Potential water quality impacts associated with the construction and operation of the NRPP project are described in this section.

Construction

Construction activities associated with the intake structure, pipeline, pump station, control building, and access road have the potential to impact on surface water quality and water quality in adjacent water bodies (namely the Nepean River, Boundary Creek and Peach Tree Creek). Specific impacts are outlined below:

- An increase in soil erosion and generation of sediment-laden runoff during open trenching for the laying of the pipeline, construction of intake pipes, pump station, control building, and access road.
- Generation and influx of pollutants in construction runoff associated with earthworks and pipeline trench excavation.
- Disturbance of existing herbaceous and exotic weeds along the banks of the Nepean River.
- Accidental spillages of chemicals/fuel by construction plant and equipment which may leach into underlying groundwater or 'wash-out' into adjacent and downstream drainage channels (particularly Peach Tree Creek, Boundary Creek and Nepean River).
- General building and construction materials used to backfill the pipeline trench etc (i.e. sand, concrete) may flow into adjacent drainage channels.
- Water collected from pipe trench dewatering has the potential to flow into adjacent drainage channels and leach into groundwater if not contained properly and appropriately.
- Once the pipeline has been constructed, and prior to commissioning, the pipeline would be hydrostatically tested to the maximum allowable operating pressure in accordance with appropriate standards. This test water may contain remnants of the pipe material, and any other residual materials contained within the pipe (for example small amounts of soil from excavation and installation). The water used for hydrostatic testing would be disposed of using appropriate methods and procedures, and in accordance with relevant NSW DEC requirements.
- Groundwater may be intercepted along sections of the pipeline alignment during excavation of the pipe trench. The newly laid pipeline may potentially create an alternative drainage pathway and alter groundwater flows if appropriate measures are not installed along the pipeline to maintain unabated transverse (cross-flows) groundwater flows.

Operation

Following the construction of the pipeline and backfilling of the pipe trench, the disturbed working areas along the pipeline route will be restored to their pre-existing states (as far as practicable), with surface runoff patterns being returned to their former flow paths. It is considered that potential impacts to surface water flows during the operation phase will be negligible. However, the act of discharging Nepean River water into the Quarantine Lake may result in a number of potential impacts, including:

- Still water contained within the Quarantine Lake may aid the breeding cycle of mosquitoes beyond the current capacity of fish predators.

- Cyanobacteria (blue-green algae) blooms resulting from high nutrient loads from the Nepean River.
- Presence of faecal coliforms that may be discharged to the Rowing Lake and reduce the ability of the lakes within the Scheme to be fit for their respective end uses.
- Exotic and pest fauna species, such as carp, may breed and displace native fauna if the banks of the Quarantine Lake are shallow with gentle slopes.
- Aquatic weeds present in the Nepean River and surrounding waterways, such as *Salvinia molesta, Eichhornia crassipes,* and *Egeria densa*, have the capacity to be transferred to the Scheme via aquatic vessels and other equipment.
- Weed seeds and fragments in the Nepean River with a diameter smaller than three millimetres may be transferred into the Scheme through the Johnson Screens and discharged to the Quarantine Lake. Outbreaks of invasive aquatic weeds within the Scheme may lead to a variety of adverse impacts, some of which may include:
  - Rapid growth and invasive nature.
  - Ability to block lakes and drainage channels.
  - Displacing native flora and fauna.
  - Reduced infiltration of sunlight into the water column.
  - Changes to water temperature, pH and oxygen levels and reduced gas exchange at the water surface.
  - Altered habitats of aquatic plants, fish, amphibians and waterfowl.
  - Interference with recreation activities in Recreation Lakes A and B.
  - Reduced aesthetic qualities of the lakes.
  - Reduced water quality from decomposing biomass.
  - Competition with native macrophytes in the Quarantine Lake.

8.2.5 Mitigation Measures

Construction Phase

Mitigation measures to minimise potential impacts on the surrounding water environment during the construction of the pipeline, pump station, control building, and access road will include:

- An appropriate Water Quality Management Strategy (WQMS) will be developed for incorporation into the CEMP.
- A site specific Erosion and Sediment Control Plan (ESCP) will be developed for incorporation into the CEMP. All erosion and sediment controls would be in accordance with the 'Blue Book' - NSW Department of Housing publication.
- Open trenching will be limited to sections of 50 metres and a maximum of four active working fronts will be open at any one time.
- Stormwater and other surface water flows will be diverted away from open trenches using straw bales or other similar temporary barriers where practicable.
- Stockpiled topsoil and subsoil will not be located within 40 metres of watercourses (where possible).
- Temporary stockpiles located adjacent to watercourses (particularly within the initial 400 metres of the pipeline) will be appropriately bunded and covered.
- Active work areas will be kept tidy and well maintained to minimise potential for construction materials (such as sand and concrete) to mobilise into drainage channels.
- Wastewater generated during the hydro-static pressure testing of the pipeline will be tested, treated (if required) and disposed in accordance with provisions outlined within a Waste Management Plan.
- Sewage and greywater generated during construction will be discharged to holding tanks or porta loos and disposed appropriately.

- Water collected during trench dewatering (from surface water and groundwater seepage) will be contained and tested prior to disposal in accordance with provisions within the CEMP.
- Traverse groundwater cross-flows and alteration of the underlying hydrogeology that may result from the installation of the pipeline will be managed through the use of clay plugs or sand bag 'trench breakers' at key intervals along the pipeline route.

Operation Phase

Mitigation measures to protect water quality, environmental flows, and minimise the proliferation of exotic fauna species, faecal coliform levels, aquatic weeds, cyanobacteria and mosquitoes within the Quarantine Lake during the operation phase include:

- Minimising poor water quality resulting from algal blooms and excessive weed growth may be reduced through controlling phosphorus and other nutrients, as well as faecal coliforms at the source (i.e. avoiding extracting Nepean River water contained in the first flush of storm events), via the constructed wetland adjacent to the Quarantine Lake, as well as appropriate mixing and circulation of water within the Quarantine Lake itself.
- Installation of a constructed wetland adjacent to the Quarantine Lake to provide the following functions:
  - Provide an additional barrier to prevent the spread of weeds into the lakes.
  - Enable manipulation of water levels within the wetland for weed control.
  - Provide competition for weed species by planting native macrophytes.
  - Allow containment and removal of weed growth within the wetland area.
  - Provide preliminary water quality treatment such as settling out of suspended solids and uptake of nutrients, prior to additional water quality treatment in the Quarantine Lake.
- Designing the Quarantine Lake to enable a water detention time of approximately 24 days in order for 95 per cent of faecal coliforms to die/degrade before being discharged to the Rowing Lake.
- Implementing a water quality monitoring program as a pre-emptive management tool to identify management issues.
- Monitoring mosquito numbers to ensure breeding of mosquitos continues to be controlled by fish predation, and is not exacerbated by still water in the Quarantine Lake.
- Providing water in the Quarantine Lake that is mixed and not allowed to stagnate in order to minimise the breeding capability of mosquitoes. Monitoring fish predation of mosquitos.
- Constructing the banks of the Quarantine Lake with steep (i.e. almost vertical) slopes to reduce the potential for exotic fauna species, such as carp, to breed and in turn reduce carp numbers within the lake.
- Implementing a multiple barrier approach to weed transfer control (refer to **Section 8.3**) that will involve:
  - Constructed wetland with shallow and deep zones.
  - Submerged intake pipes with Johnson Screens.
  - Rock rip rap at the inlet of the wetland.
  - Floating silt curtain.
  - Quarantine Lake.

8.3 Terrestrial and Aquatic Ecology

Biosis Research undertook a Terrestrial and Aquatic Flora and Fauna Assessment for the NRPP project in June 2005. The assessment provided a description of the flora communities and fauna habitats in the study area, a condition assessment of vegetation communities, identification of threatened species, populations (and their habitats) and/or endangered ecological communities likely to occur using active searching, listening and recording methods. Biosis Research undertook an additional aquatic ecology assessment with a focus on the intake structure only in April 2006. Copies of the assessment report are provided in **Appendix D** and **E** respectively.

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

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

8.3.1 Existing Environment

Terrestrial Flora

Vegetation along the pipeline route has been highly modified due to land clearing, quarrying and urban development. The eastern bank of the Nepean River comprises patches of *Casuarina Cunningham ssp. Cunninghamiana* with a few scattered shrubs of *Callistemon salignus*. The understorey along the riverbank is degraded and dominated by exotic weed species such as *Cyperus eragrostis, Eragrostis curvula funcus sp, Paspalum urvillei* and *Pennisetum clandestinum* with some native plants such as *Persicarla desciens* and the emergent *Typha domingensis* also present.

Away from the riverbank, the vegetation communities have been highly disturbed by land clearing activities and are dominated by a mosaic of herbaceous weed species such as *Acetosa sagittat, Bidens pilosa, Cardiospermum gandiflorum, Chlois gayana, Eragrostis aurvula, Ligustrum sinense, Ricinus communis, Solanum nigrum, Tagetes minuta* and *Tradescantra fluminensis*.

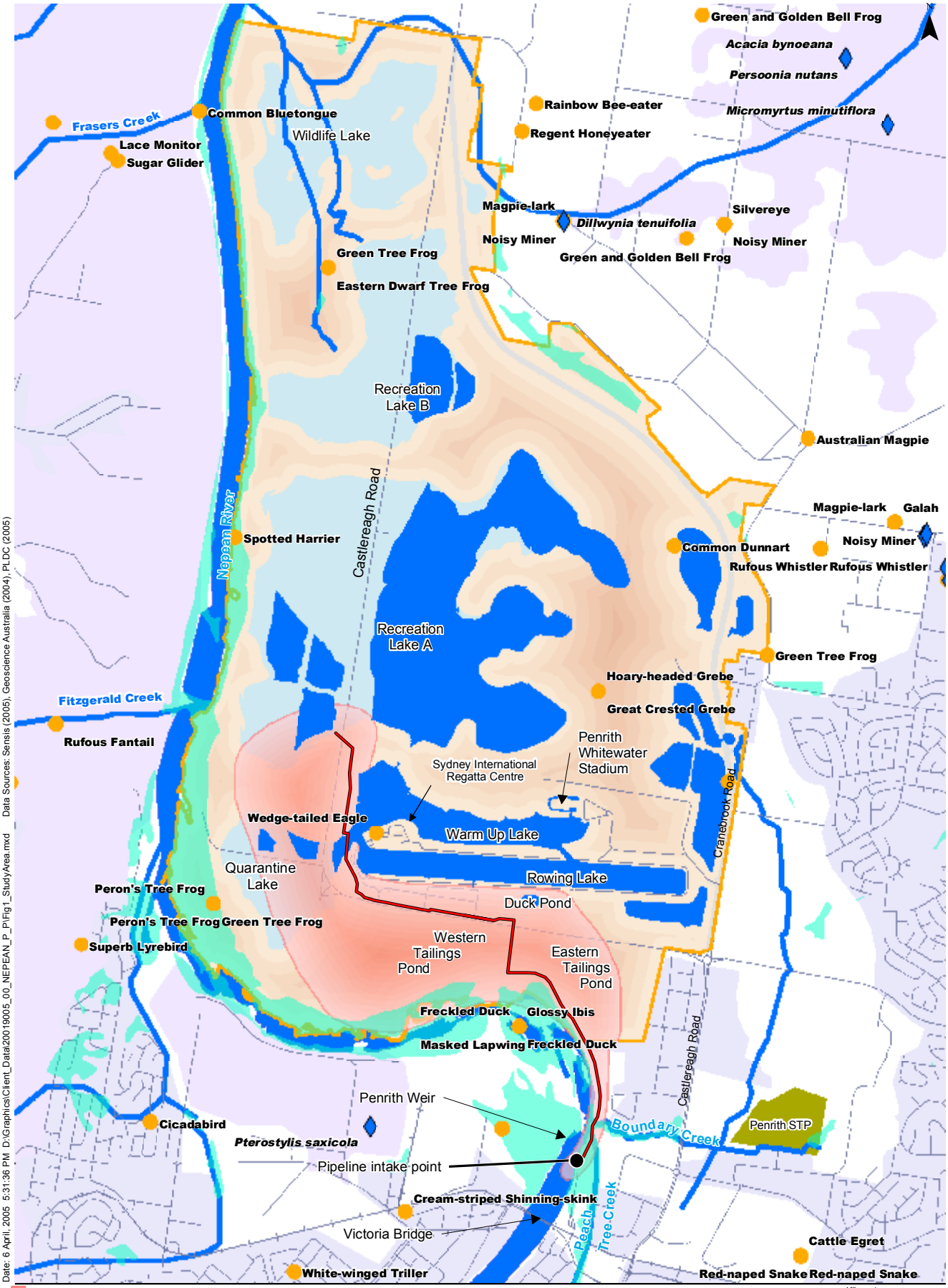
Vegetation communities can be listed as threatened under Commonwealth and State (NSW) legislation as:

- Critically endangered, endangered or vulnerable under Subdivision C of the Commonwealth EPBC Act.
- Endangered or vulnerable under Schedules 1, 2 and 3 of the NSW TSC Act.

A thin degraded strip of River-flat Eucalypt Forest (RFEF) dominated by *Casuarina cunninghaniana ssp. cunninghaniana* is located on the eastern bank of the Nepean River in the vicinity of Penrith Weir. RFEF is an EEC listed under Schedule 3 of the TSC Act. Key ecological features within the study area, including the extent of the RFEF, are depicted in **Figure 8.2**.

Vegetation along the remainder of the route is characterised by herbaceous weeds and exotic grasses, scattered native and exotic trees. No EECs listed on the EPBC Act were recorded within the study area.

A total of 23 threatened flora species listed on the TSC Act and 22 threatened flora species listed under the EPBC Act, or their habitat, have been previously recorded within the local area (DEC Atlas of NSW Wildlife and DEH Online EPBC Database). No significant flora species or their habitats were recorded within the study area during this assessment. As such Eight Part Tests and Assessments of Significance are not required for any threatened flora. A list of the terrestrial flora species under the TSC Act and EPBC Act is provided in **Appendix D**.



Data Sources: Sensis (2005), Geoscience Australia (2004), PLDC (2005)

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Study Area
Preferred Route
Penrith Lakes Scheme Site Boundary
Existing Waterway
Local Road
Main Western Railway Line
Vegetated Area
Built-up Area

Endangered Ecological Communities (TSCA)
River Flat Eucalypt Forest
Threatened Flora Species (Previously recorded)
Threatened Fauna Species (Previously recorded)

Proposed Landform Design
Open Space (Lake)
Open Space (Parkland)
Road Reserve

PENRITH LAKES DEVELOPMENT CORPORATION LTD

NEPEAN RIVER PUMP AND PIPELINE

FIGURE 8.2: TERRESTRIAL ECOLOGY

Habitats

The principal fauna habitat types present within the study area comprise:

- River and riparian vegetation:
  - Occurs along the initial 400 metres of the pipeline route from the Penrith Weir north across Peach Tree Creek and Boundary Creek. This habitat has been highly modified and is generally in a poor to moderate condition due to the low number of fauna resources it provides such as hollow-bearing trees, roost sites and foraging areas.
  - Threatened and migratory fauna that have the potential to occur within river and riparian vegetation include Freckled Duck, Painted Snipe, Large-footed Myotis, Whitebellied Sea-Eagle and Rufous Fantail.
- Man-made dams:
  - Exist along the pipeline route within the Scheme boundary and are considered to be in poor to moderate condition based on relative opportunities provided for fauna such as amount of vegetation cover and foraging habitat.
  - Threatened and migratory fauna that have the potential to occur within the man-made dams include Freckled Duck, Australian Painted Snipe, Latham's Snipe, Australian Wood Duck, Pacific Black Duck, Masked Lapwing, Australasian Shoveler, Grey Teal and Hardhead.
  - The Duck Pond may provide potential habitat for the Green and Golden Bell Frog.
- Shrubby understorey with scattered trees:
  - Exists along the pipeline route between the high riverbank adjacent to the Penrith Valley Industrial Area and where the pipeline diverts northwards between the western and eastern tailings ponds on the Scheme site.
  - Shrubby understorey with scattered trees provided some foraging habitat for common birds (such as Zebra Finch and Silvereye), however, the majority of trees present were young with thin trunk diameters and no hollows or substantial branching to provide nesting resources for threatened fauna such as bats and owls. The habitat is considered to be in poor condition providing little foraging and breeding resources for threatened fauna.
- Mown grass with planted trees:
  - Occurs in the vicinity of the control building on the high bank in Weir Reserve and along Castlereagh Road toward the western edge of the Rowing Lake.
  - Mown grass with planted trees was considered to be in poor condition due to the lack of resources for native animal species.
  - Provides no ground or shrub cover for birds, reptiles and small mammals and the trees provide little habitat for threatened species.

Terrestrial Fauna

A total of 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 recorded within the local area (DEC Atlas of NSW Wildlife and DEH Online EPBC Database). No threatened fauna were recorded during the current survey. However, the study area contains potential habitat for five threatened species listed on the TSC Act and two threatened species listed on the EPBC Act. **Table 8.8** presents the threatened terrestrial fauna species listed under the TSC Act and EPBC Act that have potential habitat in the study area.

Table 8.8: Threatened Terrestrial Fauna Species

Common Name	Scientific Name	Status	
		NSW TSC Act	EPBC Act
Green and Golden Frog	*Litoria aurea*	E[1]	V
Australian Painted Snipe	*Rostratula benghalensis australis*	E[2]	V
Painted Snipe	*Rostratula benghalensis s.lat*		M
Freckled Duck	*Stictonetta naevosa*	V	M
Large-footed Myotis	*Myotis adversus*	V	

Source: Biosis Research, 2005

Notes: 1. Listed on the TSC Act as Endangered (EI) or Vulnerable (V)

2. Listed on the EPBC Act as Endangered (E) or Vulnerable (V) or Conservation Dependent (C) or covered under migratory provisions (M) on the EPBC Act

Eight migratory fauna species were recorded during the June 2005 survey (Australasian Shoveler, Australian Wood Duck, Black-Shouldered Kite, Brown Falcon, Grey Teal, Hardhead, Masked Lapwing and Pacific Black Duck). Potential habitat for a further five migratory species exists within the study area (Freckled Duck, Latham's Snipe, Painted Snipe, Rufous Fantail and White-bellied Sea-Eagle).

Aquatic Habitats

The classification of aquatic habitats is based on the DPI (Fisheries) Fish Habitat Scheme, which assesses the fish habitat potential for watercourses. Fish habitat classifications range from **Class 1** (Major fish habitat) to **Class 4** (Unlikely fish habitat). The application of this classification scheme to watercourses within the study area is presented in **Table 8.9**.

Table 8.9: Classification of Aquatic Habitats

Classification	Watercourse Type	Watercourses within the Study Area
Class 1 Major Fish Habitat	• Large River or Creek. • Permanent Flow. • 'Critical Habitat'.	• Nepean River.
Class 2 Moderate Fish	• Small Medium Stream. • Defined channel. • Pools or Wetlands.	• Peach Tree Creek. • Boundary Creek.
Class 3 Minimal Fish Habitat	• Named or unnamed stream. • Intermittent flow. • Potential refuge. • Minimal defined channel.	
Class 4 Unlikely Fish Habitat	• Named or unnamed stream. • Intermittent flow rain only. • No pools after rainfall. • No aquatic vegetation.	• There are no class 4 watercourses identified within the study area.

Source: DPI (Fisheries)

Two threatened species of invertebrates and two threatened species of fish listed under Part 7A of the *Fisheries Management Act 1994* (FM Act) have potential to inhabit the local area. The two fish

species are also listed as Endangered under the EPBC Act. Additionally, one species, the Australian Grayling is listed as Vulnerable under the EPBC Act but only listed as protected under the FM Act.

Aquatic Flora

Aquatic habitats occurring in the vicinity of the NRPP project comprise freshwater habitats, small tributaries and impoundments, and the Nepean River.

Aquatic vegetation within the Penrith Weir pool (i.e. vicinity of the proposed location of the intake structure) consisted of beds of *Typha* sp., with isolated *Juncus* sp. and *Persicaria* sp. on the banks under a canopy of mature *Casuarina* sp. There was almost a total cover of submerged aquatic vegetation dominated by *Valiseneria americana* (native) and *Egeria densa* (exotic). Other macrophytes recorded in the area include *Creratophyllum demersum* (native), *Hydrilla verticillata* with the algae *Chara sp*. and a small amount of filamentous algae also present. Some sections of gravel and cobble substrate were encountered in shallow edge areas. The floating aquatic weed *Salvinia molesta* (exotic) was common and native *Lemna sp*. was present.

Downstream of the weir two tributaries (Peach Tree Creek and Boundary Creek) enter from the eastern bank. The banks of Boundary Creek are high and held by native and exotic trees, grasses and vines, while Peach Tree Creek channel is shallow, braided with vegetated islands and the backwaters infested with *E. densa*, *V. americana, S. molesta* and *Sagittaria platyphylla*.

Aquatic Weeds

Invasive aquatic weeds such as Salvinia (*Salvinia molesta)* and Dense Waterweed (*Egeria densa)* have been recently identified in the Nepean River in the vicinity of Penrith Weir. Other potentially invasive aquatic weeds identified in the Nepean River include:

- Water Hyacinth (Eichhornia crassipes).
- Alligator Weed (*Alternanthera philoxeroides*).
- Lagarosiphon (Lagarosiphon major).
- Cabomba (Cabomba spp.).

