Cardno
Shaping the Future

NORTHEAST BUSINESS PARK

Preliminary Environmental Monitoring Program

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Northeast Business Park Pty Ltd

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NORTHEAST BUSINESS PARK

PRELIMINARY ENVIRONMENTAL MONITORING PROGRAM

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EXECUTIVE SUMMARY

Northeast Business Park Pty Ltd (the Proponent) proposes to develop the Northeast Business Park (NEBP); a multi-use business park and marina concept that will integrate industry, marina facilities, commercial, residential, heritage and recreational greenspace precincts. The NEBP will be situated on the southern bank of the Caboolture River, approximately 7.5km inland (4.5km direct line of sight) from the coast on 769 hectares of land, with 9km of that land fronting the Caboolture River.

An Environmental Impact Statement was required by the Coordinator General for the proposed NEBP and issued for public consultation in accordance with the State significant assessment process. Detailed technical studies and consultations with the community, as well as government agencies have been undertaken to ensure the NEBP is developed in a manner that achieves balanced environmental, social and economic benefits; addressing the EIS Terms of Reference.

This Environmental Monitoring Program has been prepared to consolidate and clarify environmental monitoring commitments and recommendations and where appropriate detail environmental monitoring procedures. This Environmental Monitoring Program forms part of the Supplementary EIS response to the request by the Coordinator General on 18 June 2008.

The Environmental Monitoring Program details concisely and clearly the monitoring proposed during the construction and operational components of the proposed NEBP development and should be read in conjunction with the environmental management plans prepared and appended to the NEBP Environmental Impact Statement and Supplementary Environmental Impact Statement, and any revision thereof.

Environmental monitoring proposed is extensive in comparison to similar development requirements however the Proponent is committed to improving the ecosystem health of the Caboolture River through sustainable land use practices and best practice marine management. The Proponent therefore designs to monitor the effectiveness of such practices using rigorous methodologies targeting potential environmental issues resulting from proposed and existing natural and anthropogenic causes.

This EM Program will make a valuable contribution to coastal management and surveillance monitoring in the northern part of Moreton Bay.

1. INTRODUCTION

Cardno (Qld) Pty Ltd has been commissioned by Northeast Business Park Pty Ltd (the Proponent) to prepare an Environmental Monitoring Program (EM Program) for the proposed Northeast Business Park (NEBP) development located within Caboolture Shire in Queensland.

This EM Program has been prepared as part of the Supplementary Environmental Impact Statement (Supplementary EIS) required by the Queensland Coordinator General and will in addition to the NEBP Environmental Impact Statement (NEBP EIS), form a basis for Local, State and Federal approval decision making.

Development of NEBP will involve the establishment of a purpose-designed marina complex with mixed residential and commercial land uses across approximately 50% of the project area which demonstrates significant net environmental, social and economic benefit. In addition off-site works are proposed to provide a navigable channel in the Caboolture River for boat access to the marina.

This EM Program is a management tool used to assist:

- construction and operational staff to identify and minimise the impact to the environment through practical environmental monitoring programs; and
- decision makers to understand the range and detail of committed environmental monitoring programs.

This EM Program presents the commitments and recommendations made in the NEBP EIS to protect environmental values during the construction and operation of the proposed development. It is intended that this EM Program will demonstrate compliance with the conditions of the Coordinator General's report and other subsequent permits and approvals.

The EM Program includes monitoring on and off-site where potential environmental impacts have been forecast in the EIS, and in particular will provide significant data for determining the ecosystem health of the Caboolture River and the effectiveness of sustainable land uses practices for water quality improvements.

This EM Program includes monitoring elements for various development aspects, in particular the proposed NEBP benefits and high risk potential environmental impacts forecasted in the NEBP EIS. Each element of the EM Program sets out the:

- rational (to provide clear linkage between documentation);
- objectives,
- proposed monitoring methodology, including frequency and timing;
- performance objectives; and
- responsibilities for the proposed monitoring (short- and long-term).

This EM Program in its entirety recalls and details the commitments of the NEBP EIS, unless where there is a stand alone existing environmental management plan targeting a single element as this should be read in conjunction to this EM Program (for example, the Waste Management Plan) such to avoid miscomprehension during the implementation of the required environmental monitoring. Additionally it proposes further monitoring to satisfactorily address issues raised by regulatory authorities in the NEBP EIS public notification period.

2. DEVELOPMENT SITE MONITORING

2.1 Construction Monitoring

A Construction Environmental Management Plan (CEMP) was prepared and is presented as Appendix X2 to the NEBP EIS. The CEMP aims to assist in minimising the impact to the environment during construction of the proposed NEBP development by defining the management of construction activities and, proposing mitigation measures for the control of potential environmental impacts.

The CEMP provided mechanisms whereby the environmental performance associated with the works can be measured including environmental monitoring. This EM Program details that environmental monitoring proposed to achieve the performance indicators of the CEMP.

Monitoring methods have been proposed where required to provide additional detail to address EIS Submissions for the following elements.

- *Surface Water Quality.*
- *Groundwater Quality.*
- *Riverbank Erosion.*
- *Marine Flora.*
- *Marine Fauna.*
- *Acid Sulfate Soils.*
- *Contaminated Land.*
- *Terrestrial Flora.*
- *Terrestrial Fauna.*
- *Environmental Nuisance.*

2.1.1 Surface Water Quality

Rationale: Stormwater run off from the NEBP project area during construction was identified in then NEBP EIS as having the potential to adversely impact water quality of Raff Creek and the immediate Caboolture River external to the marina entrance.

Objective/Target: Monitor the release of potential contaminants originating from the NEBP project area entering surface waters in the locality of the site to determine the effectiveness of mitigation measures proposed to protect water quality during construction works as detailed in the CEMP.

Monitoring: Monitoring shall be undertaken in the field or laboratory as specified in Table 1 for the water quality parameter identified as having a release criteria outlined in Table 2.

Samples shall be representative of the discharge and are the responsibility of the appointed construction contractor.

In-situ monitoring shall be undertaken using calibrated equipment.

Prior to sampling requiring ex-situ (laboratory) analysis, the responsible entity shall arrange for couriering of the sample to a NATA accredited laboratory within 24 hours of sampling. Chain of custody documentation must be completed for each sample.

