

ASSESSMENT REPORT 72

**EAST POINT EFFLUENT  
RISING MAIN  
DUPLICATION PROJECT**

**POWER AND WATER CORPORATION**

ENVIRONMENTAL ASSESSMENT REPORT  
AND  
RECOMMENDATIONS

by the

NT Environment Protection Agency

December 2012

## Table of Contents

Glossary.....	4
Executive Summary .....	5
List of Recommendations.....	8
1. Introduction and Background.....	10
1.1 Environmental Impact Assessment Process.....	10
1.2 Regulatory Framework.....	11
1.3 Environmental Impact Assessment History .....	12
1.4 Relevant Policy .....	13
1.4.1 Ecologically Sustainable Development.....	13
1.4.2 National Water Quality Management Strategy and Related Projects .....	14
1.4.3 Darwin Harbour Water Quality Protection Plan .....	14
1.4.4 The Darwin Harbour Strategy.....	15
1.4.5 Recreational Waters Guidelines.....	15
2. The Proposal.....	16
2.1 The Proponent .....	16
2.2 Project Objective .....	16
2.3 Project Location and Description.....	16
3. Regional Setting .....	19
3.1 Physical.....	19
3.2 Biological .....	19
3.2.1 Marine Ecology .....	19
3.2.2 Terrestrial Ecology.....	20
3.3 Socio-economic.....	20
3.4 Cultural/Historical.....	21
4. Environmental Impact Assessment.....	22
4.1 Introduction.....	22

<b>4.2</b>	<b>Scope of the Assessment .....</b>	<b>23</b>
<b>4.3</b>	<b>Related Assessments.....</b>	<b>23</b>
<b>4.4</b>	<b>Acid Sulfate Soils .....</b>	<b>24</b>
<b>4.5</b>	<b>Water Quality .....</b>	<b>25</b>
<b>4.5.1</b>	<b>Contaminants .....</b>	<b>25</b>
<b>4.5.2</b>	<b>Outfall Mixing Zones.....</b>	<b>29</b>
<b>4.5.3</b>	<b>Monitoring Program.....</b>	<b>32</b>
<b>4.6</b>	<b>Biodiversity .....</b>	<b>34</b>
<b>4.6.1</b>	<b>Marine Ecology .....</b>	<b>34</b>
<b>4.6.2</b>	<b>Terrestrial Ecology.....</b>	<b>37</b>
<b>4.7</b>	<b>Impacts on Recreation Areas.....</b>	<b>39</b>
<b>5.</b>	<b>Conclusion .....</b>	<b>40</b>
<b>6.</b>	<b>References .....</b>	<b>41</b>
	<b>Appendix 1 - Commitments Register (Table G-1, Supplement) .....</b>	<b>44</b>

## Glossary

ASS	Acid Sulfate Soils
CBD	Central Business District of Darwin
DHAC	Darwin Harbour Advisory Committee
DLPE	Department of Lands Planning and Environment
Draft PER	Draft Public Environmental Report
EA Act	NT <i>Environmental Assessment Act 1982</i>
EAAP	NT <i>Environmental Assessment Administrative Procedures 1984</i>
EIA	Environmental Impact Assessment
EMP	Environment Management Plan
EPA	Environment Protection Agency within DLPE
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPO	East Point Outfall
ERM	Effluent Rising Main
GHG	Greenhouse Gas
LOCP	Larrakeyah Outfall Closure Plan
LWWTP	Ludmilla Waste Water Treatment Plant
NES	National Environmental Significance
NOI	Notice of Intent
NRETAS	Former Department of Natural Resources, Environment, the Arts and Sport
NWQMS	National Water Quality Management Strategy
NT	Northern Territory of Australia
NTG	Northern Territory Government
PASS	Potential Acid Sulfate Soils
PER	Public Environmental Report
SEWPAC	Australian Department of Sustainability, Environment, Water, Population and Communities
WQO	Water Quality Objectives
the Minister	Northern Territory Minister for Lands Planning and the Environment
the Project	East Point Effluent Rising Main Project
the Report	This Assessment Report 72, for the East Point Effluent Rising Main Project
the responsible Minister	Minister for Essential Services

## Executive Summary

Environmental impact assessment (EIA) is the process of defining those elements of the environment that may be affected by a development proposal and analysing the risks associated with the identified potential impacts. This Assessment Report (the Report) assesses the environmental impact of the East Point Effluent Rising Main Project (the Project) as proposed by the Power and Water Corporation (the Proponent).

The duplication of the Effluent Rising Main (ERM) at East Point is to accommodate an increase in effluent flows generated by the diversion of sewage from the Larrakeyah catchment to Ludmilla and projected population growth to 2030 in the combined sewerage 'catchment' (this includes the Darwin city, Larrakeyah and Ludmilla catchment areas). The increased capacity of the duplication will allow for a lower frequency of effluent bypass to Ludmilla Creek. The diversion of sewage to Ludmilla was planned in response to the closure of the Larrakeyah outfall.

The additional sewage will be treated at the Ludmilla Waste Water Treatment Plant (LWWTP). The LWWTP is being upgraded in hydraulic capacity and treatment capability. The upgrades do not form part of this assessment process or this Report. Likewise the proposed extension of the existing East Point Outfall (EPO) to a (yet to be determined) point some distance offshore from its current location is not included in this Report, but is subject to a separate assessment process. There will be an increase in the volume of effluent discharged at the existing near shore East Point Outfall (EPO) during the period between the diversion of sewage from Larrakeyah to LWWTP and the extension or modification of the Outfall.

The Project was assessed under the Bilateral Agreement for Environmental Impact Assessment between the NT and Australian Governments to satisfy requirements of both the NT *Environmental Assessment Act* 1982 (EA Act) and the Australian *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act).

This Report forms the basis of advice to the Minister for Lands, Planning and the Environment on environmental issues associated with the Project. The Minister may make comment and/or recommendations with regard to the proposal to the Minister for Essential Services (the responsible Minister). Recommendations are made to address relevant construction activities and ongoing operation of the ERM.

The Report is based on a review of the draft Public Environmental Report (PER), the Supplement to the draft PER (Supplement), comments from the public and NT government agencies, and additional information requested on the Supplement.

## **Key Risks**

The key risks associated with this proposal are:

- Disturbance to acid sulfate soils;
- Impact on water quality (including the contaminants of concern, outfall mixing zones and monitoring programs);
- Impacts on biodiversity; and
- Impacts on recreation areas.

## **Conclusions**

This Project – the duplication of the rising main at East Point - is assessed to be of relatively low environmental impact in terms of its construction and any enduring environmental effects from its operation. This Report has assessed the impact of pipeline duplication, mainly as a construction and disturbance issue, but with consideration of a volumetric increase of 32% of effluent discharged via the existing outfall for the duration of several years.

The operation of the installed infrastructure is a strategic component of an overall plan to consolidate sewage treatment from the Larrakeyah catchment to a combined treatment and effluent disposal facility at Ludmilla. The plan is expected to deliver a significant environmental benefit when all components of the plan are completed.

The construction of the duplicate rising main at East Point is a priority so as to derive the maximum environmental benefit from the other completed, or near completed, components of the LOCP. A direct benefit of the duplication is the reduced frequency of wet season diversion of treated effluent to Ludmilla Creek caused primarily by hydraulic surcharging of the existing infrastructure.

Some of the key issues in this assessment report have been associated with water quality – potential risks associated with unknown contaminant loads, nutrients, and the fate of such, defining the outfall mixing zone and the development of an appropriate monitoring program.

The proponent will be required to undertake specific actions to reduce uncertainty that remains at the conclusion of this assessment. In summary, these actions include:

- Verification of the outfall mixing zone through ecotoxicological investigation and benthic infauna surveys;
- Investigation of fate of nutrients through stable isotope analysis; and
- Refine the ongoing monitoring programs, to include water quality and benthic

infauna, until the new East Point extended outfall is completed.

The ongoing environmental monitoring and reporting required from the Proponent must demonstrate that environmental impacts from the Project are no greater than those predicted in this assessment.

Based on review of the PER, Supplement and Further Information, and with regard to the mitigation measures proposed by the Proponent and recommendations made in this report, it is considered that the environmental impacts of the project can be managed at an acceptable level.

# List of Recommendations

## 1. Recommendation

The Proponent will ensure that the proposal is implemented in accordance with the environmental commitments and safeguards:

- Identified in the East Point Effluent Rising Main Project's Public Environmental Report (draft PER and Supplement); and
- Recommended in this Assessment Report.

All safeguards and mitigation measures outlined in the Public Environmental Report are considered commitments by the Proponent.

## 2. Recommendation

The Proponent will advise the Minister of any changes to the proposal that could change its environmental significance in accordance with clause 14A of the Environmental Assessment Administrative Procedures, for determination of whether or not further assessment is required.

## 3. Recommendation

The Proponent is to prepare a detailed Acid Sulfate Soil Management Plan to be reviewed by an independent and suitably qualified third party auditor. The Plan must specify how PASS will be successfully managed for the duration of the project. PWC must notify the EPA if contaminated material is to be disposed of off-site.

## 4. Recommendation

The Proponent is required to clearly demonstrate the extent of impact on marine species through ecotoxicological investigation and assessment within the mixing zone at the current outfall.

The ecotoxicological investigation and assessment should be clearly scoped to provide clear guidance to selecting a site for the proposed outfall extension. The ecotoxicological investigation and assessment report is to be provided to the NT EPA within 12 months to inform conditions on the Waste Discharge Licence.

## 5. Recommendation:

The proponent is to undertake stable isotope analysis to determine extent of zone impacted by sewage and to distinguish between contaminants originating from Ludmilla WWTP effluent and contaminants from background and other



sources such as stormwater. The analysis report is to be provided to the NT EPA within 12 months of this report.