The management of invasive aquatic weeds is addressed in **Section 8.2**.

Aquatic Fauna

Thirty-nine species of fish have been recorded in the mid Hawkesbury-Nepean Catchment. Seven species of fish including one alien species were recorded during sampling for the additional aquatic ecology assessment. Sampling was dominated by the alien fish species Plague Minnow and the native species Flat-headed Gudgeon *Philypnodon grandiceps*.

There are two threatened species of fish listed under the FM Act (Table 1) which have potential to inhabit the local area; Macquarie Perch *Macquaria australasica* listed as Vulnerable and Trout Cod *Maccullochella macquariensis* listed as Endangered (refer to **Table 8.10**). Both species are also listed as Endangered under the EPBC Act. In addition one species, the Australian Grayling *Prototroctes maraena*, is listed as Vulnerable under the EPBC Act and Protected under the FM Act. However, of these species potential habitat is only thought to occur within the study area for the Macquarie Perch.

There are a number of important recreational and migratory aquatic species which are known to occur in the mid Hawkesbury Nepean Catchment. These include the Australian Bass *Macquaria novemaculeata* and the Freshwater Catfish *Tandanus tandanus* both of which are protected from commercial fishing under the FM Act. The Australian Bass is catadroganous (migrates to estuaries to

breed) is stocked in the Nepean River at Penrith and was introduced into the Penrith Lakes system (SKM 2004).

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

Table 8.10: Aquatic Fauna Listed on the FM Act or EPBC Act that have the Potential to Occur in the Local Area

Common Name	Scientific Name	FM Act	EPBC Act	Habitat and Distribution	Potential Habitat Within Study Area
Invertebrates					
Archaeophya adamsi	Adams emerald dragonfly	V		Cool clear streams with gravely riffles and extensive riparian vegetation	No
Austrocordulia leonardi	Sydney Hawk Dragonfly	E		Deep cool pools on slow flowing rocky rivers with steep sides	No
Fish					
Maccullochella macquariensis	Trout Cod	E	E	Inhabits large rivers and streams in the upper Murray Darling Basin often associated with cover such as LWD rock outcrops, boulders and deep holes	No Known from translocated stocks within Cordeaux Dam
Macquaria australasica	Macquarie Perch	V	E	Cool clean water preferring deep slow flowing pools and lakes. Eastern populations are genetically distinct from western populations. Known from Glenbrook Creek and Colo River	Yes Potential habitat within the Nepean weir and river
Prototroctes maraena	Australian Grayling	P	V	Clear gravely coastal streams and rivers from the sea to the first barrier, up to 1000 metres	No Generally found in coastal streams or rivers further south

Key: V = Vulnerable

E = Endangered

P= Protected

Concern has also been shown for freshwater mussels *Hyridella depressa* present within the vicinity of Penrith Weir which are the subject of a current study into their habitat and ability to provide biological filtration of contaminants. Freshwater mussels are known to inhabit gravel and silt substrate generally with some instream cover such as logs, tree roots or boulders through the Nepean system, however only recently has any research been conducted on ecology in the Nepean River.

8.3.2 Potential Impacts

Terrestrial Flora

Construction of the NRPP project has the potential to directly impact upon terrestrial ecology (i.e. flora and fauna) along the pipeline route as follows:

- Clearing of native vegetation along a 400 metre section of the Nepean River's eastern bank.
- Potential loss of habitats for threatened species.
- Fragmentation of riparian habitat creating barriers to faunal movement.
- Weed invasion.
- Destabilisation and erosion of river and creek bank areas.

The eastern bank of the Nepean River supports vegetation that is representative of RFEF a listed EEC under the TSC Act. RFEF is known to occur in the NSW North Coast, the Sydney Basin and the South-East Corner Bioregions and, therefore, this community is not at the limits of its known distribution. The area mapped as RFEF is currently fragmented by existing walking tracks and cleared areas and is restricted to a thin lineal strip of *Casuarina cunninghamiana* adjoining the river. This community is considered to be in poor to moderate condition due to the following factors:

- Extent of current disturbance and degradation.
- Weed dominated understorey (i.e. *Lantana camera*).
- Limited number of habitat resources it provides for threatened fauna species.

Pipeline construction works will require the clearing of a degraded area of native vegetation from a 15 metre wide working width along the initial 400 metres of the pipeline route. The total area of RFEF to be cleared from within the 15 metre wide working width is approximately 0.8 hectares. The total area of River-flat Eucalypt Forest community mapped by DEC (NPWS, 2002) within a 10 km radius of the study area is 1864 hectares.

An Eight Part Test was undertaken in accordance with the provisions of the EP&A Act (refer to **Appendix D**). The results of the Eight Part Test concluded that there will not be any significant impacts on this EEC for the vegetation clearing activities.

Establishment of a 15 metre wide working width will temporarily fragment the RFEF community but not isolate the community from interconnecting areas as the riparian forest and woodland along the eastern bank of the Nepean River is already highly fragmented and disturbed. Revegetation works to be undertaken following the construction activities will include strategies for weed management and the seeding and planting of local native plant species in accordance with a Vegetation Management Plan which will be prepared as part of the overall CEMP.

High levels of disturbance and previous clearing activities along the eastern riverbank have already contributed to a high incidence of weed invasion. This is evident through the understorey being dominated by exotic weed species. Appropriate measures will be implemented to control the spread and proliferation of weeds during pipeline construction. These will be incorporated into the Vegetation Management Plan which will be prepared as part of the overall CEMP.

Clearing of native vegetation along the riverbank is likely to cause a potential erosion hazard and destabilisation. This can result in the sedimentation of downstream watercourses through 'wash-out' and mobilisation processes during rainfall events impacting on water quality and aquatic biota. Such impacts can be adequately managed through the implementation of appropriate stabilisation measures and soil and water management controls (i.e. down gradient sediment fences and straw bales, diversion drainage).

None of the listed threatened plant species, populations or their habitats were recorded within the study area during the survey undertaken by Biosis in June 2005. As such, no Eight Part Tests are required for flora species and a SIS is not required for any flora species as part of the NRPP project. Nevertheless, construction work has the potential to impact upon 23 threatened plant species that have previously been recorded within a 10 km radius of the study area (DEC Atlas of NSW Wildlife database, DEH EPBC online database) and mitigation measures should be in place to minimise any potential impact.

No endangered ecological communities listed on the EPBC Act were recorded within the study area during the June 2005 survey. Subsequently, Assessments of Significance under the EPBC Act have not been prepared for any flora species and a referral under Section 68 of the EPBC Act to the Commonwealth Minister for Environment and Heritage is not considered necessary.

Terrestrial Fauna

No threatened fauna were recorded during the June 2005 survey however potential habitat exists for a number of species. Where there is potential habitat (foraging or breeding resources) for a threatened species in a study area, further consideration must be given to potential impact on these species. The NRPP project has the potential to impact threatened species by causing any or all of the following situations to arise:

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

The study area contains potential habitat for five species listed on the TSC Act (and 15 species listed on the EPBC Act). Potential impacts of the NRPP project on these species have been considered to determine if an impact assessment is required. As the NRPP project is unlikely to cause individual death or injury or loss/disturbance of limited foraging and/or breeding habitat for these species, Eight Part Tests and Assessments of Significance have not been prepared and a SIS is not recommended.

Aquatic Flora and Fauna

Construction of the NRPP project has the potential to directly impact upon aquatic ecology (i.e. flora and fauna) as follows:

- Installation of instream structures, involving the disturbance of the river bed at the intake structure and pump station sites.
- Temporary loss of macrophytes from a construction corridor of approximately 1000 m^2.
- Loss of aquatic habitat and obstruction of fish passage.
- Extraction of river water.
- Sedimentation of watercourses.

The Nepean River is approximately 120 metres wide at the location of the intake structure. The NRPP project will require the installation of an intake structure and connecting pipework to the pump station, which will be built into the eastern bank of the Nepean River. The intake structure will be installed 70 metres into the river and two 630 mm diameter pipelines will be laid under the river bed to connect to the pump station.

The construction of the intake structure will result in the temporary loss of macrophytes from a 15 x 70 metre corridor or approximately 1000 m^2, given the dense cover in this area. The dominant species are the exotic pest *E. densa* and native *V. americana* with beds of *Typha* sp. and *Phragmities australis*

along the bank. It is likely, given the invasive nature of the exotic aquatic weeds in the weir, that the area would quickly be colonised and covered by *E. densa* following the completion of works.

Fish need to move between habitats on their search for food, shelter, reproduction and dispersal into habitats. Barriers to fish passage will occur during construction due to the installation of sheet piling that will extend approximately 70 metres into the Nepean River and be 15 metres wide. Construction of the intake structure, pipework and pump station will be approximately three to four months. Excavating the river bed will be progressive and undertaken during daylight hours. There will also be some limited noise and vibration issues however these will be confined to a small area of the river.

The use of cofferdams and trenching of the pipeline below the substrate has the potential to result in a temporary increase in sedimentation during construction and on the removal dams as well as impacting upon benthic animals within the opened areas.

Habitat for freshwater mussels is found over much of the impacted area, however, the dense cover of macrophytes reduces the availability of habitat. Mussels are generally found in areas of sand gravel or silt substrate with some cover, large woody debris, boulders, or overhanging banks. Some habitat exists close to the bank among boulders placed for bank stabilisation and between macrophyte beds or in cobble silt patches, although the area is not known to support a large population. The construction of the pipelines may encounter a small number of freshwater mussels that would die if left exposed for any length of time.

Aquatic vegetation and substrate is utilised by a number of species of fish as breeding sites. The damage to the substrate may impact upon a small area of breeding habitat for gudgeons and galaxids within Penrith Weir.

No threatened species of aquatic fauna were observed during the survey, however the Nepean River and Penrith Weir provides potential habitat for the Macquarie Perch that is known to occur in Glenbrook Creek to the south west. Assessments of Significance under the EPBC and FM Act have been prepared in relation to the proposed intake pipeline (see Appendix 3). The assessment concluded that the proposal would not have a significant impact on this species.

Key Threatening Processes

Construction and operation of the NRPP project may impact flora and fauna species by key threatening processes (KTP) listed under the TSC Act, FM Act and/or the EPBC Act that could cause a species, population or ecological community to become threatened. KTPs relevant to the NRPP project include:

Clearing of Native Vegetation and Land Clearance

- The proposed works will impact the riparian vegetation along the Nepean River, with some clearing required for the installation of the pipeline and the pump station.

Installation and Operation of In-Stream Structures and Other Mechanisms that Alter Natural Flow Regimes of Rivers and Streams

<u>Nepean River</u>

- The pump station has the capacity to reduce flows and cause a minor drawdown effect upon the Nepean River.
- Intake pipe work would be laid under the bed of the Nepean River for approximately 70 metres to connect the intake structure with the pump station. The intake structures would be supported on concrete plinths on the river bed. These works would be confined within a sheet-piled cofferdam. Construction of the intake structure may temporarily increase the flow velocity in the channel to the west of the cofferdam. The temporary sheet pile coffer dam within the Nepean River would

be designed so as not to exacerbate flooding and to minimise the disruption to the flow regime and geomorphology of the watercourse corridor. This would be achieved by ensuring that:

- The sheet pile will be of an adequate height to accommodate and withstand river level fluctuations during minor storm events, and of an adequate strength that will endure major stormwater flow. The coffer dam structure would allow flow over during a major storm event to enable 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.
- The coffer dam retains the Nepean River for as minimal length as possible.
- Where possible, plant equipment used for excavations and works undertaken at the intake structure would be bank side with long reach arms, to minimise the area of disturbance within the Nepean River corridor.

The impact of the temporary coffer dam is not considered to be an issue due to the amount of the channel remaining open (greater than 50 metres unblocked) and the low velocity of flow (no perceptible flow recorded) during most flow levels.

- The limiting factor with regard to extraction of water from the Nepean River has been identified as the inhibition of fish passage (Bishop, 2005). The pumping regime (start to pump at 500ML/day and cease to pump once flow falls to 350ML/day) has been selected to minimise the impact on aquatic ecology. **Appendix B** (Section 5) provides details of investigations undertaken to determine these pumping constraints.

Boundary Creek and Peach Tree Creek

- Boundary Creek is around one to two metres wide at the proposed pipeline crossing and the creek channel is contained by steep sided banks held by native and exotic trees, grasses and vines. Water in the creek is fast flowing which is largely attributed to a constant discharge of treated effluent from the Penrith Sewage Treatment Plant. Water within the creek is slightly discoloured and odorous.
- Peach Tree Creek channel is characterised by low water flow over a cobble silt base at the proposed pipeline crossing. The water depth is generally less than 0.3 metres with good water clarity, although the backwaters are infested by exotic weeds. The main channel of the creek is less than one metre wide and is framed by high banks.
- River and riparian vegetation in the vicinity of Peach Tree Creek and Boundary Creek has been highly modified and is generally in a poor to moderate condition due to the low number of fauna resources it provides such as hollow-bearing trees, roost sites and foraging areas.
- The pipeline will be progressively constructed across Peach Tree and Boundary Creeks in a temporary sheetpiled cofferdam / caisson. As the cofferdam extends, it will be alternately filled and excavated and filled to provide for the pipe construction. The creek flows will be diverted around the temporary cofferdam during the construction phase. Flow dynamics will be reinstated following installation of the pipeline through reforming the portion of creek banks and cobble area that were displaced, stabilised by vegetating with native endemic species.

Degradation of Native Riparian Vegetation along New South Wales Watercourses

- The construction of the pipeline and pump station will result in the removal of a strip of vegetation along the bank of the Nepean River. This may increase the area's susceptibility to erosion.

Removal of Large Woody Debris

- The construction of the cofferdam and the area within may encounter some LWD, although little LWD was observed in the study site.
- DPI Fisheries recommend the retention of LWD and provide guidelines on the management of LWD for instream works. If impact is unavoidable on approved works then the following options (in order of desirability) are recommended:
  - Impeding sections of the LWD should be lopped.

- LWD realigned outside the construction.
- LWD relocated to a similar channel area and direction within the waterway adjacent to the work.

8.3.3 Mitigation Measures

To reduce the potential impact of the NRPP project on vegetation communities, fauna habitats and terrestrial and aquatic flora and fauna species it is recommended that appropriate mitigation measures are provided during the construction phase. DPI Fisheries was consulted throughout the development of the EA and a number of key policy and guideline documents were reviewed and considered including *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW Fisheries, 2003), and *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (NSW Fisheries, 2003). Key measures include:

Terrestrial Flora and Fauna

- A Vegetation Management Plan will be developed detailing bush regeneration works, weed management strategies and monitoring to be undertaken. The Vegetation Management Plan should be implemented by qualified revegetation contractors and be consistent with any existing management plans for the area.
- Avoid and retain large, mature trees as far as reasonably practicable to maintain existing foraging and nesting habitat resources for common fauna along the eastern riverbank areas and fauna movement corridors. This is particularly relevant for the initial portion of the pipeline adjacent to the Nepean River and in the vicinity of the RFEF stand.
- Vegetation representing ground cover (grass tussocks), understorey (e.g. low shrubs and trees) and tree canopy (e.g. large trees) should be planted during the revegetation process to provide habitat resources for fauna along the length of the pipeline and to minimise loss of connectivity within the area.
- Plants used for any revegetation or landscaping should be native species of local provenance, collected from within a five km radius of the study area. Appropriate species should be selected based on the native vegetation community present in the area. PLDC maintains a seed bank within the Scheme that contains local native species collected from the local community. Plants raised within the PLDC nursery may be suitable for use in the rehabilitation work along the pipeline route.
- Vehicles should be cleaned before and after works are completed each day to ensure weed seed is not inadvertently transported around the construction site.
- Weed biomass material that is cleared from the direct impact zone should be bagged and removed from the site to be disposed in appropriate green waste facilities. Any native biomass material should be left onsite to assist in natural regeneration of the impacted areas.
- Appropriate erosion and sedimentation controls should be implemented, particularly in the vicinity of Peach Tree Creek, Boundary Creek and the Nepean River.

It is envisaged that the application of the above mitigation measures will reduce the potential for impacts and in the longer term will enhance the riparian vegetation strip along the eastern bank of the Nepean River.

Aquatic Flora and Fauna

An Aquatic Flora and Fauna Management Plan will be prepared prior to the construction phase which will include:

- Pumping of water from the Nepean River should be managed to reduce the effects of the abstraction, preserve the natural shape of the flow and not impact on the downstream communities, fish passage and environmental flow requirements of the river (this is addressed

within **Sections 8.1 and 8.2**). Pumping constraints will include: maximum pump rate of 1.0m^3/s, pumping will commence when flows exceed 500ML/day over the weir and cease when flows fall to 350ML./day.

- A Weed Management Plan (including aquatic weeds) should be prepared as a subplan of the Vegetation Management Plan.
- 'Cut to stump' clearing methods should be employed during bank side clearing. This will typically involve leaving stumps of trees temporarily intact to retain bank stability while the construction activities are undertaken.
- Intake structure/pipework construction activities should be scheduled outside fish migratory season i.e. July through to October.
- The intake screens will comprise cylindrical, fine mesh Johnson Screens that will be submerged in a minimum of two metres of water within the Nepean River. The intake structure will operate as a low flow device to minimise the potential for impacts on fish, recreational users, and to reduce the entrainment of sediment and weed fragments on the screens. The designed maximum surface velocity across the face of the intake screens will be 0.15 m/s. The screens will be cylindrical in shape and arranged parallel with the main flow path to allow any passing current to flow along the face of the screen, thus minimising the accumulation of debris on the face of the screen. The intake structure and fishing platform will be located 110 metres upstream of the existing fish ladder at Penrith Weir. DPI (Fisheries) advise that this is an adequate distance to ensure the passage of fish is not adversely impacted.
- Any freshwater mussels located within the construction area or disturbed during excavation of the substrate should be immediately relocated to similar habitat upstream of the pipeline.
- The area disturbed during the excavation of the Nepean River should be rehabilitated by replacing the original soil profile, and through sedimentation controls such as silt curtains and revegetation with *V. americana*.
- Large Woody Debris partially within the construction area should be lopped or realigned to minimise damage to the habitat. Snags or other LWD completely within the cofferdams should be relocated adjacent to the pipeline route.
- Fish trapped within the cofferdam when the construction area is pumped dry should be released back into the weir pool, with any pest species euthanised.
- Implement erosion and sedimentation measures during construction to minimise impact during flood and high flow events.

8.4 Indigenous Heritage

Biosis Research undertook an Aboriginal Cultural Heritage Assessment for the NRPP project in June/July 2005. The assessment aimed to identify any known or potentially indigenous archaeological concerns associated with the NRPP project. A copy of the Aboriginal Cultural Heritage Assessment is provided in **Appendix E**.

The assessment methodology involved the following tasks:

- A search of the NSW DEC's Aboriginal Heritage Information Management System (AHIMS) register.
- A review of previous archaeological and cultural heritage reports applicable to the area.
- Identification of previously recorded archaeological sites within the vicinity of the pipeline route.
- Assessment of impacts and the identification of appropriate mitigation measures to reduce or alleviate any potential adverse impacts on Aboriginal Heritage.
- A site walkover of the pipeline route to identify areas of potential cultural and archaeological significance.
- Consultation with four local indigenous groups (Deerubin Local Aboriginal Land Council, Darug Tribal Aboriginal Corporation, Darug Custodian Aboriginal Corporation and Darug Aboriginal

Cultural Heritage Assessments) was undertaken and representatives from each group participated in a site walkover advising on any areas of potential cultural and archaeological significance along the pipeline route.

8.4.1 Aboriginal Consultation and Participation

An integral component of the Aboriginal Cultural Heritage Assessment has been the involvement of representatives from the Aboriginal community in the preparation of this EA. Consultation activities have included writing to the Deerubin Local Aboriginal Land Council (LALC), the Darug Tribal Aboriginal Corporation, Darug Custodian Aboriginal Corporation, and Darug Aboriginal Cultural Heritage Assessments and informing them of the NRPP project and inviting them to participate in a site walkover.

All groups expressed interest in being consulted on the project and a representative from each of the above groups participated in site walkovers conducted on Wednesday, 20 July and Thursday, 21 July 2005.

Each of the four groups was forwarded a copy of the draft Aboriginal Cultural Heritage Assessment (Appendix E) and their comments are provided in Appendix 1 of Appendix E. All groups are in agreement with the recommendations provided within the Aboriginal Cultural Heritage Assessment report.

8.4.2 Existing Environment

Ethnohistory

The historical abundance of plant and animal resources for food and craft would have influenced Aboriginal movement around the Nepean River. Throughout the 19th and 20th Centuries intensive land clearing associated with agricultural development and urban settlement in the area resulted in land ploughing, the introduction of grasses and significant clearing of the original timber and native vegetation stocks. Native vegetation remnants are currently restricted along the banks of the Nepean River.

The Aboriginal people who lived in the vicinity of the Nepean River belonged to the Darug tribe. The tribe probably comprised 500 to 600 members divided into smaller bands of 40 to 50 people. The movements of these smaller tribal bands would have been influenced by seasonal changes, hunting, and the need to establish shelters.