All monitoring shall be conducted in accordance with the current EPA Water Quality Monitoring Manual.

Table 1 Development Site Construction Surface Water Monitoring Requirements

Location	Frequency	Type	Parameter
Site discharge points and in the Caboolture River up current of the site discharge point(s).	Monthly and during rain events of > 25mm / 24 hours when a release occurs	In-situ Analysis	pH Dissolved Oxygen
Site discharge point(s) and in the Caboolture River up current of the site discharge point	Monthly and during rain events of > 25mm / 24 hours when a release occurs	Ex-situ (Laboratory) Analysis	Suspended Solids Total Nitrogen (TN) Total Phosphorous (TP) Iron
All control structures	Daily	In-situ Analysis	Inspection of structures to ensure measures are in place and operating effectively
Temporary sedimentation basins	Weekly	In-situ Analysis	pH
Temporary sedimentation basins	Weekly	In-situ Analysis	Leachate staining Algal blooms Signs of erosion

Table 2 Development Site Construction Surface Water Quality Release Criteria (Mid Estuary)

Water Quality Parameter	Release Criteria
Suspended Solids	<50 mg/L
pH	7.0 – 8.4
Dissolved Oxygen (% saturation)	80-105
Oil and Grease	No visible sheen
Total Nitrogen	0.3 mg/L
Total Phosphorous	0.025 mg/L
Iron	300µg/L
Iron Floc and Scum	None visible
Floating matter	None visible

Responsibility: The appointed Contractor.

2.1.2 Groundwater Quality

Rationale: Excavation and filling of the NEBP project area during bulk earthworks and potentially hazardous operational land uses, such as temporary fuel storage, was identified as having the potential to adversely impact groundwater quality and levels.

Objective/Target: Monitor the potential release of contaminants originating from the NEBP project area entering groundwater in the locality of the site. Monitor the groundwater levels within and adjacent to the NEBP project area.

Monitoring: Monitoring shall be undertaken at the nominated monitoring locations and at the frequency specified in Table 3. The detail on monitoring locations is provided in Appendix H2 of the EIS. Monitoring is the responsibility of the appointed Contractor or suitably qualified Environmental Consultant.

Monitoring shall be undertaken in the field or laboratory as specified in Table 4 for the water quality parameter(s) identified as having a release criteria.

In-situ monitoring of shall be undertaken using calibrated equipment.

Prior to sampling requiring ex-situ laboratory analysis, the responsible entity shall arrange for couriering of the sample to a NATA accredited laboratory within 24 hours of sampling. Chain of custody documentation must be completed for each sample.

All monitoring shall be conducted in accordance with the current EPA Water Quality Monitoring Manual.

Table 3 Development Site Construction Groundwater Monitoring Requirements

Location	Frequency	Type	Parameter	Units
Existing Shallow and Deep Piezometers within the project area	Quarterly	In-situ Analysis	Standing Water Level pH	m bgl pH units
Existing Shallow and Deep Piezometers within the project area	Quarterly	Ex-situ (Laboratory) Analysis	Total Dissolved Solids	uS/cm
Boreholes existing adjacent to the project area. At a minimum boreholes with the following IDs: • 20132; • 33508; and • 34395.	Yearly	In-situ Analysis	Standing Water Level	m bgl

Table 4 Development Site Construction Groundwater Criteria

Water Quality Parameter	Release Criteria
Total Dissolved Solids	No greater than 10% above or below background levels presented in Appendix H2
pH	6.5 – 8.5

Responsibility: The appointed Contractor.

2.1.3 Caboolture River Ecosystem Health (Water Quality)

Rationale: The NEBP is master planned development which encompasses design principles and management measures to improve the health of the Caboolture River, a severely degraded river system according to the Healthy Waterways reporting. Water quality results during the NEBP design was a powerful indicator that the Caboolture River needs improvement.

The existing water quality monitoring programme for the Caboolture River is not appropriate for measuring change in water quality because the sampling is too sporadic in both time and space. And largely the future of the programme is not certain.

Objective/Target: Monitor the change to the Caboolture River water quality following the NEBP development to enable an accurate assessment of ecosystem health.

Monitoring: Sample at 10 sites along the Caboolture River between the weir and the mouth. At least 3 sites adjacent to the NEBP site are required, which would provide a good source of data for surveillance monitoring.

Sample in winter and summer periods, commencing at least one year pre-construction.

Sample water quality parameters as detailed in Table 5.

Table 5 Caboolture River Ecosystem Health (Water Quality) Monitoring Requirements

Water Quality Indicator	Water depth	Measurement Type
Dissolved oxygen, pH, salinity, temperature, turbidity and redox	Surface & Bed	In-situ Analysis
Nutrients (TP, OP, TN, NOx, NH4, TKN)	Surface	Ex-situ (Laboratory) Analysis
Metals (Cu, Pb, Zn, Cd, Al, Fe, Cr, As, Hg, Se)	Surface	Ex-situ (Laboratory) Analysis
Suspended Solids	Surface	Ex-situ (Laboratory) Analysis

It is highly desirable that sampling be done in two 'control' estuaries, if sites can be identified as appropriate for comparison. The sampling intensity in control estuaries can be reduced to 5 sites with the same frequency as proposed for the Caboolture River.

Performance Indicators: Nil

Responsibility: Northeast Business Park Pty Ltd or devolved to another entity.

2.1.4 Riverbank Erosion

Rationale: The NEBP development has the potential to increase erosion during construction of the proposed marina entrance and lock.

The EIS specifies that the construction of the NEBP development will not significantly affect riverbank erosion up or downstream as marine traffic will not increase until the NEBP operation. The data collected during the construction period will serve as background data on natural erosion rates. The data collected as part of the EIS and reported on in the Riverbank Erosion Assessment (existing as Appendix J of the EIS) will provide a basis for comparison before and after the NEBP development providing the methodology is consistent.

Objective/Target: Monitor the potential erosion impact from construction of the marina entrance, including lock, immediately upstream and downstream within the Caboolture River and developed a dataset of natural erosion rates for comparison with operational monitoring results.

Monitoring: Install erosion pins at fixed points perpendicular to the bank facing the river at locations shown in the Riverbank Erosion Assessment. Erosion pins are individually numbered lengths of 5mm diameter stainless steel rods, secured to the riverbank.