#### **6. Recommendation**

The Proponent is required to undertake a Benthic Infauna survey along a gradient away from the current EPO to verify levels of impact relating to the current outfall mixing zones. Survey design may require inclusion of sediment particle size analysis, and should be developed in consultation with the NT EPA. Interpreted results should be submitted to the NT EPA within 12 months of this Report and will inform conditions on the Waste Discharge Licence.

#### **7. Recommendation**

The Proponent is to design and implement a Water Quality Monitoring Program to the satisfaction of the NT EPA, consistent with WDL 150-02. Monitoring should be conducted on a monthly basis and results reported to the NT EPA annually until the extension of the outfall is completed.

#### **8. Recommendation**

The Proponent is to design and implement an annual Benthic Infauna Monitoring Program to the satisfaction of the NT EPA (informed by the outcomes of Recommendation 6). Monitoring should be conducted and reported annually to the NT EPA until the extension of the outfall is completed.

#### **9. Recommendation**

If monitoring results indicate a departure from expected impacts, the Proponent must implement contingency measures in consultation with the NT EPA to deliver improved environmental outcomes equivalent to those expected from the East Point Outfall extension.

#### **10. Recommendation**

The Proponent must ensure commitments made to protect sensitive vegetation types and listed species are adhered to by contractors. Post-construction monitoring should be done in order to assess the active rehabilitation and re-growth of sensitive vegetation.

#### **11. Recommendation**

The Proponent should in consultation with the NT Department of Health develop a public consultation plan including advertising and signage on any risks to public health likely to occur in the vicinity of the effluent outfall at East Point and surrounds.

# 1. Introduction and Background

This Report assesses the environmental impact of the East Point Effluent Rising Main Duplication Project (the Project) and makes recommendations on how those environmental impacts should be mitigated and managed.

The Power and Water Corporation (PWC) (the Proponent) proposes to duplicate the East Point Effluent Rising Main (ERM) from the Ludmilla Waste Water Treatment Plant (LWWTP) to the current East Point Outfall. This infrastructure upgrade will meet the projected increases in effluent volume associated with diversion of sewage from the Larrakeyah and Darwin city catchment and projected future growth to year 2030 in the combined (Larrakeyah and Ludmilla) catchment areas.

A separate environmental impact assessment will assess the related PWC proposal to extend the East Point Outfall (EPO) further offshore.

This Environmental Assessment Report (the Report) is based on a review of the draft Public Environmental Report (PER), Supplement to the draft PER (Supplement), a request for additional information, and comments from the public and Government agencies on the PER.

The draft PER and Supplement are collectively referred to as the PER. Submissions received on the draft PER are summarised in the Supplement. The PER and further information submitted can be viewed on the Environmental Assessment register website at:

[www.nretas.nt.gov.au/environment-protection/assessment/register/pow\\_wat\\_corp](http://www.nretas.nt.gov.au/environment-protection/assessment/register/pow_wat_corp).

## 1.1 Environmental Impact Assessment Process

Environmental impact assessment (EIA) should:

- identify potential impacts on the environment (where environment is defined broadly according to the *Environmental Assessment Act*); and
- evaluate the risks of those impacts occurring.

Through its assessment of the project's environmental risks the Proponent must demonstrate:

- that risks can be managed within acceptable levels e.g. impacts would not result in significant long term environmental detriment.

Assessment gives weighted consideration to:

- an estimation of the likelihood of success of preventative and remedial measures; and

- the appropriateness of monitoring programs to provide measures of the environmental effects of the proposed Project.

Assessment of risks can be more reliably evaluated where there is good baseline environmental information. Risk assessment is constrained where this information is limited or not available. A precautionary approach to the evaluation of potential impacts is appropriate when this is the case.

This Report evaluates the adequacy of the baseline information and the commitments and environmental safeguards proposed by the Proponent to avoid or mitigate the potential impacts identified in the risk assessment process.

The safeguards may be implemented at various levels in the planning framework of a project and include (among other approaches):

- Design and layout of components and other infrastructure on the site;
- Management of construction activities; and
- Management of processes used in operations of the facility (e.g. inputs and outputs).

## **1.2 Regulatory Framework**

Environmental assessment was undertaken in accordance with the requirements of the Northern Territory *Environmental Assessment Act 1982* (EA Act). The proposal was declared a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as it was considered likely to have significant impacts on the following Matters of National Environmental Significance that are protected under Part 3 of the EPBC Act:

- Sections 18 and 18A (Listed threatened species and communities); and
- Sections 20 and 20A (Listed migratory species).

The Project is assessed under the Bilateral Agreement for Environmental Impact Assessment between the NT and Australian Governments to satisfy requirements of both the EA Act and the EPBC Act.

The contents of this Report form the basis of advice to the Minister for Lands, Planning and the Environment (the Minister) on the acceptability of environmental impacts, the adequacy of mitigation measures and the residual risks to the environment that are to be borne by the current and future community.

The Minister is required to make comment and/or recommendations concerning the proposal to the Minister for Essential Services (the responsible Minister).

The Proponent may need to obtain permits, licences and approvals under Northern Territory legislation.

The Australian Government Minister for Sustainability, Environment, Water, Population and Communities (Australian Government Minister) will need to consider the Project for an approval decision under the EPBC Act. This Assessment Report will inform the consideration.

### **1.3 Environmental Impact Assessment History**

On 25 September 2009, a Notice of Intent (NOI) outlining the proposed duplication of the ERM and the Extension of the East Point Outfall (EPO) was submitted by the Proponent to the Minister.

On 18 December 2009 the Minister determined that the proposal required formal assessment under the EA Act, at the level of a PER. The Project was referred by the Proponent under the EPBC Act to the Australian Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) on 2 October 2009 and SEWPaC advised on 2 November 2009 that the Project was a controlled action. Final PER Guidelines were issued to the Proponent on 23 February 2010.

On 19 August 2011, the Proponent advised of alterations to the proposal, in accordance with clause 14A of the NT Environmental Assessment Administrative Procedures 1984 (EAAP). The Proponent advised it wanted to split the assessment of the ERM and EPO so that the assessment of the ERM could be completed and construction commence while investigations of the EPO project carried on into 2012.

The NT Minister accepted the alteration on 7 October 2011 and the Australian Government accepted the proposed variation under the EPBC Act on 26 August 2011. The separated EPO Project was reviewed and determined on 10 November 2011 to require assessment at the level of a PER. PER Guidelines for the EPO are yet to be finalised.

On 12 November 2011, the draft PER for the ERM (this Project) was made available for public comment for a period of four weeks. Three government agency and four public submissions on the draft PER were submitted to the Proponent for comment/response in the Supplement. The submissions raised the following issues:

- Water quality changes at the current East Point outfall;
- Lack of modelling that could describe predicted impacts at the current and proposed outfall;
- Marine biodiversity impacts;

- Unknown impacts of discharges at the proposed outfall location prior to diversion of effluent from Larrakeyah;
- Changes to the 1998 assessment that included secondary and tertiary treatment of sewage at Ludmilla compared with current proposed treatment level; and
- Lack of understanding of the net environmental benefit of discharging treated sewage at either East Point or Larrakeyah.

The Proponent lodged the Supplement in response to the submissions with the then Environment and Heritage (EH) Division of the Department of Natural Resources Environment, The Arts and Sport (NRETAS) on 7 March 2012.

Further information was requested from the Proponent on 4 April 2012 and on 23 November 2012 the Proponent supplied additional information. The additional information, along with the PER, Supplement, public and government comments, has been taken into account in the preparation of this Assessment Report.

## **1.4 Relevant Policy**

### **1.4.1 Ecologically Sustainable Development**

The Australian Government affirmed its commitment to sustainable development at United Nations conferences on environment and development, notably via the Rio Declaration and Agenda 21 in 1992 and the Johannesburg Declaration at the United Nations 2002 World Summit. Australia reaffirmed its commitment at the Summit to promote the integration of the three components of sustainable development: economic development, social development and environmental protection.

In December 1992 the NT Government endorsed the National Strategy for Ecologically Sustainable Development and agreed, along with all other States and Territories, to the Intergovernmental Agreement on the Environment. The Strategy defines ESD as: *‘Using, conserving and enhancing the communities’ resources so that ecological processes, on which life depends, are maintained and the total quality of life now and in the future can be increased. ESD is development that aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations.’*

The goal of ESD is:

‘Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends’.

The core objectives of ESD are:

- ‘to enhance individual and community well-being and welfare by following a path

of economic development that safeguards the welfare of future generations;

- to provide for equity within and between generations; and
- to protect biological diversity and maintain essential ecological processes and life-support systems'.

To achieve the objectives of ESD, the Project needs to continually be informed and guided by the ESD principles. Accordingly, the assessment of this proposal, its potential impacts (positive and negative) and the management measures used to enhance positive and reduce negative impacts was undertaken in the context of ESD principles.

Subsequent decision-making processes by approval bodies must be guided by ESD principles and the continued project design and development, as well as the development and implementation of management and monitoring programs by the Proponent, should all aim to meet the objective of ESD.

#### **1.4.2 National Water Quality Management Strategy and Related Projects**

The National Water Quality Management Strategy (NWQMS) provides a national approach to improving and/or sustaining the quality of Australia's water resources.

A number of principles underpin the Strategy, namely:

- Ecologically sustainable development;
- An integrated approach to water quality management;
- Community involvement in setting water quality objectives and developing management plans; and
- Government endorsement of the water quality objectives.