Tribes living along the Nepean River would have had access to the stone resources in the gravel beds. Two types of rock were found in these beds, chert and basalt, which were utilised to make sharp cutting and scraping tools, and to supply blanks for grinding into hatchet heads.

The earliest account of Aboriginal artefacts in the vicinity of the Nepean River dates back to 1880 when a farmer exhibited eight stone axe-heads turned up by a plough at Castlereagh on the Nepean River floodplain. A number of recent archaeological assessments undertaken in the vicinity of the Nepean River have been completed by Jim Kohen, who has been investigating the archaeological potential within and surrounding the Scheme site since 1981. A detailed account of previous studies undertaken by Kohen is presented in **Appendix E**.

Historically the majority of archaeological sites identified by Kohen have occurred adjacent to waterways, along ridge lines, and on rising ground near swamps. These sites have mainly comprised surface and near ground deposits. The general correlation for the existence of sites is that archaeological potential is likely to exist in areas that have been subject to only limited ground disturbance. Furthermore, although the pipeline route is located in proximity to several water sources

the riverbank areas have been and continue to be subject to considerable water action and disturbance. Within the Scheme boundaries the level of past disturbance resulting from sand and gravel mining, road works and other development is such that potentially archaeologically sensitive landforms have been dramatically reduced or modified.

Aboriginal Land Council Area and Native Title

The study area falls within the boundaries of the Deerubin LALC which is based at Mount Druitt Village.

Land within the study area is not subject to any current native title claims. Review of the National Native Title Tribunal Register of Native Title Claims, Schedule of Native Title Applications, National Native Title Register, Register of Indigenous Land Use Agreements and Indigenous Land Use Agreements Notifications show there are:

- No applications for determination of native title, registered or otherwise.
- No Indigenous Land Use Agreements.
- No native title determinations in the vicinity of the study area.

It is recommended that the native title databases are regularly reviewed throughout all stages of project development (i.e. construction and commissioning).

Known Sites of Significance

A search of the NSW DEC AHIMS was conducted by Biosis Research on a 10 km^2 search area surrounding the NRPP project. The search identified 82 known Aboriginal archaeological sites within the search area, and of these 12 were located within a four km^2 of the study area. Notably three of the 12 sites were recorded as being located in close proximity (i.e. within 200 metres) of the pipeline route. All three sites are open camp sites containing surface scatters of stone, quartz and chert flakes. Sites and items of significance are presented in **Figure 8.3** and **Table 8.11**.

Table 8.11: NSW DEC AHIMS Recorded Aboriginal Archaeological Sites

DEC Aboriginal Site Register No.	Site Name	Site Type
45-5-0290	The Island	Open Camp Site
45-5-318	Penrith Lakes 4	Open Camp Site
45-5-0522	Penrith P/L	Open Camp Site

Source: Biosis Research 2005

8.4.3 Potential Impacts

There were no sites of Aboriginal archaeological or cultural significance identified or found within 50 metres of the NRPP project during the archival searches and site walkovers conducted with members of the Aboriginal community in June/July 2005. It is on this basis that approvals under Section 87 and Section 90 of the *National Parks and Wildlife Act 1974* (NPW Act) are not required.

Whilst historical evidence indicates the Nepean River environments supported Aboriginal occupation, previous and current land uses have more than likely disturbed and/or destroyed Aboriginal artefacts and relics within the upper two metres of the underlying ground profile. The potential does exist for buried or in-situ artefacts to remain at greater depths, but this is considered unlikely along the pipeline route.

8.4.4 Mitigation Measures

Based on the Aboriginal cultural heritage assessment undertaken by Biosis the following mitigation measures would be implemented for the NRPP project:

- Prior to construction a qualified archaeologist will review results of the geotechnical work that is to be undertaken within the sloping area of higher ground at Boundary Creek to determine whether there is any remnant natural soil profile present conducive to containing Aboriginal archaeological relics/artefacts.
- Should any buried or in-situ relic, artefact or material (including skeletal) remains suspected of being of Aboriginal origin be encountered during ground investigations works or during construction the following measures will be applied:
  - All work would cease immediately in the impact area so as to avoid any potential further damage/disturbance to the artefact/relic.
  - The construction contractor would immediately notify PLDC's Heritage Officer to arrange for a NSW DEC officer to attend the site and advise on the appropriate measures to be implemented.
  - Appropriate 'rescue-record' procedures would be implemented in accordance with the requirements of the NPW Act.
- All personnel working on site during construction would receive appropriate training through the provision of awareness briefing sessions and as part of site inductions regarding their responsibilities under relevant NSW legislation (i.e. NPW Act).

All earthworks and pipeline construction works would be monitored by a suitably qualified archaeologist to minimise the potential for damage on any sub-surface items of Aboriginal archaeological interest to occur.

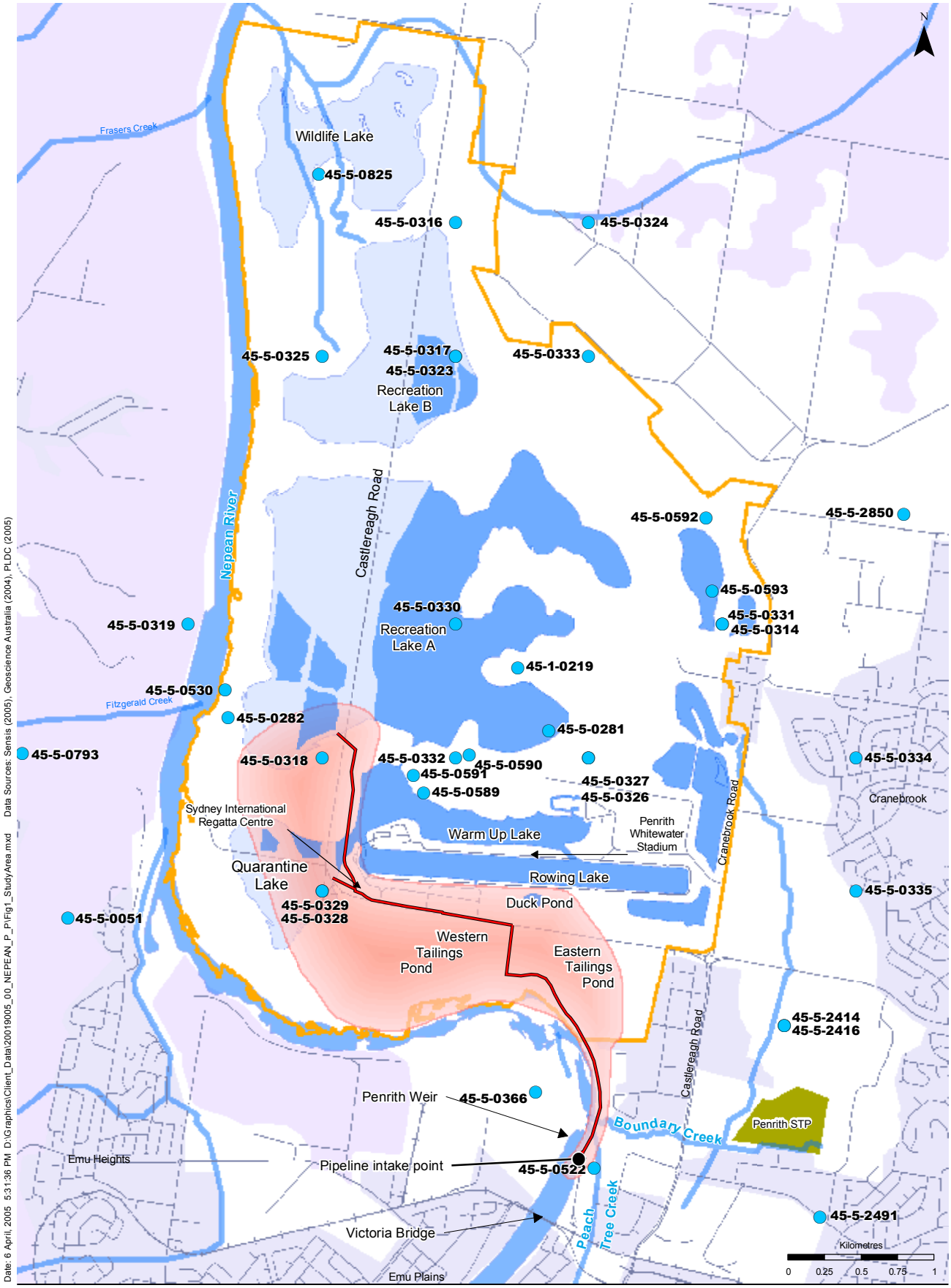

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FIGURE 8.3: INDIGENOUS HERITAGE SITES

8.5 Non-indigenous Heritage

8.5.1 Existing Environment

A Non-Indigenous Heritage Assessment has been undertaken by Maunsell for the study area to identify items of non-indigenous heritage significance potentially affected by the NRPP project. The following background research and tasks were undertaken:

- Search of relevant historical databases; heritage listings and schedules held by Commonwealth State (NSW) and local government authorities, including the Register of National Estate, State Heritage Register, State Heritage Inventory, Register of the National Trust and LEP listings.
- Review of background data and local heritage literature relevant to the area.
- Site walkover.
- Mapping of sites of non-indigenous significance in proximity and surrounding the NRPP project.

8.5.2 Historical Context

European Settlement

The area known as Castlereagh was originally declared by Governor Macquarie in 1810 although the first recorded European settlers were present up to 15 years earlier. The first land grants were made between 1795 and 1799 and were located along the banks of the Nepean River. The land was heavily forested and was cleared with the help of convicts, with much of the timber being transported to Sydney to aid development.

Agricultural activities typically comprised wheat and general crop cultivation prior to the 1820s (Department of Environment and Planning, 1984) however due to changing marketplace demand the emphasis shifted to cattle grazing which became the predominant land use by the mid 19th Century.

A secondary stage of settlement and subdivision took place from the 1860s onwards with the development of additional small holdings and allotments and market gardens in the local area. There was also an increase in the number of cottages being built (typically of the slab and weatherboard variety) and other infrastructure items such as the extension of the railway line to Penrith in 1862. The introduction of rail and road infrastructure to the area precipitated residential and commercial development. The first formal gravel quarry established in the area was the Emu Gravel Company at Emu Plains during the late 19th Century.

Existing Heritage Sites

During preparation of the Penrith Lakes Scheme Regional Environmental Study (RES), an extensive specialist study was undertaken by Fran Bently and Judy Birmingham in 1981 (*RES: History of European Settlement, Working Paper*). The primary purpose of this study was to determine the extent, type and presence of European heritage sites and items in and around the Scheme site. The study identified 75 heritage items including cemeteries, landscape features and structures. As a result of these investigations, six items within the Scheme area were identified under the *SREP No 11 – Penrith Lakes Scheme* as requiring retention, namely:

- Hadley Park.
- Nepean Park.
- McCarthys Cemetery.
- Upper Castlereagh Methodist Church and Hall.
- Upper Castlereagh School and Residence.
- Methodist Cemetery.

These items were identified for preservation and integration into the Scheme's design. As part of the technical and operational requirements of quarrying activities within the Scheme's boundary, some remaining items of interest have been removed. The area where some remaining items are located are represented in grey on **Figure 8.4**. Subsequent reports and studies conducted by Jim Kohen (refer to **Appendix E**) have identified a small number of additional items of non-indigenous heritage interest within the Scheme area.

8.5.3 Relevant Heritage Listings and Schedules

The following registers and listings have been searched and reviewed:

- Australian Heritage Council Register of the National Estate (RNE).
- National Trust Register.
- NSW Heritage Office State Heritage Register and Inventory.
- *SREP No 11 – Penrith Lakes Scheme.*
- *Penrith Local Environmental Plan 1991 (Environmental Heritage Conservation).*

8.5.4 Site Walkover

A site walkover was undertaken during July 2005 by Maunsell to identify the presence of non-indigenous heritage items located along the pipeline route. The purpose of the site walkover was to confirm the removed status or otherwise of all items previously identified, and to check for potential new items.

A total of four non-indigenous heritage items are located within 100 metres of the proposed pipeline route with the greatest concentration of items occurring approximately 100 metres west of the warm-up lake.

A summary of non-indigenous heritage items recorded within 100 metres of the pipeline route is provided in **Table 8.12**. The locations of these non-indigenous heritage items are shown in **Figure 8.4**.

Table 8.12: Heritage Items within 100 Meters of the NRPP Project

Item	Description	Location	Listing
Castlereagh Area	The Castlereagh Area is listed as the earliest official settlement on the Nepean River. Castlereagh has been described as the last remaining remnant of early settlement on the Cumberland Plain, with surviving examples of European building styles from the past 200 years (DEH, 2005). It is important to note that the majority of this area has been quarried within the Scheme boundary and only isolated items of historical interest currently exist within the area.	Upper Castlereagh, Castlereagh Road	Indicative Place on the RNE (place ID 101338)

Item	Description	Location	Listing
Upper Room Chapel, Hall and Cemetery	Methodist Chapel - A chapel with a simple rendered masonry structure, with Ecclesiastical Gothic embellishments. The interior is of a simple style with its major feature being the original box pews. Methodist Church Hall - A simple late Georgian / early Victorian timber framed and weatherboard clad structure with sash windows. Features include a hipped roof with corrugated iron bell enclosure at the top and a lean to veranda with boarded valence. The interior features early wrought iron brackets used to hang lamps and a rope for the roof mounted bell hangs from the ceiling. Methodist Cemetery - A well preserved example of a nineteenth century rural parish cemetery with grave markings ranging from simple headstones (some dating back to the Nineteenth Century) to ornate urn topped pedestals. The most significant grave belongs to John Lees, the church's founder who was transferred from the Castlereagh cemetery some years ago (DEH, 2005).	1727 Castlereagh Road, Castlereagh	National Trust Register Indicative Place on the RNE (place ID 103815) The Chapel and Hall are 'Items of environmental heritage' protected under the provisions of the *SREP 11 – Penrith Lakes Scheme.*
Mouquet farmhouse	A concrete slab remains at the site of the former Mouquet farm on the banks of the Nepean River.	Adjacent to the Nepean River, approximately 350 meters north west of the industrial area.	None

Source: Data from Australian Heritage Database (2005), interpretation by Maunsell (2005)

Plate 3 - Area Classified as the 'Castlereagh Area' on the RNE

Source: Maunsell Australia Pty Ltd, 2005

Plate 4 - Methodist Cemetery

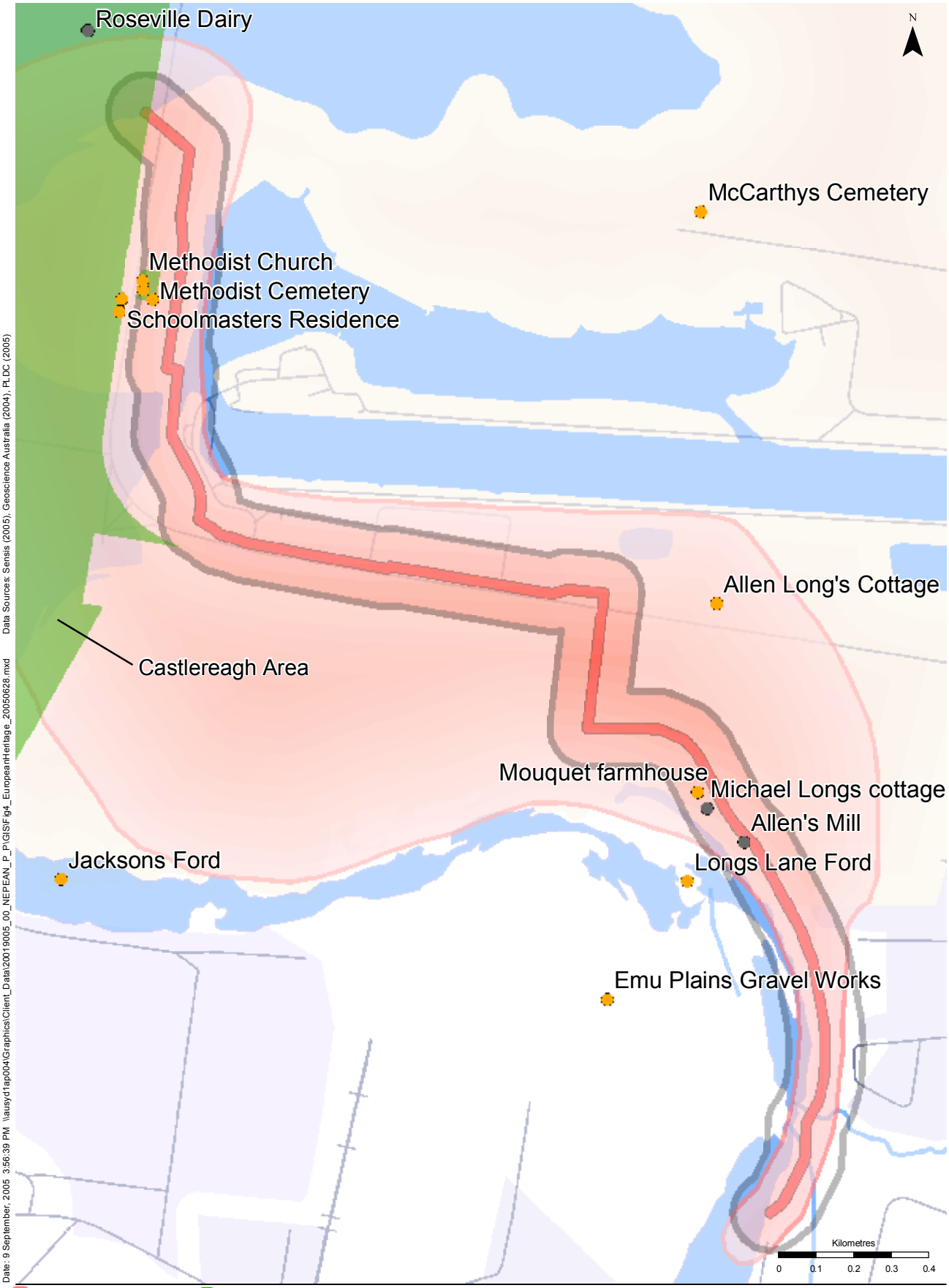
Source: Maunsell Australia Pty Ltd, 2005

Plate 5 - Methodist Chapel

Source: Maunsell Australia Pty Ltd, 2005

Plate 6 - Mouquet Farm Slab

Source: Maunsell Australia Pty Ltd, 2005



Data Sources: Sensis (2005), Geoscience Australia (2004), PLDC (2005)

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FIGURE 8.4: NON-INDIGENOUS HERITAGE ITEMS IN PROXIMITY TO THE NRPP

8.5.5 Potential Impacts

Castlereagh Area

The pipeline route crosses the Castlereagh Road alignment and traverses the 'Castlereagh Area' for approximately 20 metres before discharging into Recreation Lake A. The Castlereagh Area is listed on the Register of National Estate (RNE) as an 'indicative' place. The Australian Heritage Council is currently determining whether this place indicative should be entered onto the RNE. No decision had been made on this listing during the preparation of this EA.

The majority of the pipeline route traverses areas modified by previous and current land clearing and development activities and, therefore, will not directly impact upon any non-indigenous heritage item of significance with the exception of Castlereagh Road. Castlereagh Road is one of the oldest roads in Australia but is not protected under any heritage listing.

Upper Room Chapel, Hall and Cemetery

Although the pipeline route alignment does not directly impact on the Upper Room Chapel, Hall and Cemetery area, the alignment is approximately 80 metres from the chapel and hall and approximately 50 metres from the eastern boundary of the cemetery. The Upper Room Chapel, Hall and Cemetery area is listed on the RNE as an 'indicative' place and no decision had been made on this listing during the preparation of this EA.

The Upper Room Chapel and Hall (but not the cemetery), are listed under the SREP 11 as items of environmental heritage. Clause 14 of the SREP 11 states that development consent from the Minister for Planning under the EP&A Act would be required to:

a) demolish, renovate or extend the building or work,

b) damage or despoil the relic or place, or any part of the relic or place,

c) excavate any land for the purpose of exposing or removing the relic, or

d) erect a building on the land on which the building, work or relic is situated, or the land that comprises that place, except with development consent.

However, as direct impact of the Upper Room Chapel and Hall is not anticipated development consent would not be required.

Clause 15 of the SREP 11 states that consent should not be granted to development in the vicinity of an item of environmental heritage unless an assessment has been made of the impact of the NRPP project on:

> *'the historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance of the item and its setting.'*

It is anticipated that the pipeline would not have an adverse impact (as defined under Clause 15 of SREP 11) on the Upper Room Chapel and Hall for the following reasons:

- The Upper Room Chapel and Hall area are situated approximately 80 metres from the pipeline route and, therefore, would not be adversely impacted or incur structural damage as a result of pipeline development.

Mouquet Farm

Whilst the Mouquet Farm site is in a degraded state (i.e. only the base slab remains), and it is not listed on any heritage registers, it lies directly adjacent to the pipeline route. Subsequently, the pipeline route alignment has been adjusted so as not to adversely impact on the remains of Mouquet Farm.

8.5.6 Mitigation

The principal form of mitigation is avoidance to minimise potential impact on and damage to non-indigenous heritage items. This can be achieved by realigning the pipeline route where it is practicable to do so.