Install erosion pins at the outset of the NEBP construction.

Record the rate of change in the exposed length of pins in mm/year in accordance with Table 6.

Table 6 Development Site Construction Riverbank Erosion Monitoring Requirements

Location	Frequency	Type	Parameter
Riverbank Erosion Monitoring Locations	Yearly	Field Analysis	Bank Accretion/Erosion Bank Slope Extent of vegetation

Responsibility: Northeast Business Park Pty Ltd or a suitably qualified Environmental Consultant.

2.1.5 Marine Flora

Rationale: The development site contains approximately 19 ha of mangroves and approximately 7 ha of saltmarshes, both habitats comprising several species of estuarine flora. Approximately 0.83 ha of mangroves and 0.28 ha of saltmarsh would be lost as a result of construction of the marina basin and its entrance. Much of the marine flora on the site is also degraded, with significant opportunities to restore this flora and enhance its ecological function. Environmental monitoring will be used to provide data on the area of marine flora and its ecological health.

Objective/Target: To manage construction so that:

1. there is no net loss of marina flora on the site;
2. to restore and enhance degraded areas of marina flora on the site; and
3. to facilitate educational and research opportunities within areas of marine flora at the site.

Monitoring: Commission the collection of periodic aerial photographs (APs) of high quality and resolution, to be ortho-rectified and geo-referenced and used as a basis for mapping the position and area of marina flora on the site and at two adjoining sites (controls) to account for potential natural variability (including sea level rise) as detailed in Table 7.

Ground-truth mapping on development site and at two control sites to assure quality and accuracy of mapping.

Implement field surveys to measure species composition, density and potential fragmentation.

Table 7 Development Site Construction Marine Flora Monitoring Requirements

Location	Frequency	Type	Variables
Areas of mangrove & saltmarsh – development site + 2 controls	Aerial photography – every 2 years Ground truthing – within 2 months of each set of APs Field surveys – every 2 years	APs – ortho-rectified & geo- referenced Ground truthing – GPS positions, photos and field notes Field Surveys - quantitative, replicated and standardised sampling protocol	Area (ha) of mangroves & saltmarshes, species composition, density, fragmentation

Performance Indicators: No net loss of marine flora on the site due to construction activities; enhanced performance: to improve water quality and to increase the amount and quality of marina flora on the site.

Responsibility: Northeast Business Park Pty Ltd or a suitably qualified Environmental Consultant.

2.1.6 Marine Fauna

Rationale: Marine fauna at the development site comprises a variety of invertebrates and fishes. Some species are of commercial and/or recreational value (e.g. prawns and bream), others are known pest species (mosquito fish). Apart from the marina entrance the frontage of the site with the Caboolture River will not be disturbed. The foreshore at the marina entrance has been shown to have low ecological values. Within the site, most marina fauna is confined to tidal channels, of which two small channels would be lost during construction of the marina basin. Monitoring should focus on the channels that will not be lost, but may be disturbed indirectly by earthworks during construction (e.g. roads, flood levees, etc). This monitoring will be used to provide information for management to ensure that the diversity and abundance of native species, including those of economic interest, will not be reduced by the development; and to ensure that diversity and abundance of pest species will not be enhanced.

Objective/Target: To manage construction so that:

1) there is no physical damage to, or reduction in water quality within tidal channels on the site other than the loss of two small channels that would be removed as a consequence of the marina basin and entrance;
2) there is no reduction in diversity and abundance of native marine invertebrates and fishes in the remaining channels; and
3) an improvements programme is implemented to restore the ecological values of the channel habitats and thereby contribute to the enhancement of the value of the Caboolture River as a Fish Habitat Area.

Monitoring: Sample water quality, fish and invertebrates twice yearly in summer and winter within tidal channels at the development site and in two or more channels at each of two control sites every 2 years, as shown in Table 8.

Table 8 Development Site Construction Marine Fauna Monitoring Requirements

Location	Frequency	Type	Variables
Tidal channels on the development site and at 2 control sites	2 times of sampling each in winter & summer every 2 years	Water quality probe Baited fish traps	WQ: DO, Temp., pH, Salinity/conductivity, turbidity, redox Biota: abundance and occurrence of species

Performance Indicators: No reduction in water quality (compared though time and to ANZECC Water Quality Guidelines for Protection of Aquatic Ecosystems and Queensland's Water Quality Objectives).

No reduction in abundance and diversity of native invertebrates and fishes.

Responsibility: Northeast Business Park Pty Ltd or a suitably qualified Environmental Consultant.

2.1.7 Acid Sulfate Soils

Rationale: Significant bulk earthworks are required to transform the NEBP project area to allow construction of built form. Appendix R1 of the EIS identified the presence of actual and potential Acid Sulfate Soils (ASS). Management of ASS is required to prevent environmental harm during bulk earthworks.

Objective/Target: To minimise as much as reasonably practicable the detrimental impact on the receiving environment from ASS exposure through the effective identification, treatment and management of ASS.

Monitoring: An ASS Management Plan (ASSMP) was prepared as part of the EIS, which has been revised as part of the Supplementary EIS. Monitoring shall be undertaken in accordance with the activity specific ASSMPs to be prepared for works components which shall include at a minimum:

- identification of ASS through field and soil testing;
- validation testing; and
- daily visual assessment for iron staining, yellow efflorescence on soil surface and sulphurous odour.

Performance Indicators: As per the Revised ASSMP and the activity specific ASSMPs to be prepared for specific works components at the operational works application phase.

Responsibility: The appointed Contractor.

2.1.8 Contaminated Land

Rationale: Contaminated land has been found within the NEBP project area. Contaminated land has the potential to adversely impact surface- and ground-water, particularly when disturbed as part of bulk earthworks.

Objective/Target: To manage contamination whilst it remains on site and potential disturbance of contaminated material during bulk earthworks in a manner that protects human health and the receiving environment.

Monitoring: Undertake soil testing of the known contaminated areas to determine the background levels of heavy metals, petroleum hydrocarbons and pesticides and the extent of contaminated soil. An approved Remediation Action Plan (RAP) has been prepared for the NEBP project area (existing as Appendix F of the CEMP, Appendix X2 of the EIS).

Undertake soil testing of areas surrounding the known contaminated areas following approved treatment and/or removal methods specified in the RAP to determine compliance with remediation goals.