#### **1.4.3 Darwin Harbour Water Quality Protection Plan**

A Darwin Harbour Water Quality Protection Plan (WQPP) is being developed to underpin protection of water quality in the Darwin region. The overall aim of the WQPP is to ensure that water quality objectives (local guidelines) are maintained and that the community's values for waterways are protected.

Phase 1 of the WQPP commenced in 2006 and was completed in 2009. It included identification of key risks to water quality, Water Quality Objectives to support the gazetted Beneficial Uses, improved monitoring activities and a better understanding of assimilative processes and harbor-wide nutrient budgets.

Phase 2 of the WQPP is due for completion in July 2013.

Water Quality Objectives specify those water quality metrics that should be met in ambient waters to protect and sustain each of the environmental values and beneficial uses identified for those waters, as per the NWQMS guidelines.

#### **1.4.4 The Darwin Harbour Strategy**

The Darwin Harbour Strategy (Darwin Harbour Advisory Committee, 2010) is a guide for the responsible stewardship and sustainable development of the Darwin Harbour region. The Strategy was prepared to ensure that future development maintained or enhanced values and functions associated with the Harbour. The Strategy supports the integrated management of the Darwin Harbour region's environmental, social, cultural and economic values and uses.

The Strategy identified five key goals to achieve this aim, for Darwin Harbour. The goals are relevant to the ERM Project:

- Maintain a healthy environment;
- Support recreational use and enjoyment of the environment;
- Ensure that development is implemented in an ecologically sustainable manner;
- Protect cultural values and heritage; and
- Foster community awareness, industry partnerships and stewardship of the Darwin Harbour region.

The Strategy sets out goals, principles and guidelines for all users and stakeholders of Darwin Harbour and its catchment. A key objective is to achieve a balance between environmental, social and economic values.

#### **1.4.5 Recreational Waters Guidelines**

The Northern Territory *Public and Environmental Health Act* came into effect on 1 July 2011 and allows for the making of guidelines. On 6 July 2011, the National Health and Medical Research Council (NHMRC) Guidelines for Managing Risks in Recreational Waters (2008) were formally adopted under the Act, aligning Northern Territory practice with national guidance. The NHMRC is Australia's foremost health body promoting the development and maintenance of public and individual health requirements. The national guidance is recognised as part of the NWQMS and is used to guide management practices to support the safe recreational use of water

resources.

## **2. The Proposal**

### **2.1 The Proponent**

The Proponent of the East Point Effluent Rising Main (ERM) Duplication Project is the Northern Territory Power and Water Corporation (PWC).

### **2.2 Project Objective**

The ERM Duplication project provides a new rising main to transfer treated effluent with an increased hydraulic capacity from the LWWTP to the existing East Point Outfall (EPO). The existing rising main will be maintained as a duty standby.

The primary objective of the proposed development is to accommodate the increased treatment and hydraulic capacity of the LWWTP. A hydraulic capacity increase in the East Point ERM and at LWWTP is necessary because of closure of the Larrakeyah outfall, in accordance with the Larrakeyah outfall closure plan (LOCP). The LOCP diverts untreated sewage, previously disposed of through the Larrakeyah outfall, to the LWWTP where it will receive enhanced primary treatment.

Construction of the diversion pipe work from the Larrakeyah outfall to the LWWTP is complete. Upgrades to the LWWTP to achieve increased hydraulic capacity and enhanced primary treatment are being progressed and are not covered in this Report.

### **2.3 Project Location and Description**

Figure 1 illustrates the location of the ERM in relation to the city of Darwin, Northern Territory. Figure 2 illustrates the layout and corridor of the proposed ERM through the East Point Reserve to join the terminal manhole of the existing near-shore ocean outfall at East Point. Treated effluent from the LWWTP will be pumped through the ERM to the existing gravity outfall at East Point. The Project will employ approximately 10 people during construction.





**Figure 1** Location of the proposal within the NT (from Figure 1-1, draft PER)

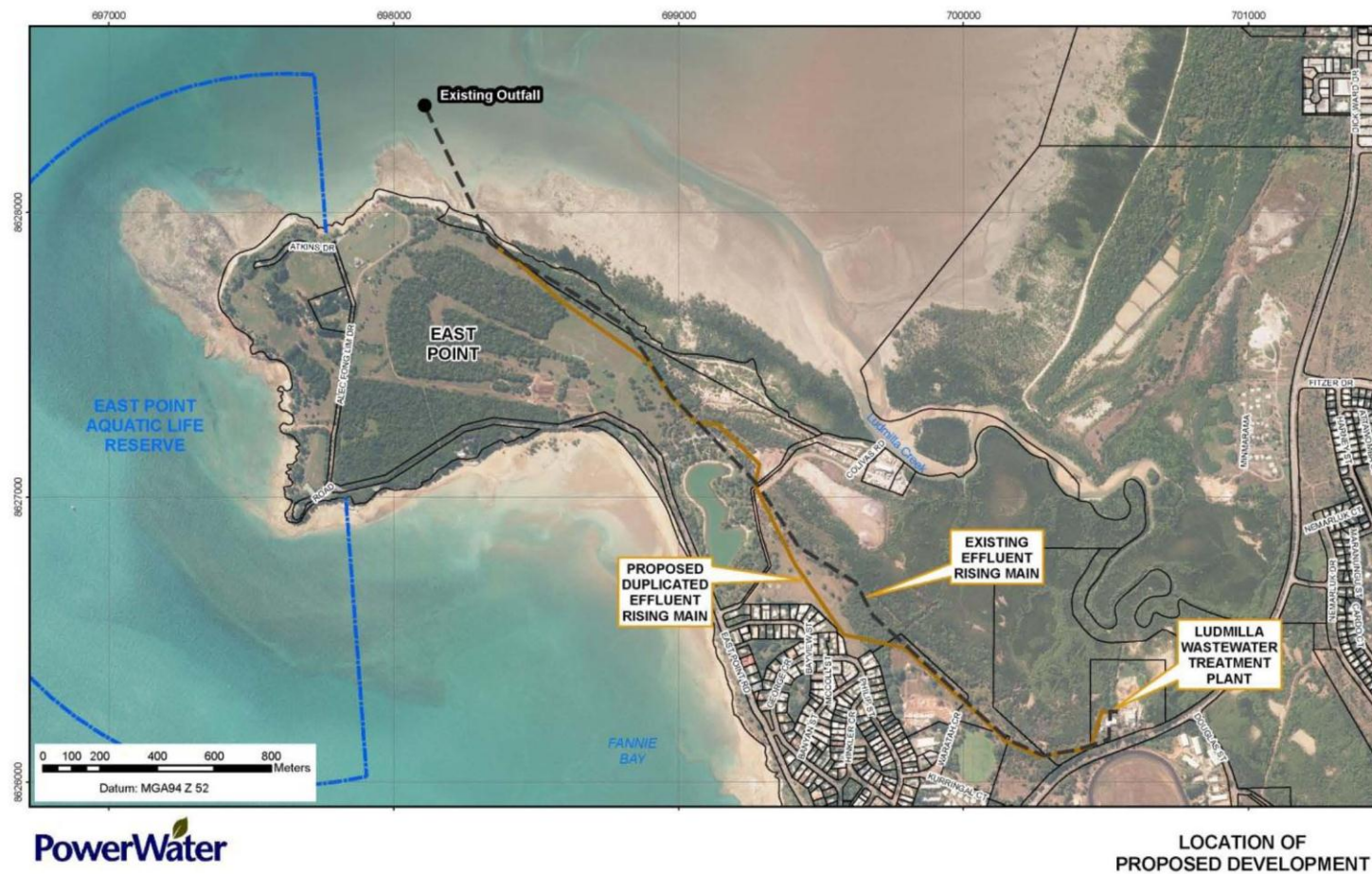


Figure 2 Alignment of the Proposed ERM Duplication (from Figure 1-2 draft PER)

## 3. Regional Setting

### 3.1 Physical

The East Point Reserve covers almost 200 hectares of Public Open Space and Conservation zoned land. A large proportion of the area is subject to primary storm surge flooding. Ludmilla Creek enters Darwin Harbour, fringed by mangrove communities on the north-eastern side of East Point. At the western end of East Point a fringing rocky reef extends into the Harbour within the East Point Aquatic Life Reserve. This area is protected under the NT *Fisheries Act*. It is prohibited to collect marine life in the reserve.

Darwin Harbour is a large ria (flooded valley) system, with a surface area of about 500 km<sup>2</sup>. The Harbour is made up of three main arms: East, Middle and West Arms. These merge into a single unit, along with the smaller Woods Inlet, before opening into Beagle Gulf to the north. Freshwater inflow from the catchment into the Harbour occurs largely from January to April with little or no inflow during the extended Dry season.

There are extensive intertidal mud flats and mangrove stands in the Harbour. Coral communities are found in several areas of rocky substrate.

Soils and sediments in the lower lying areas of the East Point Reserve are known to host some Potential Acid Sulfate Soils (PASS).

### 3.2 Biological

#### 3.2.1 Marine Ecology

Darwin Harbour has a diverse assemblage of species typical of the Indo-western Pacific Biogeographical province. Significant vertebrate species in the Harbour include marine turtles, sea-snakes, sea horses, dugongs and several species of coastal dolphin. These significant species are listed under the Commonwealth Government EPBC Act and some under the *Territory Parks and Wildlife Conservation Act* (TPWC Act).

Coral communities occur where the substrate is rocky in the lower intertidal and shallow subtidal zones. Other intertidal and marine communities in Darwin Harbour include rocky shores and pavements, sand beaches and sand and mud flats, macroalgae, seagrass beds, soft sediments and mangroves. Darwin Harbour is considered a biodiversity “hotspot” for some benthic fauna and many communities contain endemic species (Hooper et al., 2002). Areas of conservation significance in

Darwin Harbour include the Charles Darwin National Park, Casuarina Coastal Reserve and Doctor's Gully Aquatic Life Reserve.