Recommended mitigation measures to be implemented for non-indigenous heritage items include:

- Should any item be encountered during construction of the NRPP project, which is suspected to be a relic of heritage value, all work would cease that may expose the area to damage or disturbance. The Construction Environmental Manager would be notified immediately, and appropriate arrangements would be made to contact a representative of the NSW Heritage Office or other suitably qualified personnel to attend the site.
- All personnel on the site would be made aware of their responsibilities under the *Heritage Act 1977* and the location and proximity of construction works to the following non-indigenous heritage items:
  - Castlereagh Area.
  - Upper Room Chapel, Hall and Cemetery area.
  - Mouquet Farm hardstand slab.
- Temporary construction signage would be erected to advise on the proximity to heritage items (pending agreement with property owners) to secure the area.

The requirements under Section 140 of the *Heritage Act 1977* to the NSW Heritage Office may need to be satisfied for disturbance or potential disturbance to items of non-indigenous heritage interest during site earthworks and pipeline construction.

8.6 Urban Design, Landscape and Visual Amenity

8.6.1 Existing Environment

The local landscape character along the pipeline route and surrounding the pump station and control building sites is characterised by a mixture of degraded riparian forest and woodland interspersed with exotic plant communities along the eastern bank of the Nepean River, bare ground and disturbed grassland associated with the Penrith Valley Industrial Area near Cassola Place, and quarrying areas on the southern part of the Scheme site. The Nepean River flanks the southern and western boundaries of the Scheme. Two minor watercourses, Peach Tree Creek and Boundary Creek flow across the southern part of the study area, approximately 200 metres and 300 metres north of Penrith Weir respectively. Views from the Penrith Weir are framed by 10 to 15 metre high riverbanks of the Nepean River to the west and east, and the long views along the Nepean River channel which extend north and south.

On the high bank of the Nepean River there is a strong visual contrast between the urban and industrial areas to the east and the natural river environment and Blue Mountains escarpment beyond to the west.

The built form is typically two to three storey high commercial buildings with front and side access and parking areas.

Inside the Scheme boundary the landscape is dominated by the quarrying activities and largely comprises a cleared and highly modified landform, predominantly devoid of vegetation. This contrasts to the natural character of adjacent water bodies such as the Rowing Lake, Warm-up Lake and Duck Pond. Castlereagh Road delineates the Scheme site passing through the southern portion before heading north and intersecting West Wilchard Road to the north of the Scheme.

Plate 3: Proposed Location of the Pump Station

Source: Maunsell Australia Pty Ltd, May 2005.

Plate 2: Proposed Location for the Control Building that will House the Electrical Supply for the Pipeline

Source: Maunsell Australia Pty Ltd, May 2005.

8.6.2 Potential Impacts

Construction

Impacts on the local landscape and visual amenity will largely occur during and for a period after, construction of the pipeline, pump station, control building and intake structure. During this time, construction plant and vehicles will be moving along the working spread stripping topsoil, excavating the pipe trench and laying the pipe, together with constructing the control building, pump station and intake structure. The stripped working width will be approximately 15 metres. The impact of these works will be greatest at Weir Reserve and a small area along the lower riverside terrace of the Nepean River which may affect recreational users of this area in the short-term.

There is likely to be some temporary and minor impacts on the visual amenity at Weir Reserve and along the short stretch of the Nepean River's eastern bank for recreational users at this locality during the construction of the control building, pump station and vehicular access.

Operation

Once the pipeline has been installed and reinstated, the permanent effects of the NRPP project will be attributed to:

- Introduction of aboveground structures (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 will be installed at intervals along the pipeline route, particularly at watercourse crossings and at changes in direction.
- Some temporary change to the existing vegetation structure and pattern within the revegetated/reinstated areas along the pipeline route.

The new control building would be co-located with an existing public amenity block within Weir Reserve. It would house the necessary electrical and instrumentation equipment to operate the pumps, and would be approximately 75 m^2 in area, and 3.8 metres in height. The building facade would comprise a range of materials, finishes and colours to integrate into the local landscape and reduce visual intrusion. Planting to screen this building would be inappropriate in the open landscape of Weir Reserve and, therefore, is not proposed.

The pump station will be excavated into a terrace on the eastern bank of the Nepean River. A mass concrete slab and/or rock anchors will also be installed at the pump station site to stabilise the structure. This will alter the existing vegetation cover and riverbank profile within the riparian zone, however, it will also provide the opportunity to install a platform that would cantilever approximately three metres over the river channel from the bank. This platform could be used for recreational fishing, birdwatching and the enjoyment of uninterrupted views up, down and across the river. Hard-standing areas and an asphalt access road will also be constructed to enable maintenance crews to perform routine checks on the pumping equipment. Appropriate landscaping measures could be incorporated to announce the 'GRW' as part of a 'gateway' concept.

Visual evidence of the re-established pipeline route and the aboveground structures will diminish over time and, as the revegetation works establish and the built elements integrate into the landscape fabric. It is considered that there will be no long-term adverse impacts associated with the NRPP project.

8.6.3 Mitigation Measures

Construction

Construction of the pump station, control building, and pipeline would be undertaken in a staged and timely manner to minimise impacts on local visual amenity. During construction work areas will be designated and clearly defined to minimise disruption and reduce impact to the public, particularly in the vicinity of Weir Reserve.

The following measures and controls are recommended to mitigate potential impacts on the local landscape:

- Reinstatement of the working width along the entire length of the pipeline route, as soon as reasonably practicable to restore the landscape fabric and re-establish the visual integrity.
- Designate construction areas as early as possible and clearly define access and movement corridors to minimise disruption to the community and extent of native vegetation clearance.
- Ensure the height of temporary topsoil stockpiles and spoil mounds are kept under two metres.

Operation

Allowing for relevant safety and design standards, minimum size footprints for the control building and the pump station have been configured and a location identified to reduce potential visual impacts. The height of the control building and pump station, have been kept as low as possible (i.e. less than four metres in height). An appropriate range of materials, colours and textures (i.e. textured paint finishes) will be integrated into the building designs and hard surfaces to take account of surrounding landscape colours, seasonal changes and variable light conditions.

8.7 Topography, Geology and Soils

Douglas Partners carried out a full geotechnical investigation for the NRPP project in October 2005 (Douglas Partners, 2005). The field investigation comprised boreholes with in-situ testing and sampling to provide information on the subsurface stratification along the route of the pipeline and the pumping station and control building locations. The investigation provided information on the subsurface conditions and commented on excavation, batter slopes, groundwater, ease of construction and foundations. A desktop review of the Penrith 1:100,000 scale geological series sheet was also undertaken.

Note that the field investigations were based on the original location of the pumping station and control building, as proposed in the Concept Design. The final locations of these infrastructures are different and no additional geotechnical investigations have been carried out to determine the ground conditions at the final selected sites.

8.7.1 Existing Environment

Topography

Terrain along the pipeline route is characterised by gently undulating topography. Ground elevations along the length of the pipeline are generally between 20 and 25 metres Australian Height Datum (AHD).

The geomorphology along the pipeline route and at the sites of the control building and pump station comprises the following landforms:

- Water bodies (i.e. the Nepean River and associated tributaries).
- Floodplain.
- Disturbed terrain, including quarry areas on the Scheme site.

The NRPP project is located on floodplain, where extensive commercial quarrying of sand and gravel has occurred. The current landform within the site has been largely modified and created as a result of backfilling quarried land with overburden soils and /or settled fines from quarrying operations. A number of creeks previously crossed the site (e.g. Cranebrook Creek) but have since been diverted by quarrying operations.

Geomorphology – eastern bank of Nepean River

Between chainage 400 metres and 1700 metres, the proposed pipeline alignment will be five metres from the eastern bank of the Nepean River from a point immediately upstream of the weir to immediately upstream of Jackson's Ford.

A desktop geomorphology study of the river within this reach was undertaken to determine the potential for erosion and instability. Records on relevant historical information were gathered and examined. These included:

- Aerial photographs for 1983, 1998 and current conditions sourced from PLDC
- Historical parish plans from the Department of Lands website
- Reports from previous studies:
  - A Geomorphological Assessment of Erosion on the Banks of the Nepean River (WRL, 2000)
  - A Baseline Geomorphological Assessment of Erosion on the Banks of the Nepean River (WRL, 2003).

A comparison of the aerial photographs indicated that vegetation stands and tracks along the eastern bank did not appear to have changed relative to each other and the river alignment. Similarly, the parish maps also indicated no significant shifts in the location of the eastern bank.

The study area in the Baseline Geomorphological Assessment of Erosion on the Banks of the Nepean River (WRL, 2003) report was further downstream, along the reach on the west side of the Lakes development. In it, some sites that had been assessed in the 2000 study were revisited. It was found that there were still signs of erosion at a couple of these sites, while others had stabilised due to vegetation growth. This report also noted that there was negligible geomorphic change through the study area resulting from the 1990 flood and that this, plus substantial vegetation cover, meant that banks were unlikely to alter in future high flow events.

An earlier study covered a smaller area along the reach on the west side of the Scheme, but also presented some results from a 1990 study undertaken by Outhet and Hurst, which indicated a couple of areas where there were retreating scarp lines along the eastern bank within the reach being considered for the pipeline alignment, and in particular, an area at the confluence of Peach Tree Creek (WRL, 2000).

The earlier study found that within the reach west of the Scheme a number of areas where scour had been previously documented had been stabilised by vegetation growth or by restricting activities such as vehicular access.

In conclusion, a review of historical records has found no evidence that significant changes will occur in the eastern bank alignment of the Nepean River along the proposed pipeline alignment.

Areas where erosion has previously been documented have subsequently been found to have stabilised in a number of cases. This has been due to revegetation or protective works and a restriction of activities that induce erosion such as mining or vehicular access.

It is considered that the eastern bank area along the proposed pipeline alignment should be stable, provided that:

- No significant disturbances causing river bank instability along this alignment occur (e.g. mining or vehicular access); and
- Vegetation cover, particularly good groundcover, is maintained along the river bank for the entire length of the pipeline alignment.

In addition, the condition of the eastern bank of the river within this reach should also be examined prior to construction of the pipeline and any locations where erosion potential may be an issue should be identified, for example the confluence of Peach Tree Creek, and rehabilitation works be undertaken. Regular inspections should then be undertaken to ensure that the integrity of the river bank is maintained.

Geology and Soils

The 1:100,000 scale geological map of Penrith (Geological Survey NSW, 1991) indicates the site is situated on the Cranbrook Formation, a quaternary deposit comprising gravel, sand, silt and clay. The study area is underlain by Ashfield and Bringelly shales of the Wianamatta group and aluminium from the Quaternary period.

The Bringelly group of rocks comprise shale, carboniferous claystone, laminate, fine to medium grained lithic sandstone, rare coal and tuff. This rock formation upon weathering typically forms silty clays soils of moderate to high reactivity.

The Quaternary aluminium consists of quartz, lithic 'fluvial' sand, silt and clay.

The drilling of boreholes during the ground investigations undertaken by Douglas Partners (October 2005) indicated that the southern section of the pipeline route is underlain by stiff, dark brown silty sandy clays and sands overlying shale bedrock up to depths of 8.5 metres below ground level (bgl). Once on the high riverbank and on approach and within the Scheme site fill overburden was encountered overlying residual clays varying in depths of up to 2.5 metres bgl.

The 1:100,000 scale Soil Landscape Series Sheet of Penrith (1989) indicates soils within the Scheme are largely undisturbed and consist of yellow podsolic soils and yellow-brown earths greater than 1.5 metres deep. This information is not consistent with actual site conditions due to the extensive quarrying and backfilling operations that have taken place since this map sheet was published in 1989. Soil along the initial part of the pipeline alignment (outside the Scheme boundary) comprises sandy clay, silty clay, cobbles and sand, and shales (Douglas Partners, 2005).

Where backfilling of quarried areas has been undertaken, overburden material has been used and fill depths are typically in the order of 20 metres. Placement of this material has been undertaken to varying levels of compaction and engineering standards depending on location and intended future land use. These standards are as follows;

- **"Non spec" fill -** General filling operations where the fill is placed in layers and compacted systematically using earthmoving equipment. This method has the potential to impact on future construction and non-spec fill should be tested to determine compaction results.
- **"Engineered" fill -** Areas designated as Building Land, where the upper two metres or 25 per cent, whichever is greater, has been compacted to a controlled standard suitable for development. This is tested during placement to ensure that it meets the required specification- in this case a minimum dry density ratio of 98 per cent of the maximum dry density obtained by the "Standard Compaction Test", AS1289 test E2.1.
- **Fill forming lake edges -** Spread in layers and compacted to a minimum dry density ratio of 95 per cent "Standard Compaction".

The physical characteristics of the created landform soils have been subject to extensive testing during construction, which indicate that the physical character of the soils is likely to be better established than is the case for natural landforms (Coffey, 2001).

Contamination

Potentially contaminating activities previously carried out within the Scheme boundary include agriculture, quarrying activities and a former composting facility.

Potential agricultural contaminants from dairy and turf farming would be generally confined to specific locations and activities including storage and use of pesticides, storage and use of hydrocarbons, machinery and vehicle maintenance areas and the use of asbestos cement pipes for irrigation. Asbestos cement pipes have been recently removed to licensed waste disposal areas, however additional pipes may still be present within the proposal site.

Quarrying and earthmoving activities previously conducted in the area may have produced contaminants such as hydrocarbons from fuel storage and vehicle maintenance, but these would

be confined to specific areas and the potential for residual contamination is likely to be low due to the shallow depth of penetration of contamination and the homogenisation and mixing of the soils during quarrying activities (Coffey, 2001).

A former composting facility operating to the west of the Scheme area has the potential to produce some contaminants such as hydrocarbons and possibly asbestos from former buildings, however the area is unlikely to be affected by the proposed route option for the pipeline.

A groundwater plume has been identified to the east of the pipeline alignment in the vicinity of Cassola Place. Previous environmental site assessment results indicate the plume is contained within an underlying aquifer and is progressing west toward the Nepean River. General depth of the plume is approximately six metres. Maximum depth of construction work for the NRPP project in the vicinity of the plume is anticipated to be 3.5 metres and therefore it is considered that the construction activities will not significantly intercept the groundwater plume.

Salinity

Salinity occurs when salts naturally found in soil landscapes and groundwater mobilise, allowing capillary use and evaporation to concentrate that salt at the ground surface. These movements are caused by changes in the natural water cycle and land use practices. The principal affects of salinity include damage to vegetation due to salt scolding on the land surface, eroded/flaking brickwork, cracking of concrete, corrosion of steel and damage to road pavements including cracking and potholing.

Areas of known or potential soil salinity hazard have been identified in parts of Cranebrook Creek and its floodplain (DLWC, 2000) within the Scheme, however these areas are relatively isolated and are unlikely to be disturbed by the NRPP project. Overall, the NRPP project is situated in an area of moderate salinity potential.

Groundwater and Hydrogeology

The study area lies within the Hawkesbury / Nepean catchment and has an average annual rainfall of approximately 800 mm to 1,000 mm. Groundwater measurements conducted by Coffey Geosciences between 1998 and 1999 show that water levels varied between RL 11.7 metres and 13.2 metres, (i.e. approximately eight metres to 10 metres below the ground level) (Coffey, 2001).

Registered groundwater bores located within one km of the boundary of the Scheme area indicate that the groundwater in the area has an average conductivity of between 680 micro siemens per centimetre to 1005 micro siemens per centimetre (information obtained from DNR (formerly DIPNR) records. The permeable aquifer formed by the basal gravels has been removed by quarrying and has been largely replaced by low permeability soils.

8.7.2 Potential Impacts

Construction

Potential impacts resulting from construction of the NRPP project are not expected to be significant due to the type of construction required for the pipe trench excavation / laying / backfilling and the presence of compacted soil and naturally occurring soils and landforms.

The construction process will require some vegetation clearing to create a working corridor, which will involve the movements and exposure of soil increasing the potential of erosion and runoff hazards by wind and by water action (i.e. sediment ‘wash-out’).

There is potential for aeolian (wind) erosion to occur from unsecured stockpiles, spoils and exposed ground along the working width during the construction works.

Due to the relatively short construction period, any potential erosion impacts are expected to be relatively minor and short term. However, even minor soil erosion, if poorly managed, has the potential to contaminate adjacent water bodies, increasing turbidity and suspended sediment loads, and otherwise reducing water quality.

Furthermore, soils encountered in the Scheme include dispersive clays that would be prone to erosion when exposed during the construction process. Soil erosion would be exasperated when exposed to running water, such as groundwater inflows or rainfall and runoff.

Trench excavations will be above groundwater levels for the majority of the pipeline route. Groundwater inflows are more likely to be a consideration during construction of the pump station where excavation below the water table will be required for the intake structure.

The pipeline route runs between two tailings ponds on the southern part of the Scheme. These ponds comprise deep and very soft unconsolidated sediments, which have the potential to affect stability and compaction during the trenching process.

There is some potential for the banks at the proposed creek crossings to become destabilised during vegetation clearance and construction. The banks of Peach Tree Creek in the vicinity of the pipeline crossing are more deltaic, and not as steep as at Boundary Creek and therefore present less risk of instability.

The potential also exists for sedimentation to occur during the excavation and backfill processes at both creek crossings. Such sedimentation would result in some temporary adverse impacts on the water quality and aquatic biota in these creeks, particularly in the immediate downstream areas from the construction activities. Appropriate soil and water controls will be installed to minimise such impacts.

Operation

Once the NRPP is installed and rehabilitation activities have been completed, potential impacts to the topography, geology and soils of the area resulting from the operation of the NRPP are expected to be negligible.

8.7.3 Mitigation Measures

A series of mitigation measures have been developed to minimise potential impacts related to topography, geology and soils during the construction of the NRPP. Such measures include:

- A Soil and Water Management Plan (SWMP) including an Erosion and Sediment Control Plan (ESCP) will be prepared by the construction contractors prior to the commencement of construction works. These plans will contain a series of appropriate soils and water controls that will need to be installed both up/down gradient of the working width to manage the ingress of sediment- laden runoff entering local watercourses and/or diverting clean surface waters away from the construction areas. The SWMP will include measures to be employed in the management of any dewatering required during the excavation of the pipe trench.
- Vegetation clearance needs to be limited to that required as a minimum for the purpose of construction and where possible should be conducted as required rather than pre-empting construction.

- A temporary coffer-dam or similar structure will be constructed downstream of the construction activities prior to any excavations at the Boundary Creek and Peach Tree Creek crossings and water will be diverted around the construction zone in order to maintain natural drainage flows. Water discharged from the construction zone will be filtered through a crush rock dam, or similar device prior to re-entering the creek.
- The excavated pipe trench will be shored at the creek crossings to provide stability during construction.
- Rock and clean fill excavated from the creek will be moved to a separate bunded area, away from the creek bank and fenced off to dry out. This rock and clean fill will be used to reshape the creek banks to their original form on completion of the works.
- Graded rock 200 mm to 400 mm in diameter should be placed over the trenched area of the creek bed to protect it from erosion by flowing water during re-establishment.
- The stability of the reinstated creek banks will depend largely on the compaction of the backfill. A series of rehabilitation techniques may be employed to provide the ongoing stability of the banks. These techniques will be detailed in the contractor's rehabilitation plan.
- The creek banks will be re-contoured to their original form using the previously extracted materials, covered with geofabric, jute matting and/or coir matting and replanted with native vegetation. Revegetation will extend from the toe, up the bank using seedlings and reasonably established tube stock, up to two metres in height where appropriate.

8.8 Noise and Vibration

Wilkinson Murray undertook an Environmental Noise Assessment in June 2005 to review construction and operational noise impacts associated with the NRPP project. The Environmental Noise Assessment was prepared in accordance with the requirements of the NSW 'Environmental Noise Control Manual' 1994 (ENCM) and Industrial Noise Policy (INP) 2000. A copy of the Environmental Noise Assessment is provided in **Appendix F**.