Performance Indicators: All remediated soil within the project area shall comply with the soil remediation goals outlined in Table 9.

Table 9 Soil Remediation Goals

Analyte	Soil Remediation Goal (mg/kg)
Arsenic	100
Cadmium	3
Chromium	50
Copper	200
Lead	300
Zinc	500
Other Metals	HBIL (A) levels as per Table 9.1, *EPA Guidelines*
TPH (C_6-C_9)	100
TPH (C10-C_{14})	100
TPH (C15-C_{28})	1000
TPH (C_{29}-C_{35})	1000
Total TPH	1000
Benzene	1
Total BTEX	7
DDT	1

Responsibility: A suitably qualified Environmental Consultant.

2.1.9 Terrestrial Flora

Rationale:

The NEBP development encompasses areas of vegetation that have been specifically identified for retention and enhancement within the extensive Open Space Precincts that encompass approximately 419 ha (or 55%) of the site area. The various management plans that support the NEBP development specify a range of controls that are to be implemented to ensure that undesirable and unauthorised impacts to native vegetation communities do not occur. Monitoring of development activities such as vegetation clearance and earthworks, landscaping works and weed control works is required to ensure that specified impact avoidance/mitigation controls are implemented and effective.

During construction staging it will be important to monitor the success of habitat retention and enhancement works carried out as part of the NEBP development.

Objective/Target:

Monitor construction phase activities to ensure vegetation within NEBP that has been identified for retention is not damaged.

Monitor the implementation of landscaping works to ensure that appropriate and approved plant species are used and established in accordance with the approved landscaping plans.

Monitor the effectiveness of weed control works that are carried out within the NEBP's Open Space Precincts.

Monitor the ecological condition of retained and restored areas of native vegetation.

Monitoring:

Formal vegetation condition monitoring program will be implemented within the NEBP Open Space Precinct. This program will be carried out every 2 years for the duration of the construction phase of development.

The methodology for monitoring of vegetation condition has been adapted from Gibbons, P., Ayers, D., Seddon, J., Doyle, S. and Briggs, S. (2005) *Biometric Version 1.8 A Terrestrial Biodiversity Assessment Tool for the NSW Property Vegetation Plan Developer Operational Manual* NSW Department of Environment and Conservation.

The monitoring methodology will involve the following.

1. The establishment of a total of ten (10) vegetation condition monitoring sites within the NEBP Open Space Precinct, each consisting of a 50m long transect and a 20mx20m plot.

2. The location of five (5) of the monitoring sites will be fixed for the duration of the construction phase monitoring program, with the location of the other five (5) monitoring sites to be selected at random each year. The fixed monitoring sites will be located to obtain a representative measure of the condition of the different vegetation types that are being retained or restored within the Open Space

Precinct. The position of the fixed monitoring sites will be recorded using GPS co-ordinates and fixed survey marks at each end of the transect. The position of the randomly selected survey sites will be recorded using a GPS.

3. At each monitoring site estimates will be obtained of the following parameters:

    - total and native overstorey cover, species composition and median height;
    - total and native mid-storey cover, species composition and median height;
    - total and native ground stratum cover and species composition;
    - species richness; and
    - species abundance using the Braun-Blanquet cover-abundance scoring system.

4. At each monitoring site photographic records of the condition of vegetation will be obtained, at each end of the 50m transect, at each survey.

Performance Indicators: Records of the date, location and results of vegetation monitoring are maintained.

No unauthorised disturbance occurs to native vegetation identified for retention.

Landscaping and habitat enhancement works are implemented in accordance with approved plans.

The abundance and distribution of existing populations of weed species are reduced.

The ecological condition of retained and restored areas of native vegetation is either maintained or enhanced in terms of the following key parameters:

- the prevalence of native species;
- the diversity of native species;
- the health of native vegetation; and
- the recruitment of native species (including survivorship of restoration plantings).

Responsibility: Northeast Business Park Pty Ltd will be responsible for appointing an appropriately qualified consultant to carry out the vegetation condition monitoring program.

2.1.10 Terrestrial Fauna

Rationale:

The NEBP development will involve the clearance of vegetation and development of land that provides habitat for native fauna. The Open Space Precinct of the NEBP development also encompasses substantial areas of native fauna habitat that are to be retained and enhanced as an offset to the loss of existing habitat resources elsewhere on the NEBP site. The various management plans that support the NEBP development specify a range of controls that are to be implemented to ensure that undesirable and unauthorised impacts to native fauna do not occur during the construction of the NEBP.

During construction staging it is proposed to monitor the response of terrestrial fauna populations to the habitat retention and enhancement works carried out as part of the NEBP development.

The results obtained from the monitoring program will enable an assessment to be made of the nature, magnitude and likely causes of any changes in the species composition and abundance of terrestrial fauna assemblages utilising resources within the NEBP Open Space Precinct.

Objective/Target:

Monitor approved vegetation clearance works to ensure that all practicable measures are taken to avoid harm to native fauna.

Monitor construction phase activities to ensure that fauna habitat within NEBP that has been identified for retention is not damaged.

Monitor the implementation of habitat enhancement works to ensure that appropriate and approved plant species are used and established in accordance with the approved landscaping plans.

Monitor the response of terrestrial fauna populations to habitat retention and enhancement measures.

Monitoring:

Formal terrestrial fauna monitoring program will be implemented within the NEBP Open Space Precinct. This program will be carried out for the duration of the construction phase of development and will be designed to assess the response of terrestrial fauna populations to the NEBP development.

The terrestrial fauna monitoring program will involve the following.

1. Koala surveys of the Open Space Precinct carried out in accordance with the specifications of “Policy 4: Koala survey methodology for site assessment” of the Nature Conservation (Koala) Conservation Plan, every 2 years.

2. Standardised fauna surveys will be carried out at each of the 10 (5 fixed and five randomly selected) vegetation condition monitoring sites, every 2 years. The timing of the fauna surveys will be varied to account for seasonal

variation in composition of terrestrial fauna communities within the Open Space Precinct.

The standardised terrestrial fauna surveys will use methodologies consistent with those that were employed by the EPA in the vertebrate fauna surveys for the South-east Queensland Bioregion, completed as a component of the CRA/RFA process, and will involve:

- diurnal and nocturnal Herpetofauna searches;
- diurnal bird survey;
- nocturnal bird and mammal call playback;
- spotlighting;
- Elliott and cage trapping; and
- scat searches.