Marine habitats around East Point include a rocky shore (partly protected by the East Point Aquatic Life Reserve), and areas of sandy substrate, some of which sustain sparsely vegetated sea grass beds.

### **3.2.2 Terrestrial Ecology**

Terrestrial vegetation along the proposed development corridor is dominated by urban parkland and road clearings. Regrowth vegetation is made up of mixed species open woodlands and small patches of coastal monsoon vine thicket.

A flora survey in the development corridor recorded a total of 76 flora species, including 61 native flora species, and 10 'Declared Weeds' under the *Weeds Management Act* 2001. Five vegetation communities were recorded in the study area. Two are classified as sensitive or significant according to the NT Land Clearing Guidelines: the Monsoon Vine Forest (MVF) and the Mangrove Forest communities.

A total of 45 species of native terrestrial vertebrate species were recorded within the study area, including four reptile, 36 birds and five mammal species. Three introduced species, the cane toad (*Rhinella marina*), cat (*Felis catus*) and the Asian house gecko (*Hemidactylus frenatus*), were recorded in the proposed pipeline area.

Near threatened and migrant/marine species listed under Commonwealth or NT legislation recorded during the field surveys were:

- Two fauna species, the bush stone-curlew (*Burhinus grallarius*) and yellow-spotted monitor (*Varanus panoptes*), listed as near threatened and vulnerable respectively under the TPWC Act; and
- Six species of birds listed as migratory wetland or marine species under the EPBC Act.

### **3.3 Socio-economic**

The estimated NT resident population at June 2011 was 230,400, showing an annual increase over 2010/11 of 0.4%. Over the same period, the population of the Darwin region was 128,100, with Darwin having some 75,900, Palmerston 30,300 and a balance of some 21,900 people in the rural area. Approximately 618,000 people visited the Darwin tourism region in 2011. The main Indigenous group in the region is the Larrakia people.

Darwin's economy is supported by the Australian Defence Force presence and regional mining industries, and more recently by tourism and offshore gas development and on-shore processing. Aquaculture industry in Darwin Harbour includes two pond-based barramundi farms in the upper reaches of the Blackmore River and a sea cucumber research farm on Middle Arm peninsula. The NT Government owned Darwin Aquaculture Centre on Channel Island supports research and development into aquaculture species such as barramundi, pearl oysters, sea cucumbers, giant clams and rock oysters.

Heavy industry is on the increase in the Darwin region. The Darwin LNG facility operated by ConocoPhillips is at Wickham Point, and the East Arm Port is a major point of export by the primary industry and mining resource sector to Asia, currently going through expansion. INPEX is building a LNG/LPG plant at Blaydin Point, and the Greater Darwin Plan provides for further industry at Gunn Point. Other important industries in the Northern Territory are commercial fishing, tourism, horticulture, the pastoral industry, mining and defence.

Darwin Harbour and its foreshore provide a place for people to meet, play sport, fish and undertake other cultural practices. The Harbour is held in high regard and appeal for communities and tourism owing to the existing balance of the natural environment, landscaping and community infrastructure. Recreational fishing is a well established activity, with a focus on mud crabs, barramundi, a wide variety of reef fish and other pelagic species. Scuba diving and boating are other important recreational activities that occur in the Harbour.

### **3.4 Cultural/Historical**

A survey of the cultural environment was undertaken by the Proponent to evaluate the presence of significant archaeological sites, Aboriginal heritage sites and European heritage sites along the proposed development corridor.

An authorisation from the Aboriginal Area Protection Authority (AAPA) the expansion of the LWWTP and sewage pumping station was obtained by PWC.

No archaeological sites were identified in the rising main corridor. East Point contains numerous heritage sites protected under the *Heritage Conservation Act*, mainly World War II defence installations.

## 4. Environmental Impact Assessment

### 4.1 Introduction

The purpose of this Report is to evaluate the Project and to determine whether it can proceed with acceptable environmental impacts. This evaluation is achieved by identifying the risk of an environmental impact occurring as a result of Project components and activities, and evaluating the Proponent's corresponding safeguards or prevention measures to remove or mitigate the identified risks. Where the proposed safeguards are considered insufficient, or where a safeguard is deemed particularly important, recommendations are made to add to or emphasise those commitments made by the Proponent.

The environmental acceptability of the project is based on assessment of the following from the PER:

- Adequacy of information outlining the proposal (particularly which components or activities are likely to impact the environment);
- Adequacy of information on the existing environment (particularly environmental sensitivities);
- Adequacy of information on the range and extent of potential impacts and the risks of those impacts occurring within the Project context; and
- Adequacy of the proposed safeguards to avoid or mitigate potential impacts.

Conclusions and recommendations are based on comments from the review of the PER by relevant government agencies and the public, and responses from the Proponent to those comments in the Supplement and the supplied additional information.

The recommendations (in **bold**) are preceded by text that identifies concerns, suggestions and undertakings associated with the project. The recommendations should **not** be considered in isolation from the comments. Minor and insubstantial changes are expected in the design and specifications of the proposal following the conclusion of the EIA process. It will be necessary for project management to ensure that subsequent changes meet the requirements of the environmental safeguards described in the PER and the recommendations in this Report. It is understood that the operators will remain within the specified development footprints outlined in the PER.

The primary recommendations of this assessment are:



## **1. Recommendation**

**The Proponent will ensure that the proposal is implemented in accordance with the environmental commitments and safeguards:**

- **Identified in the East Point Effluent Rising Main Project Public Environmental Report (draft PER and Supplement); and**
- **Recommended in this Assessment Report.**

**All safeguards and mitigation measures outlined in the Public Environmental Report are considered commitments by the Proponent.**

## **2. Recommendation**

**The Proponent will advise the Minister of any changes to the proposal that could change its environmental significance in accordance with clause 14A of the Environmental Assessment Administrative Procedures, for determination of whether or not further assessment is required.**

## **4.2 Scope of the Assessment**

This assessment covers environmental impacts associated with the construction and operation of the duplication of the East Point ERM. It addresses impacts on the marine environment from the proposed additional effluent to be discharged at the existing EPO.

A separate proposal is in preparation for an extension of the existing East Point Outfall, which, when commissioned, would discharge effluent from the ERM into deeper water than the current East Point Outfall. The timeframe for the completion of this outfall extension is estimated to be the end of 2013. This assessment is provided on the basis that the extension of the East Point Outfall is imminent and it is imperative that works for the outfall extension project are not delayed.

This assessment does not cover construction works associated with the diversion of the Larrakeyah sewerage catchment to LWWTP or the upgrade of the LWWTP.

## **4.3 Related Assessments**

In 1998, the then Power and Water Authority (now PWC) proposed to upgrade the LWWTP and ERM. This proposal was assessed in 1998 under the EA Act at the PER level. That proposal included the diversion of untreated sewage from

Larrakeyah to LWWTP. This was to allow for the upgrade of LWWTP to ensure that all sewage would receive secondary treatment, with some targeted tertiary treatment capacity proposed to allow for the beneficial irrigation of local parks and gardens. Secondary treated effluent excess to reuse needs was to be pumped back to Larrakeyah for discharge at the Larrakeyah outfall. A duplicate rising main to the East Point outfall was proposed to accommodate Wet season overflows so that untreated sewage was not discharged into Ludmilla Creek. The environmental impact assessment concluded with the then Minister making recommendations in Assessment Report 27.

Public comment on the current ERM draft PER was critical of the PWC for modifying the 1998 proposal. The proposal has significantly altered from the 1998 assessment - to one in which an upgraded LWWTP is to deliver only enhanced primary treatment, with a focus on an increase of hydraulic capacity, as opposed to both hydraulic capacity and improved effluent quality. Further to this, concerns were raised as to whether the LOCP would deliver a net environmental benefit and questions arose as to why PWC did not submit a clause 14A notification under the EA Act to indicate the significant change in scope for the current project relative to the one assessed in 1998.

The Proponent justifies the altered overall project scope as one that incorporates continual or ongoing upgrades and that these upgrades are to be considered as part of the continual improvement of the LWWTP using principles of commercial viability and environmental sustainability. It is accepted that the overall program of works that together make up the LOCP, that is the Larrakeyah outfall closure and sewage diversion, the upgrade of the LWWTP, the construction of the duplicate ERM and the extension of the EPO will be treated as separate and discreet components for environmental assessment purposes. It is imperative to note that this Report considers only the ERM duplication component of the overall LOCP scope of works.

It is acknowledged that projects may change with time due to the changing nature of the social, environmental, political and economic context.

#### **4.4 Acid Sulfate Soils**

Acid sulfate soils are generally found in coastal and floodplain areas below 5 m Australian Height Datum, and constitute a potential hazard when disturbed. When exposed to air even for short periods, the (iron) sulfides in the soil can oxidise to produce sulfuric acid.



Potential Acid Sulfate Soils (PASS) were detected through geotechnical investigation in six boreholes at selected sites along the proposed ERM corridor. Additional investigation of soils occurred in close proximity to the LWTP.

Disposal of any Actual Acid Sulfate Soils (AASS) or Potential Acid Sulfate Soils (PASS) must be carefully planned to avoid potential contamination at the disposal site. No estimates were provided on the overall quantities of PASS to be excavated, however liming rates were provided based on the measured pH levels of the soils.

An ASS management plan is required to determine the residual risk of environmental impact from the construction of the rising main through areas of PASS in the East Point area.