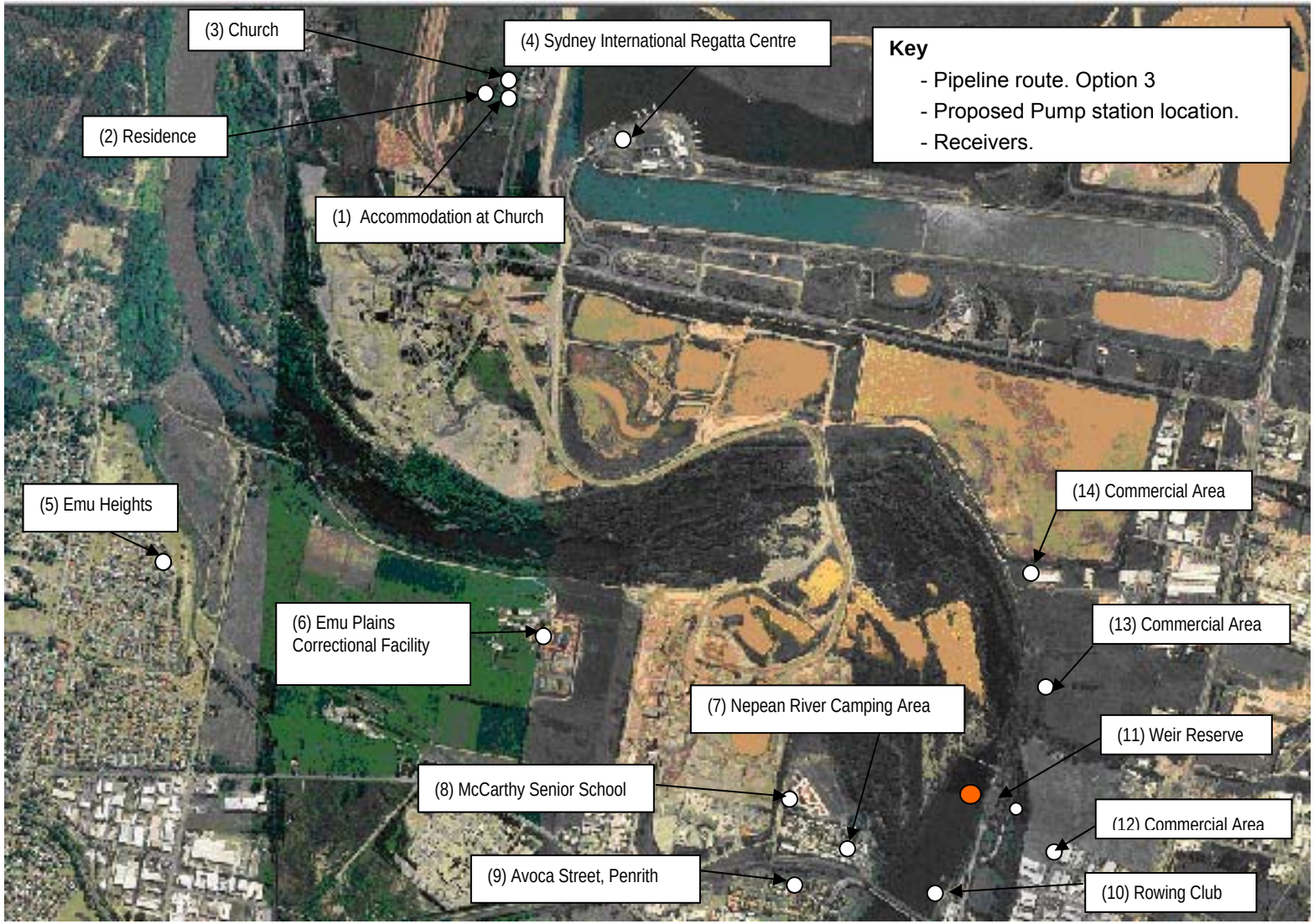
8.8.1 Existing Environment

Noise Sensitive Receivers

Noise sensitive receivers in proximity (i.e. between 250 metres and three km) of the NRPP project include an industrial/commercial area; Weir Reserve; Nepean Rowing Club; Nepean River Caravan Park; McCarthy Senior School; Avoca Street, Penrith; Sydney International Regatta Centre; locality of Emu Heights; Emu Heights Correctional Facility.

The nearest noise sensitive receiver to the NRPP project is located immediately adjacent to the pump station and control building (i.e. Weir Reserve). A number of sensitive receivers in the vicinity of the NRPP are shown in **Figure 8.5**.

Figure 8.5: Noise Sensitive Receivers



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

Background Noise Levels

Ambient noise levels were measured using both unattended and attended noise measurements. Unattended measurements were recorded at two locations (i.e. locations 9 and 10 in **Figure 8.5**) in the vicinity of the study area, between 8 and 16 June 2005, using unattended noise loggers. Additional daytime attended noise measurements were conducted at three locations (Church accommodation and residence, Emu Heights, and Emu Plains Correctional Facility) in the vicinity of the study area and directly adjacent to the pipeline route on 8 June 2005.

Results of the unattended and daytime attended ambient noise monitoring are presented in **Table 8.13**.

Table 8.13: Unattended and Daytime Noise Monitoring Results

Location Number	Description	RBL*, Background Noise, dBA			L_{Aeq} Period Noise, dBA		
		Day	Evening	Night	Day	Evening	Night
(9)	22 Avoca Drive	44	44	34	54	51	51
(10)	Rowing Club	44	44	37	54	51	50
(1) & (2)	Church accommodation and residence**	44	-	-	52	-	-
(4)	Emu Heights**	40	-	-	50	-	-
(5)	Emu Plains Correctional Facility	39	-	-	49	-	-

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

*Notes: * RBL=Rating Background Levels. RBL for each period is the median value of the Assessment Background Level values for the period over all the days measured. There is an RBL value for each period, day, evening and night.*

*** Attended noise monitoring locations estimate of RBL levels.*

8.8.2 Relevant Noise Criteria

Construction Noise Criteria

Criteria for Residential Receivers

The Environmental Noise Control Manual, Chapter 171 (NSW Environmental Protection Authority, 1994) specifies criteria applicable for construction activities. Although the manual is no longer considered NSW DEC approved guidance, the construction noise section in Chapter 171 is still referenced as no other construction noise guidelines were available during the preparation of this EA. The NSW DEC has advised that it is currently developing new draft guidelines for managing construction noise, which will adopt a 'best practice' type approach that attempts to reduce construction noise to a level that is limited by what is feasible and reasonable. It is understood that the release of this document is imminent.

The noise descriptor used to assess construction site noise is the L_{A10} noise parameter. It refers to the noise level that is exceeded for 10 per cent of the sample period. A summary of allowable L_{A10} exceedances for varying lengths of construction periods is provided in **Table 8.14**.

Table 8.14: Allowable Exceedances of Background Noise Criteria

Construction Period	Criteria
Four weeks or less	20 dB(A)
Four weeks to 26 weeks	10 dB(A)
Greater than 26 weeks*	5 dB(A)
Tonal or impulsive noise	+5 dB(A) penalty

Source: NSW DEC ENCM

* *Although not clearly stated by DEC, it is considered that for construction periods longer than 26 weeks, the L_{A10} noise level should not exceed the L_{A90} level by more than 5dBA.*

Although construction works for the NRPP project will be progressive and not limited to a specific area for any duration greater than 26 weeks, the overall construction duration for the NRPP project would exceed 26 weeks, and therefore the criteria for a construction period greater than 26 weeks (i.e. 5dB(A) is applicable for the NRPP project).

Table 8.15 summarises the relevant construction noise criteria for those residential receiver locations potentially affected by construction noise from the NRPP project.

Table 8.15: Daytime Residential Construction Noise Objectives

Location Number	Description	L_{A10}, Construction Noise Objectives[3]
(1)	Church accommodation	49
(2)	Residence	49
(5)	Emu Heights	45
(6)	Emu Plains Correctional Facility	44
(7)	Nepean River Camping Area	49
(9)	22 Avoca Drive	49

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

Where construction noise is unavoidable at residential premises, the NSW DEC ENCM guidelines recommend that construction activities adhere to the following time restrictions:

- Monday to Friday, 7 am to 6 pm with a maximum of nine hours per day.
- Saturday, 7 am to 1 pm if audible on premises, otherwise 8 am to 1 pm.
- No construction work to occur on Sundays or public holidays.

Noise Criteria for Non-residential Receivers

There are no construction noise criteria for non-residential receivers. For commercial receivers and schools it is not appropriate to assess construction noise impacts against residential receiver criteria as the commercial activities and teaching within schools typically occur inside buildings. Therefore as a conservative measure, it is recommended that the operational noise criteria be used as the construction objectives. If these levels are exceeded it would trigger the development of a construction noise management plan to consider all reasonable and feasible noise mitigation. Construction noise criteria for non-residential receivers are listed within **Table 8.16.**

[3] 'Best practise' is required where NSW DEC ENCM 1994 objectives cannot be met.

Table 8.16: Construction Noise Criteria for Non-residential Receivers

Number	Location	Construction Noise Objectives, L_{A10} (dBA)		
		Day	Evening	Night
(3)	Church	40 (inside rooms), approximately 50[4] (outside rooms)		
(4)	Sydney International Regatta Centre	65		
(8)	McCarthy Senior School	40 (inside rooms), approximately 50[6] (outside rooms)		
(10)	Rowing Club	65		
(11)	Weir Reserve	50		
(12)	Commercial Area	65		
(13)	Commercial Area	65		
(14)	Commercial Area	65		

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

For a passive recreation area such as Weir Reserve the construction noise criteria would typically be assessed at the closest boundary to the noise source. However, as the pump station, control building and to some extent the pipeline corridor are located partially within Weir Reserve this is not possible. On this basis, it is proposed that the construction noise criteria be considered at the boundary of the construction compounds established for the construction of the pump station, control building (in Weir Reserve) and the pipeline corridor (on the high bank of the Nepean River) (i.e. at a distance of 30 metres).

Operational Noise Criteria

The only noise sources likely to result in operational noise impacts are from the pump station adjacent to the Nepean River and the control building located in Weir Reserve.

For operational noise, relevant criteria are described in the NSW Government's *Industrial Noise Policy* (INP) (NSW EPA, 2000). When determining the potential noise impact on residential receivers, two forms of criterion are considered and these are known as 'intrusiveness' and 'amenity' criteria.

The intrusiveness criterion applies to the L_{Aeq} noise emission level for the introduced industrial source, measured over a period of 15 minutes. It requires that this should not exceed the RBL by more than five dB.

The amenity criterion sets an absolute limit on the value of the L_{Aeq} noise level measured over a day, evening or night period. 'Acceptable' limits apply to the total noise from all industrial sources affecting a receiver location. Where existing industrial noise levels are above or near the acceptable noise levels the new noise source should be designed to a level where it does not contribute to the total level so that the $L_{Aeq,\ period}$ levels do not increase.

As noise sources from the proposed plant will be relatively constant, the L_{Aeq} level of noise measured over 15 minutes can be assumed to be equivalent to that measured over a longer period. Based on information presented in **Table 8.13**, a summary of the relevant operational noise criteria for those residential receiver locations potentially affected by noise from the NRPP project is presented in **Table 8.17**.

[4] Assuming a 10dB reduction from inside to outside with windows open

Table 8.17: Residential Operational Noise Criteria

Number	Location	Intrusive Noise Criteria $L_{Aeq, 15minute}$			Amenity Noise Criteria $L_{Aeq,Period}$		
		Day	Evening	Night	Day	Evening	Night
(7)	Nepean River Camping Area	49	49	39	45	35	30
(9)	22 Avoca Avenue	49	49	39	45	35	30

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

The appropriate project specific noise level for residential receivers for the NRPP project would be the night time amenity criterion, as the pump station and control building could potentially be operating 24 hours per day (i.e. at any time when flow over the Penrith Weir meets the pumping requirements).

Criteria for Non-residential Receivers

For non-residential receivers such as commercial premises, schools, and passive recreation areas, the INP provides relevant operational noise criteria. **Table 8.18** summarises the relevant operational noise criteria for non-residential receiver locations potentially affected by operational noise from the NRPP project.

Table 8.18: Operational Noise Criteria for Non-residential Receivers

Number	Location	$L_{Aeq,1hour}$		
		Day	Evening	Night
(8)	McCarthy Senior School	40 inside class rooms, approximately 50[5] outside		
(10)	Rowing Club	65		
(11)	Weir Reserve	50		
(12)	Commercial Area	65		

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

For a passive recreation area the INP noise criterion would typically be assessed at the closest boundary to the noise source. As the pump station and control building are located within Weir Reserve this is not possible. Therefore, it is proposed that the criterion be achieved at 10 metres from the pump station and control building.

8.8.3 Potential Impacts

Construction

Noise Sources

Excavation of the pipe by a single excavator, pipe laying and backfilling would be the principal construction activities undertaken together with site preparatory works and earthworks. During construction, the most significant noise source (with regard to frequency of operation) will be the excavator, which would be expected to have a sound power level of approximately 112 dBA. Other equipment used may include a front end loader, mobile crane, dump truck, bobcat, roller and compactor, but these are unlikely to be used simultaneously. To estimate the L_{A10} noise level from these operations, a sound power emission level of 112 dBA has been assumed.

[5] Assuming a 10dB reduction from inside to outside with windows open.

Typical sound power levels of construction plant that will be required for the construction of the pump station, control building and pipeline are listed in **Table 8.19**. At other times, the major noise sources would be items such as hand tools, which will have a lower cumulative noise emission.

Table 8.19: Construction Equipment Sound Power Levels

Equipment	Sound Power Level (dBA)
Vibratory Piling	110
Excavator	112
Front End Loader	114
Dump Truck	110

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

Based on previous experience, three dBA was subtracted from the total sound power level from all these sources to estimate the cumulative L_{A10} sound power level from a typical construction operation. To estimate the L_{A10} noise level from these construction activities, an overall sound power emission level of 115 dBA has been assumed.

Noise Predictions

Pump Station and Control Building

The construction of the pump station and control building is anticipated to occur during normal construction hours. The predicted noise levels at the closest receivers resulting from construction works is presented in **Table 8.20**.

Table 8.20: Calculated Construction Noise Levels at Closest Receivers from Works at the Pump Station and Control Building

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

Construction noise levels from construction of the control building and pump station at the closest receivers across the Nepean River (Nepean River Camping Ground and McCarthy Senior School) are predicted to marginally exceed construction noise criteria.

Construction of the pump station may temporarily impact on users of weir reserve. Work on the control building however will not require the equipment with higher sound power levels.

Pump station works including the coffer dam installation and removal, excavation backfilling and concrete pouring for pump station and intake pipe construction is anticipated to take seven months.

[6] As construction works are proposed to occur during the day the noise predictions were conducted under zero temperature inversion conditions.

This will impact on users of weir reserve closest to the pump station area. Use of the park, with the exception of the Gazebo which is a fixed facility, is transient with users being able to choose a location away from the works and noise impacts for their recreational pursuits.

Penrith City Council Parks Department has advised that bookings for the Gazebo (located 30 metres from the closest pump station works) are in the order of 110 bookings per year, and are mostly for Saturday afternoons after 1pm, outside the proposed working hours for the pipeline construction.

Given the large area of the park available for recreational use away from the noisy activities and the Gazebo use being dominantly outside construction hours, the impacts on users of Weir Reserve are considered manageable through notification and controlled operating hours."

Pipeline

The construction of the pipeline is anticipated to occur during normal construction hours. The predicted noise levels at the closest receivers resulting from the construction works is presented in **Table 8.21**.

Table 8.21: Calculated Construction Noise Levels at Closest Receivers from Pipeline Construction

Number	Location	Calculated[7] 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

Construction noise levels from pipeline construction are predicted to exceed construction noise criteria at the Residence, Church accommodation and Church on Castlereagh Road and at Weir Reserve. There is also a marginal exceedence predicted to occur at the Nepean River Camping Area.

[7] As construction works are proposed to occur during the day the noise predictions were conducted under zero temperature inversion conditions.

These exceedances would only occur when pipeline construction is adjacent to the receiver for a period of between two and four weeks. Further to this, the Church mainly operates on a Sunday outside the proposed construction operating hours. PLDC will continue to liaise with the Church to coordinate noisy construction work around significant Church events that may be scheduled during the construction phase.

Pipe work for the area between the pump station and Boundary Creek crossing, including creek and abutment, will take approximately six months.

As for the pump station works, given the large area of the park available for recreational use away from the noisy activities, and Gazebo use being scheduled predominantly outside construction hours, the impacts on users of Weir Reserve are considered manageable through notification and controlled operating hours.

Operation

Noise Sources

The principal source of operational noise will be associated with the operation of pumping equipment (within the pump station) and building services housed in the control building at Weir Reserve. The high prevalence of night-time temperature inversions in western Sydney may also exacerbate noise levels.

The pump station will comprise two 160 kW pumps in a pit which have the ability to operate 24 hours per day. However, based on current flows over the Penrith Weir the pumps will only operate for approximately 25 per cent of the time. Sound power levels of the pumps will be reduced as the pumps will be located in a pit covered by 200 mm thick concrete panels.

The control building will house an air compressor and a transformer. The estimated sound power levels of the pumps and the equipment housed in the control building are presented in **Table 8.22**.

The building walls will be constructed of brick and metal spandrel, the roof will be metal deck, there will be a large double solid core timber door in the eastern wall and a single solid core timber door in the northern wall. Therefore, assuming the transmission loss of the building elements, reverberant levels within the building structures, and the anticipated sound power levels, a noise level of less 50 dBA $L_{Aeq,\ 1hour}$ at 10 metres would appear to be achievable for the pump station and the control building.

Table 8.22: Pump Station and Control Building Equipment Sound Power Levels

Equipment	Sound Power Level (dBA)
160 kW pumps	87
Air compressor	100
Transformer	75

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

Noise Predictions

An Environmental Noise Model (ENM) was used to calculate operational noise levels from the pump station and control building to the surrounding areas. Ground heights in the model were based on data from relevant topographic maps.

Assuming that the recommended criterion at Weir Reserve for both the pump station and the control building are met (50 dBA at 10 metres) operational noise levels at the closest receiver locations have been calculated and are presented in **Table 8.23**.

Table 8.23: 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

With the controls and equipment specification incorporated in the final design, the calculated noise levels would be lower than the relevant criterion.

8.8.4 Mitigation Measures

Construction

The proposed methods for mitigation of construction noise at the sensitive receivers within the vicinity of the construction of the pump station, control building and pipeline include the preparation of a Construction Noise Management Plan which will include but not be limited to the following:

- 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.
- Notify the local community of construction activities, including that the duration will be limited and the times of construction strictly controlled. Notification will be provided a minimum of 48 hours prior to works commencing.
- Signage will be provided at Weir Reserve two weeks prior to works commencing to alert users to upcoming disruption.
- Select low noise emission plant and equipment for the duration of the works (where possible). This should include plant and equipment fitted with 'smart' reversing alarms.
- Schedule noisy works for less sensitive periods of the day, wherever practicable, particularly around any significant Church events.
- Construction hours to be restricted to the following:

  Outside the Scheme boundary
  - Weekdays (i.e. Monday to Friday) 7am to 6pm
  - Saturday 8am to 1pm
  - No construction work is to be carried out on Saturday, Public Holidays or during night-time hours.

  Within the Scheme boundary
  - Monday to Saturday 7am to 7pm.
  - No work on Sundays, public holidays or during night-time hours, with the exception of that required for quarry haul road crossings. Should work be required outside of the agreed construction hours prior approval will be sort and the community and PCC consulted.

[8] Due to the proposed pumps being able to operate 24 hours per day and western Sydney's high prevalence of night time temperature inversion conditions, the INP's 'default' temperature inversion condition of three degrees per 100 meters was assumed in all operational noise calculations.

Operation

Operational noise emissions from pump station and control building are predicted to comply with the respective criteria at all potentially-affected receivers, assuming that the pump station and control building noise specification of 50 dBA at ten metres is met.

8.9 Air Quality and Climate

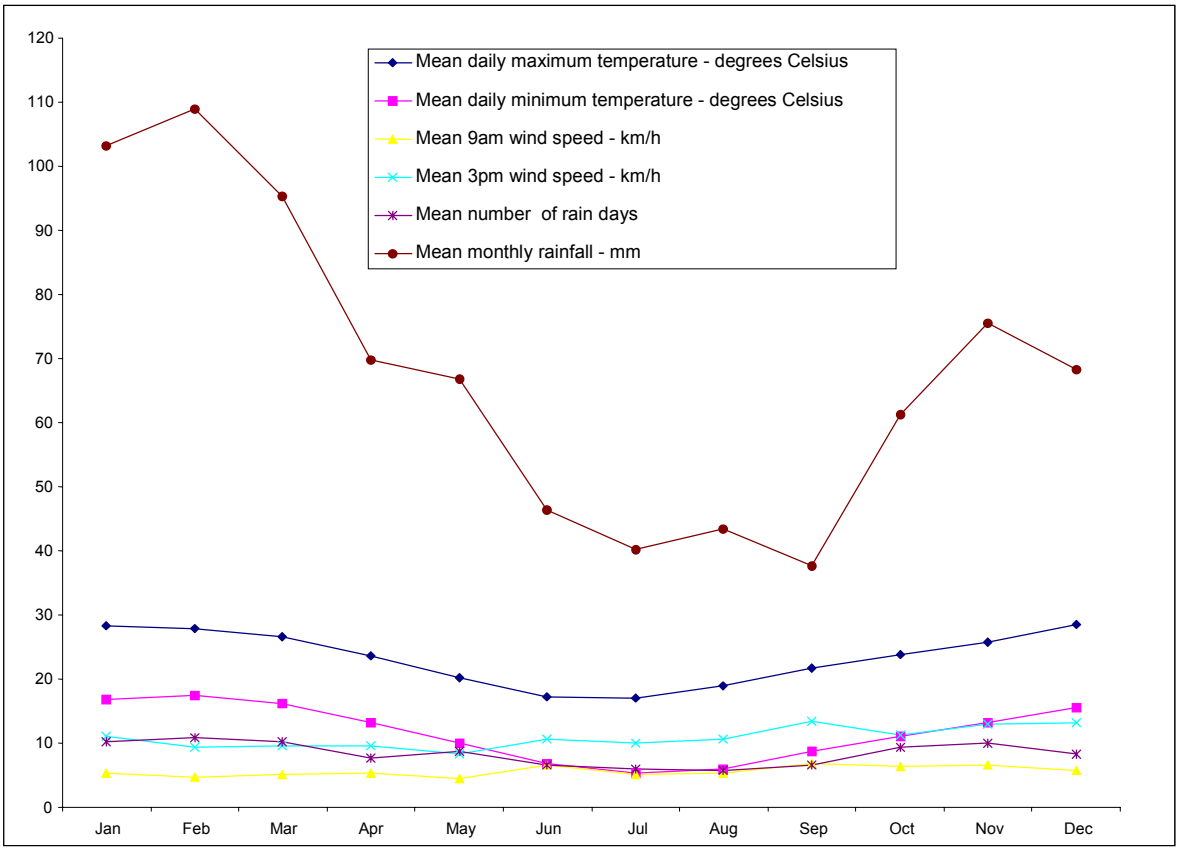
8.9.1 Existing Environment

The nearest Bureau of Meteorology (BoM) monitoring station is located within the Scheme boundary immediately north of the Sydney International Regatta Centre. However it is considered that meteorological data collected from this monitoring station is not representative of the local climatic conditions due to the short operational period of the monitoring station (i.e. approximately seven years). Alternatively, meteorological data collected from a monitoring station located at the Orchard Hills Treatment Works (i.e. located approximately nine kilometres to south east of the study area) is considered to be representative of climatic conditions experienced in the study area and has been used for the purpose of this assessment. Climatic data collected at the Orchard Hills Treatment Works includes mean daily minimum and maximum temperatures, air temperature, wind speed, relative humidity, rainfall, mean number of rain days, and mean number of clear and cloudy days.