Performance indicators: No physical harm to terrestrial fauna occurs during the conduct of authorised vegetation clearance works.

No unauthorised disturbance occurs to native fauna habitats identified for retention.

Changes to the abundance of terrestrial fauna utilising the surveyed area are detected and documented.

Reductions in the abundance of native terrestrial fauna at the NEBP site are minimised via the implementation of habitat enhancement works.

Responsibility: Northeast Business Park Pty Ltd will be responsible for appointing an appropriately qualified consultant to carry out the response of fauna monitoring program.

2.1.11 Environmental Nuisance

Rationale: Construction of the NEBP development will involve the use of powered mechanical equipment and increased vehicle movements to transform the land. There is a potential for environmental nuisance as a result of excessive noise and dust.

Objective/Target: To control noise and vibration generated by construction activities and to minimise the impact to ensure acceptable levels of amenity at the closest sensitive receptor(s).

To minimise the emission of air impurities associated with bulk earthworks.

Monitoring: **NOISE:** When requested by the administering authority, vibration monitoring and recording must be undertaken to investigate any complaint of vibration nuisance, and the results notified within 14 days to the administering authority. Monitoring must include:

- peak particle velocity (mm/s);
- location of the blast/s within the site (including which bench level);
- atmospheric conditions including temperature, relative humidity and wind speed and direction;
- the level and frequency of occurrence of impulsive or tonal noise;
- atmospheric conditions including wind speed and direction;
- effects due to extraneous factors; and
- location, date and time of recording.

AIR: When requested by the administering authority, dust and particulate monitoring shall be undertaken to investigate any complaint of environmental nuisance caused by dust and/or particulate matter from dredging spoil management, and the results notified within 14 days to the administering authority following completion of monitoring. Monitoring shall be carried out at a place(s) relevant to the potentially affected dust sensitive place and at upwind control sites and must include:

a) for a complaint alleging dust nuisance, dust deposition; and

b) for a complaint alleging adverse health effects caused by dust, the concentration per cubic metre of particulate matter with an aerodynamic diameter of less than 10 micrometre (µm) (PM10) suspended in the atmosphere over a 24hr averaging time.

Performance Indicators: **NOISE:** The noise source (measured as $L_{A10,15minutes}$) at the closest sensitive place should not exceed background (measured as $L_{A90,15minutes}$) plus 5 dB(A) in the event of a complaint and subsequent noise monitoring.

AIR: No odour or dust complaints received from adjoining operations, nearby residents or from statutory authorities.

When requested by regulatory authorities to undertake monitoring, results shall indicate compliance with the air quality criteria specified in Table 10.

Table 10 Development Site Construction Air Quality Criteria

Parameter	Maximum Criteria
24 hour average dust concentration as PM 10	150µg/m^3 at the nearest sensitive place
Average dust deposition rate	120mg/m^2/day
Odour	No detectable odour at the nearest sensitive place

Responsibility: The appointed Contractor or a suitably qualified Environmental Consultant.

2.2 Operational Monitoring

A Marina Site Based Management Plan (Marina SBMP) was prepared and is presented as Appendix Y1 of the NEBP EIS. The Marina SBMP assists in minimising the impact to the environment during the operation of the proposed NEBP development.

The Marina SBMP provided mechanisms whereby the environmental performance associated with activities can be measured. This EM Program presents that environmental monitoring proposed to achieve the objectives of the Marina SBMP. Monitoring methods have been proposed where required to provide additional detail on new monitoring programs to address EIS Submissions.

Monitoring methods have been proposed where required to provide additional detail to address EIS Submissions for the following elements.

- *Marina Water Quality.*
- *Surface Quality.*
- *Groundwater Quality.*
- *Riverbank Erosion.*
- *Marine Flora.*
- *Marine Fauna.*
- *Soil Monitoring.*
- *Terrestrial Flora.*
- *Terrestrial Fauna.*

2.2.12 Marina Water Quality

Rationale: Impacts from the marina as shown in the NEBP EIS could potentially include the release of contaminants.

Objective/Target: Marina waters should be of a quality which ensures there is no loss to water quality in the Caboolture River water quality.

Monitoring: Monitoring shall be undertaken in the field or laboratory for the water quality parameters identified as having a release criteria as indicated in Table 11.

Monitoring locations include 2 sites within the marina, in addition to sites at the entrance channel and Caboolture River immediately adjacent to the proposed lock.

Samples shall be representative of the marina water quality.

In-situ monitoring shall be undertaken using calibrated equipment.

Prior to sampling requiring ex-situ laboratory analysis, the responsible entity shall arrange for couriering of the sample to a NATA accredited laboratory within 24 hours of sampling. Chain of custody documentation must be completed for each sample.

All monitoring shall be conducted in accordance with the current EPA Water Quality Monitoring Manual.

*Monthly monitoring shall occur for up to 2 years following commencement of marina operations, to be subsequently reduced to a quarterly monitoring program following 2 year of operations.

Table 11 Development Site Operational Marina Water Quality Criteria

Parameter	Limit	Limit Type	Monitoring Frequency*
Turbidity	< 8 NTU	Median	Monthly
Suspended Solids	20 mg/L	Median	Monthly
Chlorophyll a	< 4 μg/L	80th percentile	Monthly
Total Nitrogen	< 300 μg/L	80th percentile	Monthly
Total Phosphorous	< 25 μg/L	80th percentile	Monthly
Dissolved Oxygen (% saturation)	85-105	Median	Monthly (at three depths)
pH	7.0-8.4	Range	Monthly
Petroleum Hydrocarbons	Non visible	-	Monthly
Litter	Nil	-	Monthly
Total Aluminium	< 0.2 mg/L	Median	Monthly
Total Iron	0.02 mg/L	Median	Monthly
Copper	0.3 μg/L	Median	Monthly

Lead	1.0 µg/L^{-1}	Median	Monthly
Faecal Coliforms	< 150 orgs/100mL	Median	Monthly

Responsibility: Northeast Business Park Pty Ltd or a suitably qualified Environmental Consultant.