### **3. Recommendation**

**The Proponent is to prepare a detailed Acid Sulfate Soil Management Plan to be reviewed by an independent and suitably qualified third party auditor. The Plan must specify how PASS will be successfully managed for the duration of the project. PWC must notify the EPA if contaminated material is to be disposed of off-site.**

## **4.5 Water Quality**

Uncertainty remains about the potential for impacts from additional effluent discharge at the existing East Point outfall. Increased contaminant loads are proposed to be discharged from the existing outfall until the outfall is extended. The Proponent states that the proposed discharges through the existing outfall will be temporary. Further certainty regarding these potential impacts is necessary to inform decision-making about this Project and the proposed outfall extension.

The key issues in terms of water quality are:

- Contaminants;
- Outfall mixing zones; and the
- Monitoring Program.

### **4.5.1 Contaminants**

Components of the effluent stream that can impact on declared Water Quality Objectives associated with the Beneficial Uses of Darwin Harbour (NRETAS, 2010) include toxicants (e.g. metals such as zinc), stressors (nutrients such as nitrogen and

phosphorus, and suspended solids) and microbiological pathogens (e.g. viruses). Stressors and toxicants together are termed contaminants. The draft PER and Supplement lacked sufficient data on toxicants and nutrients and their potential impacts to intertidal sediments, marine fauna and flora and their habitats to allow for a comprehensive risk assessment.

#### **4.5.1.1 List of Contaminants**

A list of known contaminants discharged at East Point along with the load of such contaminants (kg/annum) was provided in the response to the NRETAS request for additional information (NRETAS, 2012). There were some toxicants for which no data were provided. In this category, which includes particular miscellaneous industrial chemicals, organophosphorous pesticides and generic chemicals such as the oil spill dispersant Corexit 9527, reliable trigger values for marine waters are available, and consideration should be given to verifying that these toxicants are not present in the effluent stream.

#### **4.5.1.2 Contaminant Loads**

Department of Land Resource Management (December 2012) has indicated that “in the immediate zone of the discharge and sites nearby it would be expected that the local WQO’s and /or ANZECC Guidelines could be contravened”, given the additional volumes expected prior to the outfall extension and in the absence of treatment improvements.

Water quality results from the Water and Sediment Monitoring program (as outlined in Appendix Q of the PER; provided in the Supplement at Appendix M) indicated that at 11 locations north/northwest of East Point sampled monthly in 2011 there were numerous exceedances of declared WQOs. In particular, total phosphorus and filterable reactive phosphorus concentrations exceeded the declared 80th percentile WQO concentrations for most of the samples collected at each receiving water monitoring point. It remains uncertain as to whether these results indicate outlier ambient concentrations in this area of the Harbour or whether the indicated mixing zone is something other than depicted at Appendix B2 of the Supplement.

DLRM (2012) discussed the reference made by PWC with regard to one sampling event undertaken by DLRM in August 2010 for total phosphorus (TP). The applicability of a one-off sampling event is not appropriate. More recent intensive survey work by DLRM suggests that TP concentrations are below the local objectives and ANZECC Guidelines in the outer Harbour area. The Proponent should recognise that significant variation can occur as a result of tidal influence, seasonal and/or spatial variation.

Published information on Darwin Harbour water quality (Skinner et al 2009) show that point source inputs from wastewater treatment plant discharges contribute a relatively high proportion of the nitrogen and phosphorus loads to Darwin Harbour relative to Wet season stormwater runoff. Other published information (Burford, M.A. et al 2008) identifies a significant contribution of both nitrogen and phosphorus from oceanic sources to the overall nutrient budget in Darwin Harbour.

There appears to be no consideration for Wet season variability on the calculation of projected loads associated with the facility. Cardno (2012) stated that “wet weather flows” do not appear in load (kg/annum) calculations, hence the exclusion of “wet weather flows” from such calculations requires further clarification and justification by the Proponent. There is more discussion on toxic removal capacity and fate of nutrients in Section 4.6.1.4.

#### ***4.5.1.3 Bioavailability of Contaminants***

Peer review of the PWC further information submission (GHD, October 2012) indicated that the potential impacts of bioavailability of contaminants were not adequately addressed by the Proponent in the additional information provided to EPA.

PWC (PWC pers comm., 2012) responded to this with advice that: “the NRETAS comment does not specifically ask for a discussion on bioavailability and the data presented in Section 4.1 shows that concentrations in water are below the guideline level under typical operating conditions (with the exception of copper at SLUEP01 where a further 6 dilutions were required to reduce the concentration to below the guideline value). Concentrations of potentially 5 metals (there may be some query regarding the mercury and chromium results) were identified at above guideline concentration under atypical (95th percentile) discharge conditions. It is assumed that any metals present are in solution and are bioavailable (this may not necessarily be the case if the samples are not filtered before analysis and are present as insoluble solids). The next step in this would be whole of effluent toxicity testing”.

#### **4. Recommendation**

**The Proponent is required to clearly demonstrate the extent of toxicity impact on marine species through ecotoxicological investigation and assessment within the mixing zone at the current outfall.**

**The ecotoxicological investigation and assessment should be clearly scoped in consultation with the NT EPA. The ecotoxicological investigation and**

**assessment report is to be provided to the NT EPA within 12 months of this report and will inform conditions on the Waste Discharge Licence.**

#### ***4.5.1.4 Toxicant Removal Capacity / Fate of Nutrients***

The Proponent has demonstrated that the CAS (Chemical Assisted Sedimentation) treatment approach utilising coagulation and flocculation, in combination with the WWTP upgrade has the potential to significantly improve the physico-chemical properties of the effluent (Tables 2-12 and 2-13 of the PWC Further Information 2012). Uncertainty remains on the fate of nutrients. The cumulative effects and fate beyond the zone of discharge may result in chronic exposure effects (DLRM, Dec 2012).

The current CAS treatment uses coagulation and flocculation to remove particulate matter. Polymer dosing is used to aid flocculation and settling. It was confirmed by the Proponent that the polymer dose rate is low 1ml/kL (0.001mg/L), in comparison to an aquatic toxicity level of > 100mg/L – therefore no toxic effects are expected as the result of the polymer (PWC, pers comm.,2012).

The fate of potentially contaminated sediments is not clear, with potential depositional environments unverified. The Proponent states that sediment could be largely dispersed with tide beyond the Harbour. This is not substantiated.

Pages 13-24 of Appendix B (Supplement) illustrates the predicted dispersion footprint of heavy metal and nutrient water column concentrations resulting from the ERM and associated proposals, including comparisons of water quality with and without enhanced effluent treatment at the LWWTP. For some toxicants, such as copper, the proposed works make little difference, with or without enhanced treatment. For other parameters of interest, small improvements are predicted at the completion of treatment upgrades at the LWWTP. The Proponent states that TP effluent concentrations are predicted to drop by 56% due to improved treatment.

For nutrients the combined effluent discharge indicates a slightly increased mixing zone extent for Total Nitrogen (TN), and a moderately reduced mixing zone for TP for both typical (median) and atypical (90th percentile) operating conditions. The predicted mixing zone does not reach the high tide mark and intertidal rock-shelf, with the exception of atypical operations for a combined discharge prior to completion of the treatment plant upgrades.

Water quality monitoring from 2011 (provided at Appendix M of the Supplement) indicates that several parameters were detected above Darwin Harbour Water Quality Objectives at sampling locations beyond the modelled mixing zones. This

occurred with nearly all samples for total phosphorous and a majority of samples of filterable reactive phosphorous, and also occasional samples of total nitrogen and other parameters not modelled, even at a reference site. This indicates that either there may be significant departure of the model from reality, effluent does not disperse adequately, contaminants do not decay as predicted, or that background levels are already high.

DLRM (2012) indicated that the use of stable isotope investigations would be ideal to determine the fate of effluent-sourced N (nitrogen) in Darwin Harbour. The use of delta N has been proven elsewhere in determining sewage contribution to the N pool and as a tracer and could be applied to the Harbour.

## **5. Recommendation:**

**The proponent is to undertake stable isotope analysis to determine extent of zone impacted by sewage and to distinguish between contaminants originating from Ludmilla WWTP effluent and contaminants from background and other sources such as stormwater. The analysis report is to be provided to the NT EPA within 12 months of this report.**

The Proponent states that a 'zero' mixing zone is identified for lead or zinc for all scenarios because dilution below the trigger values is predicted within the initial mesh element of the model. The estimated mixing zone for copper increases moderately for the post-diversion scenarios but does not extend to the coastline or the intertidal rock-shelf for typical operations. The mixing zone is projected to reach the rock-shelf for atypical operations to a limited degree.

Peer Review (Cardno, 2012) has indicated that the fates of most metals and bacteria have been addressed adequately. The fates of arsenic, manganese and phosphorus were not discussed comprehensively. Further to this, the fates of toxicants should be re-interpreted after revised modelling is available (see Section 4.6.2). Possible consideration should be given to undertaking additional sampling to determine the distribution and inferred fate of these constituents in a sediment monitoring plan.

### **4.5.2 Outfall Mixing Zones**

The current EPO has been operating for around 35 years. Potential impacts relating to the increase in current discharges must be considered in the assessment of the proposed ERM duplication. The Project will result in a reduction in the frequency of effluent discharge from the LWWT to Ludmilla Creek during periods of high Wet

season inflows to the treatment plant, whilst higher flows of treated effluent will be discharged at the existing outfall due to the increased hydraulic capacity. This will generate a modified mixing zone at the EPO and potentially an increased hazard to sensitive receptors within the zone of impact.