Temperature

The western parts of Sydney generally experience a relatively mild climate. The summer months experience warm to hot days with mean daily minimum and maximum temperatures in January ranging from 16.9°C to 28.3°C respectively. Winters are cool to cold, with mean minimum and maximum daily temperatures in July ranging from 5.3°C to 17.1°C (refer to **Figure 8.6**).

Figure 8.6: Orchard Hills Treatment Works – Climatic Averages



Source: Bureau of Meteorology, August 2004

Rainfall

Rainfall levels recorded around the Penrith area are fairly consistent throughout the year and are typically low with a median monthly rainfall ranging from 37.7 mm in September, up to 109 mm in February. The total mean annual rainfall[9] for the area is around 816 mm. Characteristic of many parts of western Sydney, the study area experiences fog. The mean number of days of rainfall per month varies between six and 11 in this area with an annual mean of 100 days.

Wind Speed

Wind speeds recorded at the Orchard Hills BoM monitoring station are relatively low, ranging from a mean speed of 4.4 km/h at 9.00 am during May to a mean speed of 13.4 km/h at 3.00 pm during September.

Wind Direction

The prevailing annual wind direction is predominantly from the east to northeast during the summer months. Winter winds tend to be dominated by westerlies and winds from the southwest. Local landform and topography also affect the direction and speed of the prevailing winds throughout the year.

Local Air Quality

Local air quality is influenced by many factors including topography, meteorological conditions and surrounding land uses.

The meteorology and topography of the Sydney Basin combine to influence air movement conditions where certain areas such as the western portion of the basin act as a 'sink' for airborne pollutants. This 'sink' effect usually occurs at night-time under light wind conditions and clear skies as denser air travels downwards from surrounding areas of high ground to the north, west and south. Alternatively, daytime sea breezes may return and recirculate airborne pollutants (under certain wind conditions) to settle in the western parts of the Sydney Basin.

The principal air pollutant likely to be associated with the NRPP project is dust or particulate matter generated during the construction works. The assessment criterion for particulate matter is defined within the DEC's "*Approved Methods and Guidance: For the Modelling and Assessment of Air Pollutants in New South Wales",* 2001.

Land use surrounding the study area is characterised by a mix of rural lands, light industrial areas and quarrying. As such dust levels within the local airshed would be expected to be elevated. PLDC monitor deposited particulate matter and air borne particulates (PM_{10} and Total Suspended Particulates (TSP)) in order to satisfy the requirements within their Environment Protection Licence (EPL No. 2956) issued by the NSW DEC (EPA). During the reporting period from 1 March 2004 to 28 February 2005 the results of the air quality monitoring undertaken within the Scheme site generally indicate compliance with NSW DEC dust deposition target levels. Minor exceedence of the maximum total level (<4.03 g/m^2) of dust was recorded at one location. PM_{10} (average 17.99 $\mu g/m^3$) and TSP (average 39.6 $\mu g/m^3$) monitoring results recorded were well below NSW DEC target levels.

The air quality monitoring locations used by PLDC are representative of the local air quality environment. However, the nearest potentially affected receptors (residences) are located at significant distances from the Scheme boundary (800 metres south west) and as such, are likely to experience levels below those measured during monitoring.

[9] The sum of monthly mean rainfall.

Construction work associated with the NRPP project will be subject to the same air quality goals and requirements applicable to the Scheme i.e. in accordance with EPL No. 2956.

8.9.2 Potential Impacts

Overview

The principal air pollutant of concern associated with the NRPP project would be attributed to the generation of wind blown dust during the construction works. The nature of the impact would be short-term and temporary in nature associated mainly with soil disturbance and movement activities during preparatory earthworks and pipeline trench excavation/backfilling/reinstatement. Potential air quality impacts generated by construction activities can be controlled through the implementation of appropriate air quality control and dust suppression measures. Deposited dust criteria and air borne particulate criteria are presented in **Table 8.24** and **Table 8.25** respectively.

Table 8.24: Deposited Dust Assessment Criteria

Pollutant	Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Deposited Dust	Annual	2 g/m^2/month	4 g/m^2/month

Source: *DEC, 2001*
NB: *g/m^2/month = grams per square metre per month*

Table 8.25: Airborne Particulates Assessment Criteria

Pollutant	Averaging Period	Concentration
TSP	Annual	90 $\mu g/m^3$
PM_{10}	24 hr	50 $\mu g/m^3$
PM_{10}	Annual	30 $\mu g/m^3$

Source*: DEC, 2001*

Construction

The generation of wind blown dust during construction activities is the result of loose particulate matter being mobilised from an exposed surface (i.e. excavated ground or material stockpiles) and suspended in the atmosphere. The suspension of dust particles is determined by a range of parameters such as the shape and size of the particle, soil properties, prevailing weather conditions, area of exposed ground, frequency of water spraying, and the type of activity being carried out. Studies have indicated that the majority of particulate matter (i.e. 95 per cent of total fugitive dust emissions), return to the surface within 60 metres to 90 metres of the emission source. However, the fine fraction of dust particles, when mobilised, may travel up to 250 metres from the source before returning to the surface.

During the construction phase of the NRPP project the principal sources of air pollution would be attributed to the site preparatory works (i.e. working width establishment), pipe excavation and trenching, and construction vehicles and plant travelling along the working width.

The potential impacts associated with dust nuisance during the construction of the NRPP on the surrounding community (i.e. residential areas) are considered low. Surrounding commercial/industrial premises within 250 metres may experience some minor dust nuisance during construction, however, the implementation of appropriate dust suppression mitigation measures would assist in minimising potential impacts.

Operation

The operation phase of the NRPP project will not generate any significant air quality impacts. The potential for air emissions from pumping equipment can be effectively mitigated through a programme of routine maintenance and inspection, which is recommended to be included as part of the NRPP project's routine environmental inspection requirements.

8.9.3 Mitigation Measures

The following measures would be implemented to mitigate potential impacts on local air quality during the construction phase of the NRPP project:

- All vehicle loads entering and departing the working width are to be covered and secured, particularly loose materials.
- Exposed stockpiles and unsealed construction areas would be sprayed with water from watering carts as appropriate, or stabilised with seeding and planting as soon as it is practicable to do so.
- Onsite vehicle speed limits will be established and enforced, and as appropriate reviewed in accordance with meteorological conditions, site safety requirements, and the Vegetation Management Plan.
- Vehicles and machinery would be regularly serviced and maintained to optimum working conditions to minimise potential emissions.
- Works will cease when wind speeds exceed 10 m/s and where dust generation cannot be effectively minimised until adequate controls can be implemented or until such weather conditions abate.
- No vegetation, timber or combustible material would be burnt on site. Material that is unsuitable for reuse or recycling on site is to be removed and transported for subsequent storage, reuse, recycle or disposal.
- Any complaints relating to air emissions from construction activities would be promptly investigated and additional controls implemented where required.
- Vehicles and construction crews will be confined to work areas to prevent any inadvertent encroachment or otherwise into exposed and stripped areas of ground or area subject to rehabilitation.
- All emission controls used on vehicles and construction equipment would comply with relevant NSW DEC standards as provided under Section 124 of the *Protection of the Environment Operations Act 1997.*
- Revegetation/stabilisation of disturbed land surfaces with appropriate seeding and native plant mixes will be undertaken as soon as it is possible to do so to minimise dust episodes and topsoil dispersion.

8.10 Waste

Waste generated during the construction and operation phases of the NRPP project will be managed to achieve the following specific aims:

- Continually update and improve waste management throughout the development of the NRRP project.
- Ensure disposal of chemical, fuel and lubricant containers, solid and liquid wastes conforms to requirements of the NSW DEC (EPA).
- Ensure resource recovery and recycling is undertaken efficiently.

8.10.1 Existing Environment

A number of NSW DEC (EPA) approved waste disposal facilities (landfills) surround the study area (refer to **Table 8.26**). These waste disposal facilities are classed as either Solid Waste Class 1 (putrescible waste accepted) or Solid Waste Class 2 landfills (inert materials only accepted).

Table 8.26: List of Local Landfills

Operator or Owner	Location	Licence Classification (Class)	Local Govt Area
Blacktown Waste Services Pty Ltd	Richmond Road, Marsden Park	Solid Waste Class 2	Blacktown
Brandown Pty Ltd	Elizabeth Drive, Kemps Creek	Solid Waste Class 2	Liverpool
Collex Pty Ltd	Wallgrove Road, Horsley Park	Solid Waste Class 2	Fairfield
Collex Pty Ltd	Burfitt Road, Schofields	Solid Waste Class 2	Blacktown
Enviroguard	Mamre Road, Erskine Park	Solid Waste Class 2	Penrith
Glenfield Waste Disposals (L.A. Kennett Enterprises Pty Ltd)	Cambridge Avenue, Glenfield	Solid Waste Class 2	Campbelltown
Kari and Ghossayn Pty Ltd	Clifton Avenue, Kemps Creek	Solid Waste Class 2	Penrith
Penrith Waste Services Pty Ltd	Mulgoa Road, Mulgoa	Solid Waste Class 2	Penrith
SITA Environmental Solutions	Elizabeth Drive, Kemps Creek	Solid Waste Class 2 and Industrial Waste	Penrith
Waste Service NSW (Eastern Creek)	Wallgrove Road, Eastern Creek	Solid Waste Class 1	Blacktown
Waste Service NSW (Jacks Gully)	Richardson Road, Narellan	Solid Waste Class 1	Camden

8.10.2 Potential Impacts

Construction

Construction activities associated with the NRPP project have the potential to generate waste materials such as the following:

- Pipe laying building waste – this would mainly include plastic and glass reinforced plastic type materials associated with the use of PE and HDPE.
- General building waste – surplus construction materials from the intake and discharge structures, control building, pump station, and general site reinstatement. Materials are likely to comprise concrete, gravels, sands, fencing, steel reinforcement.
- General waste – from construction workers, including domestic refuse (litter).
- Green waste – vegetation and other such organic materials from clearance relating to working width preparation.
- Excavated material – surplus soil and rock from backfilling and grading after pipe laying.
- Human waste – mobile site toilets (sewage).
- Maintenance waste – waste generated from on-site plant/vehicle maintenance (e.g. oil, washdown wastewater).

Operation

It is envisaged that negligible waste would be generated once the pipeline is operational. It should be noted that impacts arising from the release of sediment-laden runoff from construction would be classified as non-controlled aqueous liquid waste and is addressed in more detail in **Section 6.3**.

8.10.3 Mitigation Measures

Potential impacts associated with the generation of waste during the construction and operation phases of the NRPP project can be minimised through implementation of the following mitigation measures:

- Preparation of a Resource and Waste Management Plan.
- All wastes would be correctly classified in accordance with the *Environmental Guidelines: Assessment, Classification & Management of Liquid and Non-liquid Wastes*, produced by the EPA in July 1999 (the Waste Guidelines) to accurately identify management, transportation and disposal requirements.
- Handling, storage and transport of hazardous materials and waste would be in accordance with the National Code of Practice and the relevant Material Safety Data Sheet (MSDS) for the product.

Additional specific mitigation measures are outlined below:

Separation and Storage

The various components of the waste stream will be kept separate, where possible, as detailed below:

- Hazardous waste will be separated from non hazardous waste. If small amounts of hazardous waste are mixed with non hazardous waste the entire quantity of waste becomes hazardous.
- Recyclable waste to be kept separate in a designated area for future disposal at the appropriate recycling facility.

The various components of the waste stream will be stored, where possible, as detailed below:

- All general inert and solid waste generated will be stored in waste containers located at designated points along the pipeline corridor, isolated from surface water drains and the pipe trench. Waste will be removed at regular intervals and disposed of, as required, to an approved waste facility.
- All storage containers and locations for the various waste streams shall be clearly labelled to ensure that mixing of wastes is avoided.
- Waste will be stored in an environmentally friendly manner and not adjacent to potentially sensitive areas such as natural vegetation, stormwater drains, residences or local watercourses. Waste will not be stored or come in contact with any incompatible waste.

Transportation of Waste Materials

- Waste to be disposed offsite will be transported to a waste facility that is licenced under the POEO Act to receive waste of that type.
- Any waste identified as hazardous, industrial or Group A wastes, in accordance with the Waste Guidelines will be transported by an authorised contractor, to which a written agreement must be in place.
- Any vehicle used to transport waste will:

- Be kept in a clean condition, and be constructed and maintained so as to prevent spillage of waste.
- Have containers that are safely secured on the vehicle.
- Be covered when loaded so as to prevent spillage and loss of waste, and the emission of odours.
- Ensure that incompatible wastes must not be mixed or transported together.
- Ensure that materials segregated for recycling must not be mixed with other waste.

Reporting

Reporting for waste movements will include as a minimum:

- Reporting protocols to ensure that hazardous (liquid and non-liquid), industrial, or Group A liquid wastes are tracked from 'cradle to grave'.
- Compilation of a waste data form for solid and inert waste materials, providing a description of the waste types, physical nature of wastes, proposed treatment, dates of movement, transporters details and waste destination details.
- Good on-site environmental practice will ensure the recording and monitoring of recyclable materials on site.

Reporting requirements will be implemented and further developed at the construction stage.

Resource and Waste Management Plan

Waste Management Strategies would be managed in accordance with the *Waste Avoidance and Resource Recovery Act 2001* and by adopting the Resource Management Hierarchy principals (in order of priority) of avoidance, resource recovery and disposal. These principles would be embodied in a Resource and Waste Management Plan (RWMP) which would form part of the CEMP for the NRPP project.

The RWMP would be required to take account of the following:

- Quantity and classification of waste materials.
- Disposal/reuse strategies for each type of material.
- Details of how waste would be stored and treated on site.
- Identification of all non-recyclable waste.
- Identification of strategies to reduce, reuse and recycle.
- Procedures and disposal arrangements for unsuitable excavated material.

Opportunities for utilising appropriate recycled material for use in (example) backfilling or reinstatement works. This would include research into suitable available materials from other developments within the Penrith locality. The cost effectiveness of this measure would need to be evaluated as part of the construction contract.

8.11 Land Use

8.11.1 Existing Environment

Existing Land Use

Land use within the study area is characterised by open space and recreational facilities, riparian forest and woodland, the Nepean River, undeveloped industrial lands and quarrying. Maunsell undertook an audit of the existing land use pattern within the study area in July 2005.

Land within the Scheme boundary is currently identified as Australia's largest construction materials quarry, supplying around 75 per cent[10] of Sydney's sand and gravel requirements. Quarrying activities conducted on the Scheme site primarily comprise:

- Overburden stripping and movement by bulldozers and scrapers.
- Extraction of raw feed by loaders, shovels or drag lines.
- Processing of raw feed at specialised plants.
- Tailings management and rehabilitation.

A number of development approvals have been issued for various works on the Scheme site and are subject to conditions that require the disturbed landform to be rehabilitated once the quarrying activities have been completed in order to aid the formation of the Scheme's proposed lake system. Progressive redevelopment of the Scheme site has already commenced with the construction of the Sydney International Regatta Centre and creation of 196 hectares of parkland with canoeing and rowing courses, and the White Water Stadium. These facilities were venues during the 2000 Sydney Olympic Games and are now utilised for a range of sporting, corporate and social events.

The Scheme is bounded immediately to the west by the Nepean River and its vegetated banks, and beyond by the Blue Mountains. Isolated residential developments are scattered throughout the surrounding areas. Land use to the north and north east comprises a mixture of rural and rural lands and residential development. A large site owned by the Commonwealth Department of Defence with restricted access is located approximately one km to the north east, and is accessed from Cranebrook Road. Cranebrook is situated to the east of the Scheme and the Penrith Valley Industrial Area is located immediately to the east of the initial portion of the pipeline route (refer to **Plate 4**).

Plate 4 - Industrial Land Adjacent to a Section of the Pipeline

Source: Maunsell Australia Pty Ltd, 2005

[10] Information from PLDC website: http://www.penrithlakes.com.au

Specific land use surrounding the study area includes the following:

- Blue Mountains escarpment.
- McCarthys Cemetery.
- Sydney International Regatta Centre.
- Cranebrook residential area consisting of a relatively modern primarily residential development with four schools and other facilities, such as a community centre.
- Industrial area, with light industrial and some commercial outlets to the east of Castlereagh Road, and Crane Enfield Metals and the Penrith Sewerage Treatment Plant to the west. The Sun Masamune Sake Brewery is located on Cassola Place within the industrial area, and brews sake for distribution in Australia and export to Asia, Japan and the US. The Sake Brewery is also a tourist attraction.
- McCarthy Catholic Senior High School.
- Boral Quarries – an additional quarry site utilised for the same operations as quarried sites within the Scheme, but located outside the Scheme boundary. A connecting bridge over the Nepean River links the Boral site to operations within the Scheme.
- Emu Plains Correctional Centre – a minimum security correctional centre, where inmates are employed in dairy farming and telemarketing work.

Land use within the study area includes the following:

- Nepean River corridor with vegetated embankments.
- Penrith Weir.
- Weir Reserve, with public facilities including a wedding pavilion, Japanese garden, pergola's, benches and public amenities (refer to **Plate 5**). The reserve is used for picnicking, walking and fishing from the Nepean River.
- A community focal point and heritage precinct, comprising a church, church hall and cemetery to the east of Castlereagh Road, and a currently empty former school and single residence. Budget accommodation facilities associated with the Church have also been established immediately south of the cemetery.
- Muru Mittigar, an Aboriginal cultural centre enabling visitors to learn about local Aboriginal culture and art. The centre also houses a café and small shop selling Aboriginal craft and souvenirs; and also the Penrith Lakes Environmental Educational Centre.
- Three single story residential dwellings on large lots remain within the Scheme boundary.

Plate 5 - Northern tip of Weir Reserve adjacent to Penrith Weir

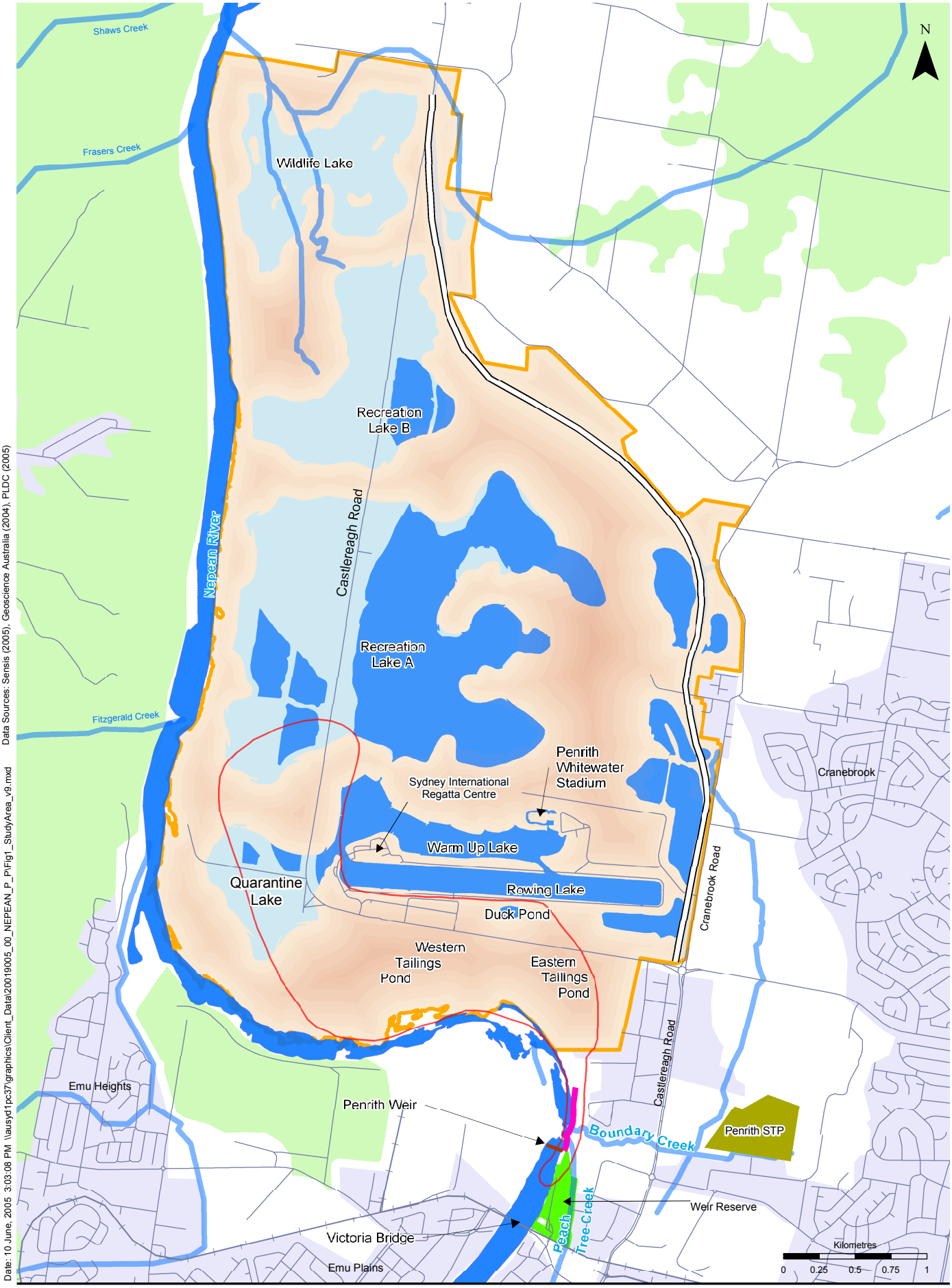
Source: Maunsell Australia Pty Ltd, 2005

Future Land Use

Ultimately, land within the Scheme boundary will be rehabilitated and developed as a recreational parkland project featuring a system of interconnected lakes. It is envisaged that the future Scheme will comprise:

- 900 hectares of open space.
- 700 hectares of lakes.
- 400 hectares of residential/commercial development.