2.2.13 Surface Water Quality

Rationale: Stormwater flowing from an urban catchment has the potential to contaminate existing waters however water sensitive urban design is part of the NEBP development which minimises the risk of this occurrence.

Objective/Target: Monitor the release of potential contaminants originating from the NEBP entering surface waters in the locality of the site.

Monitoring: Monitoring shall be undertaken at the nominated monitoring locations and at the frequency for those water quality parameters specified in Table 12.

Samples shall be representative of the discharge.

In-situ monitoring shall be undertaken using calibrated equipment.

Prior to sampling requiring ex-situ laboratory analysis, the responsible entity shall arrange for couriering of the sample a NATA accredited laboratory within 24 hours of sampling. Chain of custody documentation must be completed for each sample.

All monitoring shall be conducted in accordance with the current EPA Water Quality Monitoring Manual.

Table 12 Development Site Operational Surface Water Monitoring Requirements

Location	Frequency	Type	Parameter
Site discharge point(s) and in the Caboolture River up current of the site discharge point	Quarterly	Ex-situ (Laboratory) Analysis	pH Suspended Solids Dissolved Oxygen Total Nitrogen Total Phosphorous Iron
All control structures	Quarterly	In-situ Analysis	Inspection of structures to ensure measures are in place and operating effectively
Wetlands	Quarterly	In-situ Analysis	Leachate staining Algal blooms pH Turbidity Dissolved Oxygen Temperature

Performance Indicators: All waters released from the project area shall comply with the release criteria outlined in Table 13.

Table 13 Development Site Operational Surface Water Quality Release Criteria (Mid Estuary)

Water Quality Parameter	Release Criteria
Suspended Solids	<50 mg/L
pH	7.0 – 8.4
Dissolved Oxygen (% saturation)	80-105
Oil and Grease	No visible sheen
Litter	No visible litter
Total Nitrogen	0.3 mg/L
Total Phosphorous	0.025 mg/L
Iron	300µg/L
Iron Floc and Scum	None visible
Floating matter	None visible

Responsibility: Northeast Business Park Pty Ltd or a suitably qualified Environmental Consultant.

2.2.14 Groundwater Quality

Rationale: The establishment of an urban land form on existing rural land adjacent to a waterway has the potential to adversely impact water levels of groundwater and groundwater chemistry.

Objective/Target: Monitor the potential change to groundwater levels and chemistry to compare with pre-development water levels and chemistry in the locality of the site.

Monitoring: Monitoring shall be undertaken at the nominated monitoring locations and at the frequency specified for parameters listed in Table 14 and is the responsibility of the Operator. Detail of monitoring locations is provided in Appendix H2 of the NEBP EIS.

In-situ monitoring of shall be undertaken using calibrated equipment.

Prior to sampling requiring ex-situ laboratory analysis, the responsible entity shall arrange for couriering of the sample to a NATA accredited laboratory within 24 hours of sampling. Chain of custody documentation must be completed for each sample.

Table 14 Development Site Operational Groundwater Monitoring Requirements

Location	Frequency	Type	Parameter	Units
Existing Shallow and Deep Piezometers within the project area	Yearly for 5 years	In-situ Analysis	Standing Water Level pH	m bgl pH units
Existing Shallow and Deep Piezometers within the project area	Yearly for 5 years	Ex-situ (Laboratory) Analysis	Total Dissolved Solids	uS/cm
Boreholes existing adjacent to the project area. At a minimum boreholes with the following IDs: • 20132; • 33508; and • 34395.	Yearly for 5 years	In-situ Analysis	Standing Water Level	m bgl

Performance Indicators: All groundwater within the project area shall comply with the criteria outlined in Table 15.

Table 15 Development Site Operational Groundwater Monitoring Criteria

Water Quality Parameter	Release Criteria
Total Dissolved Solids	No greater than 10% above or below background levels presented in Appendix H2 of the EIS.
pH	6.5 – 8.5

2.2.15 Riverbank Erosion

Rationale: The NEBP development has the potential to increase the natural rate of erosion from the introduction of increased marine traffic in an un-developed waterway.

Objective/Target: Monitor actual erosion following commencement of the NEBP operation.

Monitoring: Erosion pins installed during the construction phase of the NEBP development (refer to section 2.1.3 of the EM Program) along the entire length of the Caboolture River, including adjacent to the dredge footprint, will be utilised to determine the long term trend to riverbank erosion.

Record the rate of change in the exposed length of erosion pins in mm to allow determine the potential impact of boat wash on the natural riverbanks.

Monitoring shall be undertaken at a frequency of every 5 years following the commencement of NEBP operation, and should coincide with the release of aerial photography available from the State Government.

Revegetation and rehabilitation of the NEBP coastal buffer is to be undertaken in accordance with a 'Revegetation and Rehabilitation Management Plan', proposed to be compiled as part of the detailed design of the Open Space Precinct at the operational works approval stage.

Performance Indicators: No more than a 10% change to background rates of bank erosion.

Responsibility: Northeast Business Park Pty Ltd or devolved to either a community group involved in long-term restoration of coastal environments in the locality or the Queensland Government.

2.2.16 Marine Flora

Rationale:	Most of the marine flora at the development site would be set aside within open space areas or foreshore buffers. Moreover, a comprehensive programme of monitoring during construction would enable NEBP to compile a very extensive database (including control sites) which could be used for comparison against any monitoring undertaken during the operational phase. Therefore, there is no requirement for any long term environmental monitoring of marine flora at the site. Notwithstanding this, if some problem is identified by stakeholders, or some environmental accident occurs that could affect marine flora (e.g. a large spillage), it will be most important that further sampling uses the same methodology to allow comparisons through time and that the database is readily available to enable appropriate statistical comparisons.
Objective/Target:	Establish a variety of sampling stations, including controls that could be sampled if monitoring of marine flora is required; establish, maintain and ensure ready access to a database of all previous sampling details and results that can be utilised if required.
Tasks/Actions:	Select prospective sampling locations at NEBP and at control sites, which can be “activated” if required. Ensure electronic and hard copies (at least three sets of each) of all previous sampling events are properly archived and ensure that future management is aware of and has approval to access all data compiled on marine flora at the site and control sites.
Performance Indicators:	Appropriate repositories for hard and electronic copies (at least three sets) of the database. Timely implementation of any future monitoring that may be required in response to an environmental event (e.g. accidental spill) or specific concerns that may be raised by stakeholders.
Frequency:	Intermittent and triggered by environmental accident or specific concerns raised by stakeholders.
Responsibility:	Northeast Business Park Pty Ltd or other site management is responsible for appointing an expert in ecological databases.