In 2010, Beneficial Uses and preliminary WQOs for Darwin Harbour were declared under section 73(1) of the *Water Act*. The WQOs relevant for receiving waters adjacent to East Point are those designated as 'outer estuary' in the declaration. Each contaminant or pathogen indicator present in the released effluent (such as ammonia, phosphorus, *Enterococci* etc.) has mixing zones of varying sizes due to the nature of their decay rates and dispersion.

The existing East Point Outfall is located at a point where it is exposed at spring low tides, resulting in effluent discharges directly to the lower intertidal mudflats without dilution. The Hydrodynamic Modelling of Darwin Harbour Report No 4 (Supplement Appendix B) acknowledges that the models used (RMA 10&11) are far-field models and can only be used in a limited way for near-field (i.e. close to the point of discharge) predictions. Appendix B states that:

*"The model requires that initial dilution of the effluent is averaged over the mesh element that represents the outfall point. This results in an introductory dilution greater than that observed in the natural environment. This is a common and known limitation of a far field model (Blumberg, 1996). The mesh element representing the current outfall covers an area of 148m<sup>2</sup>.*

The location of the point of discharge in the intertidal zone is a significant issue because at low tide effluent contacts the sediments directly with an inherent increase in public health risk due to exposure to undiluted effluent.

Mixing zones for the existing outfall were not adequately described in the PER and questions were raised on the model assumptions and predictions. The 'average' hydraulic loading to the existing outfall is projected to have an increase from 9.5 ML/d to 12.5 ML/d or approximately 32% following the Larrakeyah diversion.

Dispersion modelling of a range of nutrients and toxicants at the existing outfall was requested so as to provide some indication of whether there would be a significant increase in the areal extent and duration exposure on the marine ecosystem from additional discharges, with allowance for the anticipated improvement in effluent treatment.

The PER Supplement Appendix B provides predictions on the expected fate of a number of effluent parameters discharged at the existing EPO. The modelled

parameters are presented with a comparison of three scenarios for specific parameters at both typical (median) and atypical (90%ile) concentrations (examples are provided at pp 13-24 of Appendix B).

The mixing zones represent the hypothetical area where, at some point in the 30 day tidal cycle, the parameter exceeds the WQO trigger value. If the trigger value concentration is exceeded only once at any point during the 30 day tidal cycle it is deemed to form part of the overall mixing zone. The duration or frequency of exceedence cannot be determined from these plots of peak model output. Results of modelled parameters that affect environmental (nutrients and toxicants) and recreational (microbiological) Beneficial Uses are discussed in Sections 4.6 and 4.7 respectively.

Peer review by Cardno (2012) highlights the need to verify the modelled mixing zone. No evidence of model validation has been presented by the Proponent. Only a 2D model is provided, which may not appropriately model the 3D characteristics of the plume. Cardno (2012) noted that there are apparent discrepancies between the tracer measurements and model comparisons. There is a need for a quantitative comparison with regard to the hydrodynamics within and beyond the mixing zone. The mixing zone needs to be verified in relation to habitats and bathymetry.

There are concerns as to the adequacy of the modelling identified by Cardno (2012) which state that:

- The modelling is two-dimensional, but no reference of justification is provided for not using a three-dimensional model other than general statements;
- The calibration of the model is not convincing;
- There is no validation of the model against data which was not used in the calibration.
- There is no assessment of the near-field dilution/dispersion which could be compared with that introduced by the far-field model which is acknowledged to overestimate the initial dilution; and
- There is no modelling of a time-series of discharges including short-lived peak flows.

The outputs of the modelling do not present a clear definition of the mixing zone.

Uncertainty regarding the model output has consequences for the certainty of the fate of nutrients and toxicants and potential impacts on sensitive receptors such as reef and seagrass habitat and benthic infauna. It is recommended that the issues

regarding the modelling and definition of the mixing zone are verified prior to these assessments being undertaken.

The absence of a clearly defined and verified mixing zone puts significant constraints on the certainty of this assessment. It is anticipated that there is a highly modified mixing zone surrounding the existing EPO. The Proponent must undertake surveys to verify the modelled mixing zone to provide certainty to predictions on the impact from adding an additional 32% hydraulic loading, including whether the mixing zone will change in response to extra loading.

## **6. Recommendation**

**The Proponent is required to undertake a Benthic Infauna survey along a gradient away from the current EPO to verify levels of impact relating to the current outfall mixing zones. Survey design may require inclusion of sediment particle size analysis, and should be developed in consultation with the NT EPA. Interpreted results should be submitted to the NT EPA within 12 months of this Report and will inform conditions on the Waste Discharge Licence.**

It will be important to establish that the EPO extension can be demonstrated to achieve better environmental outcomes than effluent discharge at the current location. As previously indicated, this will be the subject of a separate assessment.

The LWWTP discharge to Harbour waters is licensed under the NT *Water Act* (section 73(1)) on the basis that the declared Water Quality Objectives for Harbour waters are not met within a mixing zone associated with the discharge. Concentrations of contaminants in the effluent are projected to decrease following upgrades to the treatment process at the LWWTP. However, increases in the hydraulic loading following the diversion of sewage from Larrakeyah will most likely increase overall loads of contaminants into the area of the existing outfall, at least for the duration of use of the near shore outfall. Overall, there is a net decrease in the contaminant load to the Harbour receiving waters arising from the termination of sewage discharge at Larrakeyah combined with improved nutrient removal at the LWWTP.

### **4.5.3 Monitoring Program**

The Proponent has commenced a Water, Sediment and Biota (pre-impact) monitoring program (Appendix Q of the draft PER) associated with the relocation and increased capacity of the proposed outfall extension. This program is designed to



obtain 'pre-impact' baseline data on the effect of the proposed discharge on the marine environment, in particular the effect on key condition attributes associated with the East Point Aquatic Life Reserve. Few results from this program are available to assess any impacts associated with discharge at the current outfall, whether from the 35 years of incremental discharge since 1976 or the change from late 2011 when Larrakeyah was added to the catchment.

Discussion on the proposed Water, Sediment and Biota Monitoring Program (Appendix Q, PER) states there is little consistent time-based historic Harbour-wide monitoring data but rather more project specific data. Nevertheless, declaration of WQO's for selected water quality parameters of interest was made in 2010.

The proposed monitoring program does not adequately address impact on sensitive benthic habitats. It would appear that many of these habitats will be subject to increased nutrient and metal (contaminant) loads from the existing outfall in the short term because of projected higher load volumes.

DLRM (2012) questioned whether the monitoring that occurred took into account tidal/ seasonal variation, with reference to "monthly monitoring at SLU080 is compared with a sample from May 9 and a one-off survey...". It is recognised that the monitoring program should be reviewed to suitably account for and acknowledge tidal and seasonal variation.

PWC currently hold WDL 150-02 to enable waste water discharge to the receiving environment under section 74 of the *Water Act*. WDL 150-02 requires the Licensee to undertake water, sediment and biota monitoring programs using the multiple lines of evidence approach to assess potential environmental impacts. The current licence also requires the Licensee to develop a Conceptual Site Model and Environmental Risk Assessment and a plan to develop Site Specific Trigger Values to assess potential environmental impacts.

## **7. Recommendation**

**The Proponent is to design and implement a Water Quality Monitoring Program to the satisfaction of the NT EPA, consistent with WDL 150-02. Monitoring should be conducted on a monthly basis and results reported to the NT EPA annually until the extension of the outfall is completed.**

## **8. Recommendation**

**The Proponent is to design and implement an annual Benthic Infauna Monitoring Program to the satisfaction of the NT EPA (informed by the**

**outcomes of Recommendation 6). Monitoring should be conducted and reported annually to the NT EPA until the extension of the outfall is completed.**

A separate environmental impact assessment is being undertaken to assess the PWC proposal to extend the current East Point Outfall further offshore. This extension would allow for dispersion of effluent in deeper water off East Point, resulting in an anticipated environmental benefit. This is yet to be assessed.

PWC is required to prepare contingency measures, including improved treatment at the LWWTP (in keeping with the 1998 assessment), in the event that the EPO extension does not proceed and no net environmental benefit associated with the EPO can be demonstrated.

Until the EPO extension project has been implemented the Proponent will be relying on monitoring to demonstrate impacts are no greater than those predicted in this assessment. If monitoring indicates a departure from predicted impacts, the contingency measures will need to be implemented to improve environmental outcomes.

## **9. Recommendation**

**If monitoring results indicate a departure from expected impacts, the Proponent must implement contingency measures in consultation with the NT EPA to deliver improved environmental outcomes equivalent to those expected from the East Point Outfall extension.**

## **4.6 Biodiversity**

### **4.6.1 Marine Ecology**

Effluent discharges to the environment over the life of the existing outfall, have caused changes in the physico-chemical and biological nature of the receiving environment. It is expected to be a highly modified receiving environment. This Project will add further volume of effluent to this modified environment.

Impacts to habitats and species can be characterised by issues from:

- Direct toxicity of components in the effluent; and
- Fate of effluent constituents (partitioning to sediments, degradation rates, volatilisation, bioaccumulation).

The Proponent has provided a description and discussion of the characteristics of the effluent including fate of its components in the water column and sediments. It is noted that some contaminants are expected to decrease in the future due to improvements in wastewater treatment achieved by the current upgrade of LWWTP. It is also important to note that there is a significant reduction in volumes of untreated sewage discharging to the Harbour as a result of the closure of the Larrakeyah outfall.

This assessment requires the mixing zone to be properly defined for the existing operation, modelled for an increased hydraulic capacity (this Project) and verified (for ongoing licensing). Following verification of the mixing zone, the fate of toxicants and nutrients beyond the mixing zone are to be investigated (Section 4.6 of this Report).