The future landform and land use is illustrated in **Figure 8.7**.



Data Sources: Sensis (2005), Geoscience Australia (2004), PLDC (2005)

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- Study Area
- Penrith Lakes Scheme Site Boundary
- Existing Waterway
- Future Waterway
- Local Road
- Main Western Railway Line
- Penrith Weir
- Vegetated Area
- Built-up Area
- River walk
- Proposed Castlereagh Road Alignment

PENRITH LAKES DEVELOPMENT CORPORATION

NEPEAN RIVER PUMP AND PIPELINE

FIGURE 8.7: PROPOSED LANDFORM DESIGN

8.11.2 Potential Impacts

Construction

Construction of the NRPP project will require the establishment of a 15 metre wide working width along the majority of the pipeline route, subject to the construction techniques employed at specific locations, such as watercourse and road crossings, where slightly larger or smaller working areas may be required.

Prior to the commencement of construction works for the NRPP project defined working areas around the control building and pump station sites at Weir Reserve and on the eastern bank of the Nepean River will be established, together with the working width for the pipeline route. Temporary fencing and access gates will be installed in advance of the site preparatory, pipe trench and laying works to contain all construction activities within these areas and to prevent any inadvertent or otherwise tracking of construction plant, vehicles and crews outside of these areas and/or the public from entering these areas.

Construction will occur progressively along the length of the pipeline and as such construction crews and temporary compounds will be mobile as pipe trenching, laying and backfilling takes place. On this basis the majority of impacts on existing land use activities and patterns will be temporary and attributed to:

- Clearing of native vegetation communities along a 400 metre section of the Nepean River's eastern bank.
- Severance of a portion of the Nepean River during the installation of the intake structure and pipework.
- Land severance of private properties traversed by the pipeline route, particularly those land parcels that form part of the Penrith Valley Industrial Area around Cassola Place.
- Interruption of recreational activities at Weir Reserve and two sections of the GRW.
- Alteration of natural drainage systems where the pipeline crosses Peach Tree Creek and Boundary Creek.

The clearing and removal of native vegetation (i.e. trees and shrubs) from the initial 400 metres of the pipeline route and the disturbance to open space areas at Weir Reserve is unavoidable. The pipeline route and location of the aboveground structures (i.e. control building and pump station) and hardstand areas have been selected to minimise such impacts.

There will be some minor, temporary disruption to recreational users of Weir Reserve (including access to the Nepean River for a stretch of approximately 100 metres for fishing) and the GRW (when constructed). Appropriate measures will be implemented to maintain access and mobility at Weir Reserve, with the majority of this area remaining open to the public. Two sections of the GRW between Weir Reserve and Cassola Place will be temporarily impacted by the pipeline construction works. The GRW along this section of its route will comprise a steel boardwalk and asphalt pathway. Temporary alternative access measures will be established to all the continued use of this facility throughout the duration of the construction works. Ongoing consultation will be maintained with relevant PCC representatives to coordinate the GRW and NRPP project construction works and to agree the appropriate measures to maintain access to the public.

Operation

Permanent land use impacts associated with the NRPP project will be attributed to the loss of around 225 m^2 of open space at Weir Reserve due to the introduction of aboveground structures such as the control building and hardstand areas for vehicle access. An additional 43 m^2 area will be required for the roof structure of the pump station, which will be mainly built into the riverbank and be buried below

ground level. The roof structure will provide the opportunity to create a fishing and viewing platform for the public, and will also 'tie-in' with the GRW. Seating will be provided so that users of the GRW can 'rest' and 'relax' by the river.

The inclusion of the control building adjacent to the existing amenity building will require the existing roof to be raised. This will provide additional ventilation and light to the amenity building.

The pipeline will be buried along its entire length, however, once installed there will be some restrictions on land use and permissible activities within the pipeline easement. Pipeline easement will be negotiated with each property owner. Payments for land will be assessed under the provisions of the Land Acquisition (Just Terms Compensation) Act.

8.11.3 Mitigation Measures

Potential impacts on land use will be minimised through implementation of the following mitigation measures:

- Ongoing consultations with relevant representatives at PCC to coordinate and agree the GRW and the NRPP project construction works and measures to be implemented. Where possible, impacts upon the use of the GRW and rehabilitated areas of revegetation along the pipeline route will be addressed as part of the design and construction methods of the NRPP project. In the event that impacts are unavoidable, any areas of the GRW and/or vegetation that have been disturbed would be reinstated.
- A Traffic Management Plan will be developed and implemented during the construction phase to provide maximum safety and ease of adjacent land uses to the construction zone (i.e. quarry operations within PLDC and users of the Sydney International Regatta Centre).
- Full restoration of land drains and watercourses intercepted by the pipeline route will be reinstated to reflect their former state. These works will be carried out following the cessation of the main construction activities.

9. Environmental Matters for Consideration

9.1 SREP 11 – Penrith Lakes Scheme

In addition to the requirements of the EP&A Act, this EA has been prepared in accordance with the requirements of the *Sydney Regional Environmental Plan No 11 – Penrith Lakes Scheme*. Clause 8(4) of SREP 11 provides a list of matters that the consent authority shall take into consideration in determining an application to carry out development to implement the Penrith Lakes Scheme. The matters listed under clause 8(4) and an assessment of each is provided in **Table 9.1**.

Table 9.1: Matters to be Considered in Accordance with Clause 8(4) of SREP 11

SREP 11 Item	Response
a) the Penrith Lakes Scheme Regional Environmental Study,	The Penrith Lakes Scheme RES has been referenced throughout the EA and a copy will be made available to the Minister for Planning.
b) the recommendations, if any, of such technical working parties as may be established from time to time by the consent authority,	Recommendations of the PLWC have been detailed in **Section 8.2** Water Quality and **Section 8.2** Flora and Fauna. As mentioned in this EA, the PLWC review of the Penrith Lakes Water Plan is an amendment to the existing SREP 11 in accordance with their recommendations and finalisation of the Scheme. This would necessitate requisite amendments to the Deed.
c) the statement of environmental effects accompanying the application,	This document is an EA (as required under Part 3A of the EP&A Act) that will accompany the lodgement of a project application to the DoP for determination.
d) the proposed sequence of extraction and rehabilitation,	Not Applicable.
e) whether the land is to be dedicated to the Crown and, if not, the proposed control and management of the land,	The land will remain the property of PLDC until completion of the Scheme wherein ownership will be transferred to DoP (the former DIPNR).
f) the management and control of water resources including:	-
(i) the source of water in order to fill any lake (including the quality and quantity of water from that source),	These matters are addressed in **Section 8.2** Water Quality.
(ii) water reticulation systems from the Nepean River to any lake, from lake to lake and from any lake to the Nepean River,	These matters are addressed in **Section 8.2** Water Quality.
(iii) the water quality of any lake (including the aquatic ecosystem),	These matters are addressed in **Section 8.2** Water Quality and **Section 8.3** Flora and Fauna.
(iv) water treatment facilities,	These matters are addressed in **Section 8.2** Water Quality and **Section 8.1** Flooding and Hydrology.
(v) water depth of any lake,	These matters are addressed in **Section 8.1** Flooding and Hydrology.
(vi) flood control,	These matters are addressed in **Section 8.1** Flooding and Hydrology.
(vii) storm water control,	These matters are addressed in **Section 8.1** Flooding and Hydrology.
(viii) the effect that development would	These matters are addressed in **Section 8.2** Water

SREP 11 Item	Response
have upon the quantity and quality of the existing groundwater, the level of the existing water table and groundwater movement,	Quality and **Section 8.1** Flooding and Hydrology.
(ix) lake usage,	Lake usage has been accommodated in the design of the NRPP through consideration of lake water levels and water quality and has been addressed in **Sections 8.1** and **8.2**. Future usage of Recreation Lake A will be for active recreation including boating. **Section 8.11.1** describes future land use.
(x) staged development of the lakes and their usage during stage development,	These matters are addressed in **Section 6.8.6**. Staging.
(xi) the need to monitor the water quality of the lakes having regard to their intended use, and	These matters are addressed in **Section 8.2** Water Quality
(xii) the effect upon the Hawkesbury/Nepean River system,	These matters are addressed in **Section 8.2** Water Quality and **Section 8.3** Flora and Fauna.
g) the rehabilitation and reconstruction of the land including:	-
(i) landscape design,	These matters are addressed in **Section 8.6** Urban Design, Landscape and Visual Amenity.
(ii) the structural stability and soil compaction of landforms (including, where appropriate, the land shown on the structure plan as future urban),	These matters are addressed in **Section 8.7** Topography, Geology and Soils.
(iii) the stability and impermeability of the Nepean River embankment,	These matters are addressed in **Section 8.7** Topography, Geology and Soils.
(iv) soil conservation, and	These matters are addressed in **Section 8.7** Topography, Geology and Soils.
(v) revegetation,	These matters are addressed in **Section 8.3** Flora and Fauna and **Section 8.6** Urban Design, Landscape and Visual Amenity.
h) access to, the supply of water from any existing source to, and the supply of and access to municipal and utility services to, land to which this plan applies, other than that part of that land the subject of the application,	Temporary and permanent impacts from the construction and operation of the NRPP project on existing supply of water and municipal and utility services are addressed in **Section 6.8** Other Design Influences and **Section 7** Construction Issues.
i) any item of the environmental heritage listed in Schedule 3,	No items of environmental heritage listed under Schedule 3 are directly impacted by the NRPP project.
j) the effect upon a locality, place or building not listed in Schedule 3 having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations, and	The pipeline route alignment has been selected to avoid any significant locality, place or building. As the pipeline and pump station are to be installed beneath the ground any impacts will be temporary (with the exception of the control building and roof of the pump station).
k) the need and frequency to monitor the implementation of the subject development	These matters will be addressed in the CEMP, an outline of which is presented in **Section 10**.

Source: MAPL, 2005

9.2 Consideration of Matters of National Environmental Significance

Under the environmental assessment provisions of the Commonwealth EPBC Act, matters of NES presented in **Table 9.2** are required to be considered with regard to the development of the NRPP project.

Table 9.2: EPBC Act – NES Checklist

Factor	Summary of Findings	Impact (Beneficial or Adverse)
Any environmental impact on national heritage places?	Heritage investigations conducted as part of this EA have concluded that there would be no impact on a place of National Heritage as a result of the NRPP project. The pipeline enters the Castlereagh Area, which is listed on the Register of National Estate as 'indicative'. The indicative listing has no legal weighting and is intended as an information source only.	None
***Any environmental impact on World Heritage Properties as identified under Section 3A of the* World Heritage Properties Conservation Act 1983?**	This EA concluded that there would be no impact on any World Heritage Properties as a result of the NRPP project. The adjacent Greater Blue Mountains Area is a World Heritage Property however the NRPP would not impact upon that area.	None
Any environmental impact on Ramsar wetlands of international importance?	Ecological investigations carried out as part of this EA have concluded that there would be no impact on any listed RAMSAR wetlands of international importance.	None
Any environmental impact on Commonwealth listed threatened species or ecological communities?	Threatened flora and fauna species listed under the *EPBC Act 1999* are known to occur in the surrounding area. Targeted searches and habitat assessment conducted as part of this EA concluded that there would be no impacts on these species.	None
Any environmental impact on Commonwealth listed migratory species or migratory species listed under international agreements?	Potential habitat for migratory fauna occurs in the vicinity of the study area however no significant impacts are expected to occur for species of migratory birds protected under international agreements.	None
Any environmental impact on a Commonwealth marine area?	The NRPP project is not located within or adjacent to a Commonwealth marine area. There would be no impacts upon a Commonwealth marine area as a result of the NRPP project.	None
Does any part of the proposal involve a nuclear action?	The NRPP project does not involve a nuclear action.	None

Source: Maunsell Australia Pty Ltd, 2005

Although not a matter of NES, it is important to consider impacts on Commonwealth land as it also offered protection under the EPBC Act. However, the NRPP project is not located within or adjacent to any Commonwealth land and, therefore, it is concluded that there will be negligible impacts.

10. Construction Environmental Management Plan

A CEMP will be developed to address specific environmental issues associated with the NRPP project by the construction contractor prior to any construction work being undertaken. The CEMP would detail appropriate strategies and management measures to control and manage environmental risks, assess environmental performance and comply with relevant statutory requirements during the construction of the NRPP project. The primary objective is to implement a CEMP that prevents pollution and manages the generation of waste.

The CEMP would be structured to include as a minimum:

- Site and project specific objectives and targets.
- Description of compliance and adherence to relevant PLDC occupational health and safety compliance guidelines and standards.
- Description of relevant statutory requirements and compliance to standards and codes of practice.
- Hazards and risks associated with the construction.
- Potential constraints to the construction.
- Details of environmental control works.
- Timing of environmental control activities.
- Clear definition of roles and responsibilities for the proposed activities.
- Procedures and instructions for implementing, maintaining, assessing and monitoring environmental controls.
- Reporting procedures (incident, complaint, non-conformance).
- Details of training for personnel working on the project.
- Procedures and schedules for undertaking and recording environmental inspections and auditing.
- Emergency procedures.
- Corrective action requirements and verification.
- Assignment of authorised personnel and a procedure for changing and issuing the CEMP.
- Details of how the changes to the environmental management documentation and data are to be identified and communicated to relevant project personnel.
- Mechanism for regular evaluation of environmental performance.

An indicative outline of the table of contents of the CEMP for the NRPP project is provided in **Table 10.1** below.

Table 10.1: Indicative Table of Contents for the CEMP for the NRPP Project

Section Number	Section Title
Section 1.0	**Introduction**
1.1	Purpose and Scope
1.2	Environmental Management System Overview
1.3	CEMP Outline
1.4	Environmental Policy
1.5	Distribution of the CEMP
Section 2.0	**Objectives and Targets**
Section 3.0	**Constraints**
Section 4.0	**Environmental Risk Identification and Assessment**

Section Number	Section Title
4.1	Project Risk Identification and Assessment
4.2	Subcontracted Activities
Section 5.0	**Environmental Controls**
5.1	Environmental Project Instructions
5.2	Monitoring or Environmental Controls
5.3	Subcontractor Plans
5.4	Environmental Awareness Training
5.5	Emergency Preparedness and Response
5.6	Checking and Corrective Action
Section 6.0	**Roles and Responsibilities**
6.1	General
6.2	Project Environmental Representative
6.3	Procurement Personnel
6.4	Subcontractors
6.5	All Personnel
6.6	Peer Reviewer
6.7	Names of Key Personnel
Section 7.0	**Miscellaneous**
7.1	Abbreviations and Definitions
7.2	Plan Control
7.3	Distribution List of Registered Copies
7.4	Plan Review

10.1 Supplementary Environmental Management Plans

Supplementary EMPs would be prepared (where required) and would include the identification of potential impacts and an outline of appropriate mitigation measures to be implemented. Any requisite supplementary EMPs would detail measures to comply with specific standards, guidelines, acts or regulations and would also be structured to fit within the overall framework of the CEMP. Such supplementary EMPs may include, but not be limited to:

- Stormwater Management Plan (SMP) and/or ESCP. The ESCP would detail all site specific measures to be implemented during construction to effectively manage the potential for erosion and transportation of sediment loads on/off the site.
- Water Quality Management Plan would be included in the SMP to assess the effectiveness of erosion, sediment and water quality controls particularly at the crossings of Boundary Creek and Peach Tree Creek.
- Vegetation and Landscape Management Plan to assist in the rehabilitation of disturbed vegetated areas and control of weeds.
- Flora and Fauna Management Plan to assist in the management of flora and fauna during the construction phase.
- Air Quality and Dust Management Plan to assist in the control and management of fugitive dust to nearby residences, users of Weir Reserve, and occupiers of businesses in the adjacent industrial estate.
- Noise and Vibration Management Plan to assist in the reduction of potential noise and vibration impacts.

- Traffic Management Plan to minimise adverse impacts on users of the Sydney International Regatta Centre.
- Resource and Waste Management Plan.
- Heritage Management Plan.
- Emergency Procedures for chemical spills and other potential incidents.
- Rehabilitation Plan.

10.2 Environmental Inspections and Auditing

Audits and site inspections would be carried out during construction to ensure compliance with the measures contained in the CEMP and Supplementary EMPs.

The frequency of audits and inspections would be determined through compliance with PLDC HSE standards and implementation would be in accordance with relevant PLDC guidelines.

Audits would involve reviewing environmental documents, records and monitoring results and conducting site walkovers to ensure compliance with the requirements of legislation, contract documentation and the CEMP.

Contractor performance would be managed through specifications that would be tailored purposely to the project by the inclusion of environmental management measures that the contractor would need to implement. This would be documented in the CEMP.

10.2.1 Schedules and Reporting

Registers or schedules should be developed as part of the CEMP to provide a record of site conditions and activities. Reference should be made to PLDC guidelines for such forms. Examples of the records that should be developed as part of the CEMP include (but are not limited to):

- Site surveillance, inspections and an audit schedule and register.
- Non conformance register.
- Corrective actions register.
- Incident Report Register.
- Complaints Register.
- Induction and Training Register.

11. Draft Statement of Commitments

In accordance with the DGRs issued by the Director-General for Planning, a draft SoC is required to be included within the Environmental Assessment (refer to **Table 11.1**). The draft SoC provides a list of commitments that PLDC is prepared to make to minimise or avoid the environmental impacts of the NRPP project (refer to potential environmental impacts and mitigation measures outlined within **Section 8.0**).

The draft SoC will be finalised following consideration of the feedback received during the public exhibition of the EA.

Table 11.1: Draft Statement of Commitments for Nepean River Pump and Pipeline

1. Prior to Construction	
Environmental Outcome (commitment)	**Measure (commitment)**
1.1. The proposed Nepean River Pump and Pipeline (NRPP) will be constructed in accordance with the proposal contained in the Environmental Assessment 'Nepean River Pump and Pipeline Environmental Assessment' prepared by Maunsell dated August 2006.	1.1.1 PLDC will notify in writing, the Director-General and Penrith City Council of the start of construction of the NRPP. This notification will be four weeks (or within any other time agreed to by the Director-General) prior to commencement of construction.
	1.1.2 The NRPP will be constructed in stages. PLDC will provide to the Director-General a staging report four weeks (or within any other time agreed to by the Director-General) prior to construction commencement. The staging report will: a) Describe the stages; b) Identify how the conditions will be addressed in each stage
	1.1.3 PLDC will engage an Environmental Management Representative (EMR) that demonstrates compliance with AS/NZS ISO 14012:1996 Guidelines for Environmental Auditing: Qualification criteria for environmental auditors. The EMR will be available during the construction activities as defined in the CEMP. PLDC will request approval for the nominated EMR from the Director-General at least eight weeks before construction commences (or within any other time agreed to by the Director-General).
	1.1.4 PLDC will engage an Accredited Certifier to provide independent review and approval of design. The Certifier will be accredited to issue construction and Compliance Certificates under the Engineers Australia "Accredited Engineers Scheme".
	1.1.5 PLDC will obtain a Construction Certificate under Part 4A of the EP&A Act for detailed engineering plans.
	1.1.6 A Construction Environmental Management Plan (CEMP) will be prepared in accordance with the conditions of approval, mitigation measures detailed in the Environmental Assessment and all relevant Acts and Regulations. PLDC will obtain the Director-Generals approval for the CEMP before construction commences. The CEMP will be reviewed by the EMR prior to submission to the Director General. The CEMP will include programs addressing: a) Soil and water management including sediment and erosion control in accordance with the 'blue book' NSW Department of Housing publication; b) Vegetation and weed management (including aquatic weeds); c) Resource and waste management in accordance with Waste Avoidance and Resource Recovery Act 2001;

1. Prior to Construction	
Environmental Outcome (commitment)	**Measure (commitment)**
	d) Construction method statements for the intake pipe construction and creek crossings; e) Flora and fauna management; f) Noise and vibration management; g) Air quality management; h) Traffic Management; and i) Complaints management
	1.1.7 PLDC will provide information regarding the construction of the NRPP on the Penrith Lakes website before construction commences and maintain the information until the construction ends. The information will include updates of the work progress and future planned works, any publicly available reports relating to the NRPP and contact details for relevant staff for queries or complaints.
	1.1.8 PLDC will submit a Pre-Construction Compliance report to the Director-General at least four weeks before construction commences (or within any other time agreed to by the Director-General) detailing compliance with pre-construction terms of approval.