2.2.17 Marine Fauna

Rationale: During the construction of the NEBP there would be a small loss of tidal channel that would be offset by restoration or enhancement of tidal channels elsewhere on the site. The effectiveness of these offsets would be assessed as part of the monitoring during the construction phase. Thus, there is no need for an ongoing programme of monitoring marine fauna on the NEBP site. As proposed for the marine flora (section 2.2.14), if some problem is identified by stakeholders, or some environmental accident occurs, use of the same methodology will allow comparisons among sites and over time.

Objective/Target: Establish a variety of sampling stations, including controls that could be sampled if monitoring of marine fauna is required; establish, maintain and ensure ready access to a database of all previous sampling details and results that can be utilised if required.

Tasks/Actions: Select prospective sampling locations at NEBP and at control sites, which can be "activated" if required.

Ensure electronic and hard copies (at least three sets of each) of all previous sampling events are properly archived and ensure that future management is aware of and has approval to access all data compiled on marine fauna at the site and control sites.

Performance Indicators: Appropriate repositories for hard and electronic copies (at least three sets) of the database.

Timely implementation of any future monitoring that may be required in response to an environmental event (e.g. accidental spill) or specific concerns that may be raised by stakeholders.

Frequency: Intermittent and triggered by environmental accident or specific concerns raised by stakeholders.

Responsibility: Northeast Business Park Pty Ltd or other site management is responsible for appointing an expert in ecological databases.

2.2.18 Soil Monitoring

Rationale: Various components of the project are proposed to be irrigated using recycled water. Nutrients and salts derived from effluent use may impact on the soil structure and functioning.

Objective/Target: Determine the potential impact from effluent use on soil properties at the effluent re-use areas within the NEBP project area.

Tasks/Actions: Soil cores 200mm and 500mm in depth shall be collected from 5 randomly selected locations throughout the effluent irrigation.

Performance Indicators: No significant change in soil productivity.

Runoff to existing surface water, groundwater, and proposed stormwater treatment trains should not exceed the water quality criteria specified by the Queensland Water Quality Guidelines 2006 parameters tabulated below in Table 16.

Table 16 Development Site Operational Golf Course Water Quality Criteria

Parameter	Median Criterion
Total Nitrogen	0.5mg/L
Total Phosphorus	0.05mg/L

Frequency: Annually.

Responsibility: The entity under a third party agreement for effluent reuse, Northeast Business Park Pty Ltd or a suitably qualified Environmental Consultant.

2.2.19 Terrestrial Flora

Rationale:

The NEBP development encompasses areas of vegetation that have been specifically identified for retention and enhancement within the extensive Open Space Precincts that encompass approximately 419 ha (or 55%) of the site area. During the construction stages of the NEBP development, substantial resources will be dedicated towards the protection and enhancement of native vegetation communities within the Open Space Precinct.

Ongoing maintenance and enhancement of the vegetation communities within the Open Space Precinct will be required. Monitoring of the vegetation communities will required during the operational phase of the NEBP development to ensure that desired environmental, social and aesthetic outcomes are achieved.

Objective/Target:

Monitor the condition of vegetation communities within the NEBP's Open Space Precincts to identify the nature of any further weed management, habitat enhancement or other maintenance works.

Monitoring:

The formal vegetation condition monitoring program implemented during the construction phase of the NEBP development will be maintained for a period of five (5) years following the completion of the construction phase of development. A revised vegetation condition monitoring program for the Open Space Precinct will be designed and implemented at the completion of the initial five (5) years of the construction phase monitoring program.

Performance Indicators:

Landscaping and habitat enhancement works are implemented and maintained in accordance with approved plans.

The abundance and distribution of existing populations of weed species are reduced.

The ecological condition of retained and restored areas of native vegetation is either maintained or enhanced in terms of the following key parameters:

- the prevalence of native species;
- the diversity of native species;
- the health of native vegetation; and
- the recruitment of native species.

Responsibility:

Northeast Business Park Pty Ltd will be responsible for the initial five (5) years of the post construction phase monitoring program.

The entity with legal tenure of the Open Space Precinct will assume responsibility for the on-going monitoring of the condition of vegetation communities.

2.2.20 Terrestrial Fauna

Rationale:

The Open Space Precinct of the NEBP development encompasses substantial areas of native fauna habitat that are to be retained and enhanced as an offset to the loss of existing habitat resources elsewhere on the NEBP site. The Open Space Precinct will also be utilised by residents of, and visitors to, the NEBP for a range of active and passive recreational activities some of which have the potential to result in harm to or disturbance of native fauna populations utilising the NEBP site.

Ongoing maintenance and enhancement of the fauna habitat values of the Open Space Precinct will be required. Monitoring of the effectiveness of these programs and the response of native fauna populations to human use of the Open Space Precinct will be required to ensure that desired environmental and social outcomes are achieved.

Objective/Target:

Monitor the response of terrestrial fauna populations to habitat retention and enhancement measures.

Monitor the response of terrestrial fauna populations to active use of the Open Space Precincts by residents of, and visitors to, the NEBP development.

Monitoring:

The formal terrestrial fauna monitoring program implemented during the Construction Phase of the NEBP development will be maintained for a period of five (5) years following the completion of the Construction Phase of development. A revised terrestrial fauna monitoring program for the Open Space Precinct will be designed and implemented at the completion of the initial five (5) years of the Operational Phase monitoring program.

Performance Indicators:

No physical harm to terrestrial fauna occurs as a result of active use of the Open Space Precinct by residents of, and visitors to, the NEBP development.

Changes to the abundance of terrestrial fauna utilising the Open Space Precinct are detected and documented.

An effective long-term fauna monitoring program is designed and implemented using the baseline information obtained from the construction phase and initial five (5) years post construction fauna monitoring program.

Responsibility:

Northeast Business Park Pty Ltd will be responsible for the initial five (5) years of the post construction phase terrestrial fauna monitoring program.