The Proponent has undertaken a towed camera survey to provide a basic map of benthic habitat types. The resulting benthic habitat map indicates that substrate and water depth are likely key factors in habitat distribution. The majority of the mapped area (68% or 2219ha) consisted of habitats with no epibenthos on sandy substrates with no bioturbation (Geo oceans 2012). Geo oceans (2012) observed that no seagrass was present in the mapped area at cover greater than 1%, and conclude that seagrass in this location is sparse, patchy and ephemeral, with abundance varying greatly over time.

Based on data obtained via the towed camera survey, the Proponent concludes that benthic communities near the outfall are of intrinsically low value and that the impact (of the project) will be minor. Although this conclusion lacks scientific certainty, it is not unreasonable to find that historic and existing operations are expected to have resulted in a significantly changed receiving environment. The proponent will be required to undertake an assessment of the ecotoxicological effects of the outfall (Recommendation 4), verify the modelled mixing zone through determining Benthic Infaunal assemblages (Recommendation 5) and monitor any change over time (Recommendations 7,8).

A number of EPBC listed marine species are likely to occur in the project area. These species are listed as matters of National Environmental Significance (NES) under the EPBC Act and include coastal dolphins, dugong, marine turtles and migratory birds. To satisfy the assessment of the potential impacts of this Project on EPBC listed species or their habitats, the proponent was asked to consider using the information gathered on potential impacts of contaminants to marine flora and fauna and knowledge of the location of the impact (i.e. the mixing zone).

#### **4.6.1.1 Dugongs and Marine Turtles**

Six species of marine turtles are known to occur in the waters of the Northern Territory - the green turtle (*Chelonia mydas*), flatback turtle (*Natator depressus*), hawksbill turtle (*Eretmochelys imbricate*), loggerhead turtle (*Caretta caretta*), leatherback turtle (*Dermochelys coriacea*) and the olive ridley turtle (*Lepidochelys olivacea*). Of these, the green, hawksbill and flatback turtles are seen foraging for food in Darwin Harbour with the olive ridley and loggerhead turtles suspected to be infrequent users (NT Government: East Arm Wharf Expansion Project draft EIS, 2011). Casuarina Beach (6-7 km north of the Project) is a known nesting beach for Flatback turtles.

Potential turtle foraging habitats have been mapped for Darwin Harbour (INPEX, 2011). Flatback and hawksbill turtles forage on the filter feeder communities which are extensive in Darwin Harbour (estimated to cover 7,912 ha). The hawksbill turtle also forages on seagrass (an estimated 2,520 ha in Darwin Harbour) and macro algal communities (estimated 247 ha) in addition to filter feeders. Green turtles forage amongst seagrass, macro algal and fringing mangrove communities (estimated 1,743 ha). Incidental observations of Green turtles have been made within the East Point Aquatic Life Reserve (GHD 2009). No suitable foraging habitats have been recorded in the immediate vicinity of the existing EPO.

No suitable dugong foraging habitat has been recorded in the immediate vicinity of the proposed development or the existing EPO.

#### **4.6.1.2 Coastal Dolphins**

The snubfin (*Orcaella*), Indo-Pacific humpback (*Sousa chinensis*) and Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) are the most commonly recorded cetacean species in Darwin Harbour (Palmer, 2008). Over the last 15 years, Darwin and its Harbour have experienced rapid development associated with a significant increase in population. Dolphin species inhabiting Darwin Harbour may be vulnerable to displacement from anthropogenic activities because their population size is small, reproductive rate is low and they are long lived (Palmer, 2010).

For the purposes of this assessment it is considered that the Project is unlikely to significantly change the existing conditions at the East Point Outfall, in terms of impacts to coastal dolphins and listed marine species.

## **4.6.2 Terrestrial Ecology**

### **4.6.2.1 Migratory Birds**

The Proponent drew upon migratory shorebird count data obtained from the Shorebirds 2020 Subgroup of Birdlife Australia (2011) for surveys conducted between February 1984 and October 2011 of known migratory bird habitats in the Darwin Region. The Supplement states that “Data for the East Point area was recorded under three categories:

- East Point A
- East Point B
- East Point – Entire Area
- Spot on Marine Claypan.

Note: East Point – Entire Area was recorded as a separate count by a separate observer for the entire area and is therefore a different dataset from the datasets for areas A and B”.

The proposed ERM Corridor runs through the most western section of the area marked as East Point B on the Shorebirds 2020 survey map. In order to minimise disturbance to this area the Proponent has committed to a comprehensive range of mitigation measures including:

- Minimising ground disturbance and potential impacts on adjacent areas of mangrove and coastal monsoon forest communities; and,
- Undertaking significant construction works in the vicinity of this area in the Dry season when most northern hemisphere migrants are absent (May – August).

These measures are considered sufficient to mitigate potential impacts to migratory birds.

### **4.6.2.2 Disturbance to Existing Vegetation**

A total of approximately 3 hectares (10 m wide and 3 km long) of vegetation will be cleared along the proposed development corridor. It has been indicated that a potential further 3 hectares of disturbance may occur as result of construction activity either side of the development corridor. Disturbance to these areas will be limited to the construction phase and the areas of disturbance will be managed as per PWCs Land Management Procedure (see Appendix J, Power and Water Land Management Procedure [PWC, 2011a]). Areas that are disturbed during construction activities will be progressively rehabilitated.

The East Point Recreation Reserve contains patches of two sensitive or significant vegetation types - monsoon vine forest and mangrove vegetation communities, classified under the NT Land Clearing Guidelines (2010). Monsoon forest patches are significant as they cover only 0.2% (2700 km<sup>2</sup>) of the NT landscape, but contain 13% (604 species) of all known Northern Territory flora. Mangrove communities are significant as they support a distinctive suite of species and are important as nursery habitat for many fish species.

The ERM is to be located on largely cleared areas. A relatively small area of existing monsoon forest and mangroves (approx 0.5 ha) will be cleared. This clearing is considered acceptable and with the inclusion of rehabilitation targets.

Two listed species were recorded in surveys at East Point: yellow-spotted monitor (*Varanus panoptes*) – vulnerable and bush stone-curlew (*Burhinus grallarius*) – Near Threatened. Potential impacts and mitigation actions outlined in the PER are adequately described and commitments made with regard to mitigating impacts to terrestrial flora and fauna (refer to Appendix 1).

## **10. Recommendation**

**The Proponent must ensure commitments made to protect sensitive vegetation types and listed species are adhered to by contractors. Post-construction monitoring should be done in order to assess the active rehabilitation and regrowth of sensitive vegetation.**

### **4.6.2.3 Disturbance to Revegetated Areas**

East Point Reserve contains areas where previously disturbed vegetation has been rehabilitated by community groups in order to promote biodiversity and enhance recreation areas at East Point Recreation Reserve. The Friends of East Point Landcare Group raised concerns about impacts to vegetation and areas of revegetation they had planted at East Point that are in the proposed development corridor.

PWC has undertaken to provide Friends of East Point Landcare Group with native seedlings to re-vegetate and assist with watering in the area of concern. A survey of the site by PWC found that most of the existing vegetation had been destroyed by fire during the previous Dry seasons. PWC should consult with the local Landcare group on rehabilitation target and methods.

## 4.7 Impacts on Recreation Areas

The primary treatment of sewage at the LWWTP includes the use of chlorine for disinfection. Improved disinfectant control and dosage rates in recent times has seen indicator bacteria reduced to low levels in the effluent, and, in most cases, levels low enough to meet environmental health guidance at the point of discharge.

The anticipated levels of *E.coli* in the effluent stream following the upgrades at LWWTP are in Table 2.2 of the Supplement.

Based on those levels, the projected 90th percentile level for indicator bacteria in the effluent may exceed the NMHRC guidance for safe harvest of aquatic foods (e.g. shellfish) in tidal waters at the near shore environment adjacent to the East Point outfall.

This area is not known as a recreation swimming area, although it is frequented by people walking along exposed tidal areas and by people collecting food (e.g. fishing and shellfish harvesting). Secondary contact, (i.e. partial body immersion), is probable by people either walking in close proximity to the exposed outfall or by splashing about in residual tidal pools with a high proportion of effluent at low tide.

The NT Department of Health recommends a review of the existing signage at the outfall. NMHRC guidelines recommend appropriate signage as a risk reduction measure where whole-body (primary) contact recreational use may otherwise be contemplated.

## 11. Recommendation

**The Proponent should develop a public consultation plan including advertising and signage, in consultation with the NT Department of Health, to provide information on the risks to public health associated with the vicinity of the effluent outfall at East Point and surrounds.**

## 5. Conclusion

This Project – the duplication of the rising main at East Point - is assessed to be of relatively low environmental impact in terms of its construction and any enduring environmental effects from its operation. This Report has assessed the impact of pipeline duplication, mainly as a construction and disturbance issue, but with consideration of a volumetric increase of 32% of effluent discharged via the existing outfall for the duration of several years.

The operation of the installed infrastructure is a strategic component of an overall plan to consolidate sewage treatment from the Larrakeyah catchment to a combined treatment and effluent disposal facility at Ludmilla. When all components of the plan are completed, the plan is expected to deliver a significant environmental benefit.

The construction of the duplicate rising main at East Point is a priority so as to derive the maximum environmental benefit from the other completed, or near completed, components of the LOCP. A direct benefit of the duplication is the reduced frequency of Wet season diversion of treated effluent to Ludmilla Creek caused primarily by hydraulic surcharging of the existing infrastructure.

Some of the key issues in this assessment report have been associated with water quality – potential risks associated with unknown contaminant loads, nutrients and the fate of nutrients, defining the outfall mixing zone and the development of an appropriate monitoring program.