2. During Construction	
Environmental Outcome (commitment)	**Measure (commitment)**
2.1 NRPP to be implemented in accordance with environmental approvals and industry standards	2.1.1 The EMR will be available during construction at the site and be present on-site during any critical construction activity as defined in the CEMP. The EMR will: a) Consider and advise PLDC and the Director-General on matters specified in the Conditions of Approval and compliance with such; b) Determine whether work falls within the definition of construction where clarification is requested by PLDC; c) Review the CEMP; d) Periodically audit PLDC's activities to evaluate compliance with the CEMP. Periodic auditing will involve site inspections of active work sites at least fortnightly; e) Provide written reports to PLDC of any non-compliance with the CEMP observed or identified by the EMR. Non compliance will be managed as identified in the CEMP; f) Issue a recommendation to PLDC to stop work immediately if in the view of the EMR an unacceptable impact on the environment is occurring or is likely to occur. The stop work recommendation may be limited to specific activities causing an impact if the EMR can easily identify those activities. The EMR may also recommend that PLDC initiate reasonable actions to avoid or minimise adverse impacts; g) Review corrective and preventative actions to monitor the implementation of recommendations made from audits and site inspections; h) Certify that minor revision to the CEMP are consistent with the approved CEMP; and i) Provide regular (as agreed with the Director General) reports to the Director-General on matters relevant to carrying out the EMR role including notifying the Director-General of any stop work recommendations.
	2.1.2 All works will be undertaken in accordance with the CEMP approved by the Director-General.
	2.1.3 All works will be completed in accordance with the design drawings approved by the Accredited Certifier.
2.2 Minimise impact on hydrology	2.2.1 Works within the Nepean River bed will be confined within a sheet-piled cofferdam (or equivalent). A sediment curtain will be fitted around the cofferdam to manage and control release of sediment generated during construction works. The temporary coffer dam will be designed so as not to exacerbate flooding and to minimise the disruption to the flow regime and geomorphology of the water course corridor.

2. During Construction	
Environmental Outcome (commitment)	**Measure (commitment)**
2.3 Minimise impact on water quality of local watercourses (i.e. Nepean River, Peachtree Creek and Boundary Creek)	2.3.1 Temporary flow diversions at Peach Tree Creek and Boundary Creek crossings will include in-river bunding (sheet piling) or piping of the creeks. Where possible, drainage would be attenuated so as not to introduce scouring or erosion at the outlet points for the diversion. This may be achieved through the temporary construction of an attenuation pond, which would facilitate the reduction in the diverted creek flows prior to discharge into the Nepean River.
	2.3.2 An appropriate Water Quality Management Strategy (WQMS) will be developed for incorporation into the CEMP incorporating controls recommended in the Environmental Assessment.
	2.3.3 A site specific Erosion and Sediment Control Plan (ESCP) will be developed for incorporation into the CEMP. All erosion and sediment controls would be in accordance with the 'Blue Book' - NSW Department of Housing publication.
2.4 Minimise the impact on terrestrial ecosystems	2.4.1 A Vegetation Management Plan will be developed detailing bush regeneration works, weed management strategies and monitoring to be undertaken. The VMP will be implemented by qualified contractors and be consistent with any existing management plans for the area.
	2.4.2 Large and mature trees will be retained as far as reasonably practicable.
	2.4.3 Vegetation representing ground cover (grass tussocks), understorey (e.g. low shrubs and trees) and tree canopy (e.g. large trees) will be planted during the revegetation process.
	2.4.4 Plants used for the revegetation or landscaping will be native species or local provenance where practical.
	2.4.5 Weed biomass material that is cleared from the direct impact zone will be bagged and removed from the site to be disposed in appropriate greenwaste facilities. Any native biomass material will be left onsite.
2.5 Minimise the impact on aquatic ecosystems	2.5.1 Any freshwater mussels located 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 pump and pipeline works area.
	2.5.2 Intake structure, pump station and pipe work construction activities will be scheduled outside fish migration season (July to October) where practical.
	2.5.3 An aquatic weed management plan will be prepared as a sub-plan to the VMP.
	2.5.4 ‘Cut to stump’ clearing methods will be employed during the bank side clearing where practical.
	2.5.5 The areas disturbed during the excavation of the Nepean River will be rehabilitated by replacing the original soil profile, protected by sediment curtains and revegetated with V. americana
	2.5.6 Large woody debris or snags partially or completely within the construction area will be lopped, realigned

2. During Construction			
Environmental Outcome (commitment)		**Measure (commitment)**	
			or locally relocated to minimise damage to habitat.
		2.5.7	Fish located within the cofferdam when the construction area is pumped dry will be released back into the weir pool, any pest species will be euthanized. Photos of pest species will be provided within the CEMP for easy identification.
2.6	Minimise impact on indigenous heritage	2.6.1	Should any buried or in-situ relic, artefact or material (including skeletal) remains suspected of being of Aboriginal origin be encountered during ground investigation works or during construction the following measure will be applied: a) All work would cease immediately in the impact area so as to avoid any potential further damage/disturbance to the artefact/relic. b) The construction contractors will immediately notify PLDC's heritage Officer to arrange for a NSW DEC officer to attend the site and advise on appropriate measures to be implemented. Appropriate 'rescue-record' procedures would be implemented in accordance with the requirements of the NPW Act 1974.
		2.6.2	All personnel working on site during construction will receive appropriate training as part of site inductions regarding their responsibilities under the NPW Act in terms of archaeological relics.
		2.6.3	All earthworks will be monitored by a suitably qualified archaeologist.
2.7	Minimise impact on non indigenous heritage	2.7.1	All personnel working on site during construction will receive appropriate training as part of site inductions regarding their responsibilities under the Heritage Act 1977 in terms of archaeological relics and the specific location of the heritage items; Castlereagh area, upper room chapel, hall and cemetery and mouquet farm hard stand slab.
		2.7.2	Should any item be encountered during construction of the NRPP project, which is suspected to be a relic of heritage value, all work will cease that may expose the area to damage or disturbance. The EMR will be notified immediately and appropriate arrangements will be made to contact a representative of the NSW Heritage Office or other suitably qualified personnel to attend the site.
		2.7.3	Temporary construction signage would be erected to advise on the proximity to heritage items to secure the area.
2.8	Minimise impact on urban design, landscape and amenity	2.8.1	Construction of the pump station, control building and pipeline will be undertaken in stages and in a timely manner.
		2.8.2	The working width will be reinstated along the entire length of the pipeline route, as soon as reasonably

2. During Construction			
Environmental Outcome (commitment)		**Measure (commitment)**	
			practical.
		2.8.3	Construction work areas will be designated and clearly defined.
		2.8.4	Temporary stockpiles and spoil mounds will be kept under two metres in height.
2.9	Minimise impact on topography, geology and soils	2.9.1	A Soil and Water Management Plan (SWMP) including Erosion and Sediment Control Plan (ESCP) will be prepared and incorporated into the CEMP.
		2.9.2	Vegetation clearance will be limited to that required as a minimum for the purpose of construction.
		2.9.3	A temporary coffer-dam or similar structure will be constructed downstream of the construction activities prior to any excavations at the Boundary Creek and Peach Tree Creek crossings and water will be diverted around the construction zone.
		2.9.4	The excavated pipe trench will be shored at the creek crossings to provide stability during excavation.
		2.9.5	Rock and clean fill excavated from the creek will be moved to a separate bunded area, away from the creek bank and fenced off to dry out. This rock clean fill will be used to reshape the creek banks to their original form on completion of the works.
		2.9.6	Graded rock 200mm or 400mm in diameter will be placed over the trenched area of the creek bed to protect it from erosion by flowing water during re-establishment.
		2.9.7	The creek banks will be re-contoured to their original form using the previously extracted materials, covered with geofabric, jute matting and/or coir matting and replanted with native revegetation. Revegetation will extend from the toe, up the bank using seedlings and reasonably established tube stock, up to two metres in height where appropriate.
2.10	Minimise impact of noise and vibration	2.10.1	A Construction Noise Management Plan (CNMP) will be prepared as part of the CEMP.
		2.10.2	Construction hours to be restricted to: <u>Outside the Scheme boundary</u> - Weekdays (i.e. Monday to Friday) 7am to 6pm - Saturday: 8am to 1pm - No construction work is to be carried out on Saturday or Public Holidays or during night-time hours. <u>Within the Scheme boundary</u> - Monday to Saturday 7am to 7pm. - No work on Sundays or public holidays or during night-time hours, with the exception of that required for quarry haul road crossings. Should work be required outside of the agreed construction

2. During Construction	
Environmental Outcome (commitment)	**Measure (commitment)**
	hours prior approval will be sort and the community and PCC consulted.
	2.10.3 Stationary plant and equipment will be operated directing the noise emissions away from sensitive receptors where practical.
	2.10.4 The offset distance between noisy plant and equipment, and surrounding noise sensitive receptors will be maximised.
	2.10.5 PLDC will notify the local community of construction activities, including that the duration will be limited and the times of construction strictly controlled. Notification will be provided a minimum of 48hrs prior to works commencing.
	2.10.6 Low noise emission plant and equipment will be selected for the duration of works (where possible).
	2.10.7 Signage will be provided at Weir Reserve two weeks prior to works commencing to alert users to the upcoming disruption.
	2.10.8 Noisy works will be scheduled for less sensitive periods of the day, wherever practicable, particularly around any significant Church events.
2.11 Minimise impact on air quality	2.11.1 All vehicle loads entering and departing the working width will be covered and secured.
	2.11.2 Exposed stockpiles and unsealed construction areas will be sprayed with water as appropriate, or stabilised with seeding and planting as soon as it is practicable to do so.
	2.11.3 Onsite vehicle speed limits will be established and enforced, and as appropriate reviewed in accordance with meteorological conditions, site safety requirements, and the VMP.
	2.11.4 Vehicles and machinery will be regularly serviced and maintained to minimise potential emissions.
	2.11.5 Works will cease when wind speeds exceed 10m/s and where dust generation cannot be effectively minimised until adequate controls can be implemented or until such weather conditions abate.
	2.11.6 No vegetation, timber or combustible material would be burnt on site. Material that is unsuitable for reuse or recycling on site will be removed and transported for subsequent storage, reuse recycle or disposal.
	2.11.7 Any complaints relating to air emissions from construction activities would be promptly investigated and additional controls implemented where required.
	2.11.8 Vehicles and construction crews will be confined to works areas to prevent any inadvertent encroachment or otherwise into exposed and stripped areas of ground or areas subject to rehabilitation.
	2.11.9 All emission controls used on vehicles and construction equipment would comply with relevant NSW DEC standards as provided under Section 124 of the Protection of the Environment Operations Act 1997

2. During Construction	
Environmental Outcome (commitment)	**Measure (commitment)**
	2.11.10 Revegetation/stabilisation of disturbed land surfaces with appropriate seeding and native plant mixes will be undertaken as soon as it is possible to do so to minimise dust episodes and topsoil dispersion.
2.12 Minimise waste generation	2.12.1 A Resource Management Plan embodying the principals of the resource management hierarchy will be prepared as part of the CEMP.
	2.12.2 All wastes will be correctly classified in accordance with the Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes, produced by the EPA in July 1999 to accurately identify management, transportation and disposal requirements.
	2.12.3 Handling, storage and transport of hazardous materials and waste will be in accordance with the National Code of Practice and the relevant Material Safety Data Sheets (MSDS) for the product.
2.13 Minimise impact on existing land use	2.13.1 PLDC will consult with Penrith City Council to coordinate the pipeline works with the Great River Walk.
	2.13.2 A Traffic Management Plan will be developed and implemented during the construction phase to provide maximum safety and ease of access for adjacent land uses to the construction zone.
	2.13.3 Land drains and watercourses intercepted by the pipeline route will be reinstated to reflect their former state.
2.14 The effectiveness of the mitigation measures will be assessed and reported during the construction phase.	2.14.1 PLDC will provide the Director–General and Penrith City Council report(s) in respect of the environmental performance of the construction works and compliance with the CEMP, the Statement of Commitments and any other relevant Conditions of Approval. The reports(s) will be prepared within six months of the start of construction and there-after at six monthly intervals. The EMR will review the Construction Compliance Reports before they are submitted to the Director-General and bring to the Director-Generals attention any shortcomings.
2.15 Construction will comply with approved designs	2.15.1 A compliance certificate under Part 4A of the EP&A Act will be issued by an Accredited Certifier to the Department of Planning, confirming that works have been completed in accordance with approved designs.

3. Pre-Operation	
Environmental Outcome (commitment)	**Measure (commitment)**
3.1 The proposed NRPP will be operated in accordance with the proposal contained in the Environmental Assessment 'Nepean River Pump and Pipeline Environmental Assessment' prepared by Maunsell dated August 2006.	3.1.1 PLDC will submit a Pre-Operation Compliance Report to the Director-General at least four weeks before the Operation of the NRPP (or within any other time agreed to by the Director-General) detailing compliance with pre-operation terms of approval.
	3.1.2 An Operation Environmental Management Plan (OEMP) will be prepared and implemented addressing the operational mitigation measures proposed in the Environmental Assessment, Statement of Commitments and the Conditions of Approval. The OEMP will be submitted to the Director-General for approval before operation commences.

4. Operation	
Environmental Outcome (commitment)	**Measure (commitment)**
4.1 The proposed NRPP will be operated in accordance with the proposal contained in the Environmental Assessment 'Nepean River Pump and Pipeline Environmental Assessment' prepared by Maunsell dated August 2006.	4.1.1 The NRPP will be operated in accordance with the approved OEMP.
	4.1.2 The automatic pump operating system will be fully maintained with provisions for monitoring and overriding control from PLDC offices, or other appropriate location to suit future management of the Lakes Scheme.
4.2 The NRPP will be operated to protect the Penrith Lakes from poor Nepean River water quality	4.2.1 Quarantine lake will be designed to enable water detention time of approximately 24 days in order for 95 percent of faecal coliform to die/degrade before being discharged to the Rowing Lake or Lake A.
	4.2.2 All water pumped from the Nepean River will be pumped via constructed wetlands, as well as appropriate mixing and circulation of the receiving lake waters.
4.3 Minimise impact on urban design, landscape and visual amenity	4.3.1 The pump station will be configured and located to reduce potential visual impacts. An appropriate range of materials, colours and textures will be integrated into the design and hard surfaces to take account of surrounding landscape colours.
	4.3.2 The height of the control building will be kept as low as possible (less than four metres in height) and an appropriate range of materials, colours and textures will be integrated into the building design and hard surfaces to take account of surrounding landscape colours.
4.4 Minimise impact on Nepean River flows and fish passage	4.4.1 The pump and pipeline will be operated in accordance with the following the operating rules:
	a) Maximum pumped flow rate to be 1.0 m^3/s b) Pumping to commence when flows over Penrith weir exceed 500 ML/day and pumping to cease when flows fall below 350 ML/day
	4.4.2 After initial filling of the lakes, the pump will be operated for lakes system top up only, not for lake flushing.

4. Operation	
Environmental Outcome (commitment)	**Measure (commitment)**
4.5 Protect the lakes from weed invasion as a result of NRPP operation	4.5.1 Implementing a multi-barrier approach to weed transfer control including: a) Constructed wetland with shallow and water deep zones; b) Submerged intake pipes with Johnson screens; c) Rocks rip rap at the inlet of the wetlands; d) Floating silt curtain; and e) Quarantine lake.

12. Conclusions

Penrith Lakes Scheme is an undertaking in western Sydney that will involve the staged development of residential/commercial, open space and lake precincts. A key component of the Scheme's development will be the formation and construction of an interconnected lakes system to satisfy the future recreational needs in western Sydney. Adequate water supply to the lakes is essential for the completion and long term viability of the Scheme's development. Extracting water from the Nepean River has been identified as the only viable source of water to fill the lakes within the Scheme.

Under a Deed of Agreement that was made in 1987, PLDC are required to design and construct a pump and pipeline to extract water from the Nepean River at a point upstream of Penrith Weir to facilitate the initial filling and long term water supply of the lakes within the Scheme.

The NRPP project will involve the construction and operation of a new 4.3 km water supply pipeline, intake/discharge pipework and structures, pump station and instrumentation equipment, and a constructed wetland and Quarantine Lake.

Construction and operation of the NRPP would meet the project objectives provided in **Section 1.3**:

- The NRPP will resolve the long term water supply issue for the Scheme through initially filling the lakes and providing an effective and reliable long term water supply.
- Pumping rules have been devised that will deliver adequate water supply to the Scheme and provide a mechanism for lake filling by Scheme completion.
- The pipeline has been designed in order to be integrated with the alignment of the Great River Walk.
- Potential environmental impacts have been identified and measures are incorporated to manage these.

Key environmental issues associated with the development of NRPP project have been considered.

Water will be extracted from the Nepean River at a rate of 1.0 m^3/s, and pumping will commence when flow over the Penrith Weir exceeds 500 ML/day and will cease when flow falls to 350 ML/day. These pumping rules have been devised to maximise the volume of water extracted and minimise the impact on the ecological status of the Nepean River.

The uncontrolled discharge of extracted river water into the lakes may adversely impact on the Scheme water quality and result in the proliferation of aquatic weeds via the transmigration of seed provenance and weed litter from the Nepean River to the Scheme's lakes system. Potential water quality impacts will be mitigated via the river water being transferred to a Quarantine Lake and constructed wetland before being discharged to the Scheme.

Pipeline construction works will require the clearing of a degraded area of native vegetation from a 15 metre wide working width along the initial 400 metres of the pipeline route. The total area of RFEF to be cleared from within the 15 metre wide working width is approximately 0.8 hectares.

Construction of the intake structure will require the temporary removal of approximately 1,000 m^2 of macrophytes for erection of the cofferdam.

The Nepean River and Penrith Weir provides potential habitat for Macquarie Perch. Assessments of Significance under the EPBC and FM Act have been prepared in relation to the proposed intake pipeline and concluded that the construction activities would not impact on this species.

It is considered unlikely that unrecorded archaeological sites and artefacts of indigenous heritage significance would be uncovered during construction. Monitoring initial top soil stripping in some locations would occur and work would cease immediately at the location should artefacts be disturbed.

Impacts on the local landscape and visual amenity will largely occur during and for a period after construction of the pipeline, pump station, control building and intake structure. The impact of these works will be greatest at Weir Reserve and a small area along the lower riverside terrace of the Nepean River which may affect recreational users of this area in the short-term.

Once the pipeline has been installed and reinstated, the permanent effects of the NRPP project will be attributed to above ground structures such as pump station and control building and paved access at Weir Reserve and on the lower bank of the Nepean River. Visual evidence of the re-established pipeline route and the aboveground structures will diminish over time and, as the revegetation works establish and the built elements integrate into the landscape fabric. It is considered that there will be no long-term adverse impacts associated with the NRPP project.

Noise levels associated with the construction of the pipeline, control building and pump station are predicted to exceed guidelines at a number of sensitive receivers and may temporarily impact on users of Weir Reserve. Operational noise levels are expected to satisfy guidelines.

Accordingly, it is considered that the construction and operation pipeline and associated infrastructure is justified in terms of the objective minimising environmental impacts.

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Internet Links

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Australian Government Bureau of Meteorology http://www.bom.gov.au

Department of the Environment and Heritage: http://www.deh.gov.au/heritage/national/index.html

Geological Society of Australia: http://www.gsa.org.au/

National Trust: http://www.nsw.nationaltrust.org.au/

NSW Department of Environment and Conservation incorporating Environment Protection Authority - http://www.environment.nsw.gov.au/home.htm

NSW Heritage Office: http://www.heritage.nsw.gov.au/

Penrith City Council: http://www.penrithcity.nsw.gov.au

Penrith Lakes Development Corporation: http://www.penrithlakes.com.au

Penrith Online: www.penrithonline.com.au

Professional Historians Association: http://www.phansw.org.au/

Royal Australian Institute of Architects: http://www.architecture.com.au/i-cms?page=1

Appendix A: Environmental Assessment Requirements

Appendix B: Water Balance and Water Quality Modelling Assessment

Appendix C: Aquatic Weed Transfer and Water Quality Assessment

Appendix D: Terrestrial and Aquatic Flora and Fauna Assessment

Appendix E: Aboriginal Cultural Heritage Assessment

Appendix F: Environmental Noise Assessment

Appendix G: Additional Aquatic Ecology Assessment