The proponent will be required to undertake specific actions to reduce uncertainty that remains at the conclusion of this assessment. In summary, these actions include:

- Verification of the outfall mixing zone through ecotoxicological investigation and benthic infauna surveys;
- Investigation of fate of nutrients through stable isotope analysis; and
- Refine the ongoing monitoring programs, to include water quality and benthic infauna, until the new East Point extended outfall is completed.

The ongoing environmental monitoring and reporting required from the Proponent must demonstrate that environmental impacts from the Project are no greater than those predicted in this assessment.

Based on review of the PER, Supplement and Further Information, and with regard to the mitigation measures proposed by the Proponent and recommendations made in this report, it is considered that the environmental impacts of the project can be managed at an acceptable level.



## 6. References

ANZECC (1997) National Water Quality Management Strategy. Guidelines for sewerage systems –effluent management. Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand.

Australian Government (1992) National Strategy for Ecologically Sustainable Development.

<http://www.environment.gov.au/about/esd/publications/strategy/intro.html#Objective>

Blumberg, A. F. (1996). *Modeling Outfall Plume Behavior Using Far Field Circulation Model*. Journal of Hydraulic Engineering (New York, N.Y.).

Burford, M.A., Alongi, D.M., McKinnon A.D., Trott L.A. (2008) Primary production and nutrients in a tropical macrotidal estuary, Darwin Harbour, Australia.

Cardno (December 2012) PowerWater Duplicate Rising Main Proposal Review of additional information for completion of Environmental Impact Assessment. Prepared for the NT EPA.

Department of Environment, Water, Heritage and the Arts (2009) Matters of National Environmental Significance Significant Impact Guidelines 1.1, Environment Protection and Biodiversity Conservation Act, 1999.

Department of Environment, Water, Heritage and the Arts (2009b).Significant Impact Guidelines for 36 Migratory Shorebird Species. Migratory Species EPBC Act policy statement 3.21. Draft. Commonwealth of Australia, Canberra.

DHAC – Darwin Harbour Advisory Committee (2010) The Darwin Harbour Strategy – a comprehensive guide for the responsible stewardship and sustainable development of the Darwin Harbour region.

DLP (2011) Department of Lands and Planning Response to Further Information Request by Department of Natural Resources, Environment, the Arts and Sport, NRETAS (23 November 2011).

DLRM (2012) Response to Further Information requested by Department of Natural Resources, Environment, the Arts and Sport,

GHD (2012) PER: Response to NRETAS' Request for Additional Information (PWC October 2012) Technical Review.

Hooper, J.N.A, Kennedy, J.A & Quinn, R.J (2002). *Biodiversity Hotspots, patterns of richness and endemism, and taxonomic affinities of tropical Australian sponges (Porifera)* Biodiversity and Conservation **11**:851-885.

Inpex (2011) Supplement to the Draft Environmental Impact Statement, Ichthys Gas Field Development, April 2011.

NRETAS (2012) Letter, Attachment A further information for the assessment of the Power and Water Corporation Duplicate Rising Main Proposal.

NT EPA (2010) Ecologically Sustainable Development in the Darwin Harbour Region: Review of Governance Frameworks.

NT Government (2011) East Arm Wharf Expansion Project draft EIS.

NRETAS (2010) Water Quality Objectives for the Darwin Harbour Region - Background Document.

Palmer, C. (2008) Coastal dolphin research in the Northern Territory. Marine Biodiversity Group, Department of Natural Resources, Environment, the Arts and Sport, Darwin, Northern Territory.

Palmer, C. (2010). Darwin Harbour Coastal Dolphin Project, Interim Report to the Biodiversity Unit, Department of Natural

PWC (2012) Personal communication (email correspondence) Thursday 22 November 2012 – East Point effluent rising main additional comments PWC Peer Review Commentary.

PWC 2008. Land Management Procedure (F2005/2041 Version 2). Power and Water Corporation (Appendix J)

Shorebirds 2020 Subgroup of Birds Australia (2011). Data Extraction for Surveys Conducted Between February 1984 and October 2011 of Known Migratory Bird Habitats in the Darwin Region, unpublished.

Skinner, L., Townsend, S. and Fortune, J. (2008) *The impact of urban land-use on total pollutant loads entering Darwin Harbour*. Department of Natural Resources, Environment, The Arts and Sport. Darwin.

Water Monitoring Branch (2005). The Health of the Aquatic Environment in the Darwin Region. Dept of Natural Resources, Environment and the Arts, Darwin.

Ylitalo, G.M., Baird, R.W., Yanagida, G.K., Webster, D.L., Chivers, S.J., Bolton, J.L., Schorr, G.S. and McSweeney, D.J. (2009) *High levels of persistent organic pollutants measured in blubber of island-associated false killer whales (*Pseudorca crassidens*) around the main Hawaiian Islands*. Marine Pollution Bulletin 58, 1922-1952.

## Appendix 1 - Commitments Register (Table G-1, Supplement)

No.	Commitment (Action)
<b>1</b>	<b>Acid Sulphate Soils</b>
1.1	PWC will review and implement the acid sulphate soils management plan as part of an overarching construction environmental management plan.
1.2	Soil disturbance and vegetation clearing will be limited as far as practically possible.
1.2	Activities will be restricted to the dry season and drainage systems (natural and artificial) will be re-established after construction is completed.
<b>2</b>	<b>Erosion and Sedimentation</b>
2.1	A draft ESCP will be provided to NRETAS for review prior to the commencement of construction activities.
2.2	Soil disturbance and vegetation clearing will be limited to the extent practicable.
2.3	Construction activities will be restricted to the Dry season.
2.4	Disruption of drainage systems (natural and artificial) during the construction phase will be avoided to the extent practicable. Where avoidance of disruption is not possible, drainage will be re-established after construction is completed.
2.5	Unsealed surfaces and stockpiles will be wetted down or sealed where continuing dust generation is observed.
2.6	Run-off from unsealed areas of construction zones will be treated through sediment traps or silt fence prior to discharge to the environment.
<b>3</b>	<b>Contaminant Run-off</b>
3.1	PWC will ensure proposed safeguards are incorporate into the overarching Construction Environmental Management Plan (CEMP).
<b>4</b>	<b>Noise and Vibration</b>
4.1	Construction activities will align with NRETAS Noise Guidelines for Development Sites, June 2011.
4.2	All construction vehicles and other machinery will be fitted with noise restriction apparatus in accordance with current Australian regulations and standards.
4.3	The CEMP will advise PWC staff and contractors to be considerate of residents and other users of East Point who may be in close proximity to construction zones.
<b>5</b>	<b>Air Quality</b>

5.1	PWC will ensure the above air quality management measures are incorporate into the CEMP.
<b>6</b>	<b>Terrestrial Flora and Fauna</b>
6.1	PWC commits to minimising areas of disturbance, particularly areas of Mangrove and Coastal Monsoon Forest communities.
6.2	PWC commits to ensuring that clearing of vegetation for construction and operational activities associated with the Proposed Development will be undertaken in accordance with the NRETAS Northern Territory Land Clearing Guidelines (NRETAS, 2010b). Wherever possible, PWC will seek to identify opportunities to rehabilitate previously disturbed areas as part of the Proposed Development.
6.3	PWC commits to reducing the extent of weed infestations along the Proposed Development corridor through implementing measures to minimise the potential import and / or spread of weeds during construction and rehabilitation in consultation with DCC.
6.4	<p>PWC commits to ensure that measures will be taken to minimise potential impacts on vegetation communities, threatened fauna and migratory shorebirds and their habitats, such as:</p> <ul style="list-style-type: none"> <li>• Undertaking significant works in the vicinity of areas where migratory shorebirds roost and forage in the dry season when most northern hemisphere migrants are absent (May – August)</li> <li>• Strict controls on sedimentation or other impacts that may impact shorebird feeding sites</li> <li>• Controls on activities or facilities that might disturb feeding and roosting birds (e.g. noise, nocturnal lighting)</li> <li>• Covering the trench each evening to minimise fauna becoming trapped and checking the length of open trench each morning to remove any fauna that has fallen / entered the trench.</li> </ul>
6.5	PWC commits to progressive rehabilitation of areas, with suitable species from the relevant vegetation communities, that are disturbed during construction activities or no longer required, and with due consideration of the requirements of fauna species that will potentially recolonise these areas.
<b>7</b>	<b>Biting Insects</b>
7.1	PWC will construct and operate the Proposed Development in accordance with a BIMP.

7.2	Stormwater drainage for the Proposed Development will be constructed in accordance with the Guidelines for preventing biting insect problems for urban residential developments or subdivisions in the Top End of the Northern Territory (Medical Entomology, 2009).
7.3	Scrapes, and other disturbed areas will be rehabilitated to be free draining.
7.4	Any depressions resulting from construction activities will be rectified upon completion of construction, to prevent these areas from becoming perennial mosquito breeding sites.
7.5	All workers will be informed that pest and disease-carrying mosquito species may be periodically present at the wharf.
7.6	Appropriate personal protection equipment will be made available in accordance with guidelines developed by the Medical Entomology Branch of the Department of Health.
<b>8</b>	<b>Land-use</b>
8.1	PWC will reinstate the bike path as soon as practicable and safe for path users.
<b>9</b>	<b>Sites of Recreational and Socio-economic Importance</b>
9.1	PWC will reinstate the bike path as soon as practicable and safe for path users.
9.2	PWC commits to ensuring that clearing of vegetation for construction and operational activities associated with the Proposed Development will be undertaken in accordance with the Northern Territory Land Clearing Guidelines (NRETAS, 2010b).
<b>10</b>	<b>Itinerants</b>
10.1	PWC will clearly sign post, and where appropriate, delineate construction areas (including fencing and barricades) to prevent unauthorised access.