The entity with legal tenure of the Open Space Precinct will assume responsibility for the on-going monitoring of terrestrial fauna populations.

3. OFF-SITE MONITORING – NAVIGATIONAL DREDGING

3.1 Construction Monitoring

A Dredging Site Based Management Plan (Dredging SBMP) was prepared and is presented as Appendix R3 of the NEBP EIS. The Dredging SBMP assists in minimising the impact to the environment during capital and maintenance dredging works. Dredging of the Caboolture River navigation channel and marina entrance is required for the proposed NEBP development.

The Dredging SBMP provided mechanisms whereby the environmental performance associated with dredging can be measured. This EM Program presents that environmental monitoring proposed to achieve the objectives of the Dredging SBMP. Monitoring methods have been proposed where required to provide additional detail on new monitoring programs to address EIS Submissions.

Monitoring methods have been proposed where required to provide additional detail to address EIS Submissions for the following elements.

- *Water Quality.*
- *Hydraulics.*
- *Coastal Siltation.*
- *Marine Flora.*
- *Marine Fauna.*
- *Acid Sulfate Soils.*
- *Shorebird Habitat.*
- *Environmental Nuisance.*

3.1.1 Water Quality

Rationale: Capital dredging within the navigation channel will involve excavation of sediment which has the potential to increase suspended sediment and turbidity levels in and around the dredge areas.

Objective/Target: To ensure no degradation of the local aquatic environment.

Monitoring: Water quality monitoring shall be undertaken for the parameters having a water quality criteria as detailed in Table 17 and at the monitoring locations and frequency specified in Table 18.

All monitoring shall be conducted in accordance with the current EPA Water Quality Monitoring Manual and is the responsibility of the dredging Contractor.

Table 17 Off-site Construction (Capital) Dredging Water Quality Criteria

Parameter	Acceptable Criteria
At Dredge	
Turbidity	Less than 10% above background.
pH	8.0 – 8.4
At Spoil Disposal Area (at NEBP project area)	
pH	7.0 – 8.4
Suspended solids	50 mg/L
Dissolved Oxygen	80 – 105% saturation
Total Nitrogen	Less than 300 µg/L
Total Phosphorus	Less than 25 µg/L

Table 18 Off-site Construction (Capital) Dredging Monitoring Requirements

Location	Frequency	Type	Parameter
Background			
Mid-water column between 500 and 100 metres up current of the dredge apparatus and Release point for Spoil Disposal Area	Daily on an outgoing tide during dredging works	In-situ Analysis	pH Turbidity Dissolved Oxygen
Mid-water column between 50 and 100 metres up current of the Release point for Spoil Disposal Area	Weekly on an outgoing tide during dredging works	Ex-situ (Laboratory) Analysis	Suspended Solids
At Dredge			
50 m distance from the boundary of the silt curtain at mid water column	Daily on an outgoing tide during dredging works	In-situ Analysis	pH Turbidity Dissolved Oxygen
At Spoil Disposal Area (at NEBP project area)			
At release point	Daily when a release occurs	In-situ Analysis	pH Dissolved Oxygen
At release point	Weekly when a release occurs	Ex-situ (Laboratory) Analysis	Suspended Solids

Responsibility: The appointed Contractor or a suitably qualified Environmental Consultant.

3.1.2 Hydraulics

Rationale: The tidal hydraulics of the Caboolture River has been shown to be minimally impacted by the capital dredging in the Supplementary Coastal Processes study by Cardno Lawson Treloar (2008), however collection of background data is proposed to allow a comparison of measures during the NEBP operation and ongoing maintenance dredging to confirm these scientific predictions.

Objective/Target: To ensure that pre-construction water level data is collected for comparison to measurements obtained following the operation of the NEBP.

To ensure the construction phase of the development does not adversely impact on the tidal water levels within the Caboolture River and associated wetlands.

Pre-Construction Monitoring:

Install a water level meter within the Caboolture River adjacent to the development site to collect water level information over a 60 day period.

Analyse the collected water level information to obtain tidal harmonic constants for comparison with future water level measurements.

Construction Monitoring:

Install a water level meter within the Caboolture River adjacent to the site to collect water level information over a 60 day period.

Analyse the collected water level information to obtain tidal harmonic constants for comparison with pre-construction predicted water levels.

Performance Indicators: Water level at high and low tide is no greater than 10% different to pre-development predicted water level.

Frequency: Water level monitoring to be undertaken every 5 years during the NEBP construction.

Responsibility: Northeast Business Park Pty Ltd or a suitably qualified Environmental Consultant.

3.1.3 Coastal Siltation

Rationale: Capital dredging of the Caboolture River has limited potential to impact on the banks at the mouth of the Caboolture River as shown in the supplementary coastal processes study (CLT, June 2008). However the sand flats have been identified as having high ecological values and are a shorebird habitat area and monitoring of siltation is therefore proposed.

Objective/Target: To ensure that the function of the sand banks at the mouth of the Caboolture River is not impacted.

Monitoring: Assess long-term channel migration and accretion/erosion of adjacent sand banks at the mouth of the Caboolture River in Moreton Bay by undertaking an assessment of aerial photography to determine channel movements and areas of accretion or erosion of the sand banks adjacent to the mouth of the Caboolture River.

Aerial photographs will be captured at a scale of no greater than 1:20,000 and will coincide with a low tide event preferably.

Date, time and weather conditions for the monitoring day and the week prior are to be recorded with each image taken.

Monitoring of siltation rates within the dredged navigation channel of the Caboolture River by undertaking a monitoring program consisting of regular hydrographic surveys of the navigation channel and adjacent banks. Comparison of subsequent surveys will be undertaken to determine erosion and accretion trends adjacent to the dredge area.

Performance Indicators: Sand banks adjacent to the mouth of the Caboolture River are not significantly altered such that the ecological values of the banks are reduced.

Any changes in shoreline surrounding the navigation channel should be consistent with the natural shoreline changes in the general vicinity.

Frequency: Assessment every 5 years during the NEBP construction following capital dredging works.

Responsibility: Northeast Business Park Pty Ltd or a devolved entity.

3.1.4 Marine Flora

Rationale:

Site inspections and consultation with stakeholders indicate that no marine flora such as seagrass currently exists within or at the entrance to the Caboolture River, including the navigational channel within the proposed footprint of dredging. Extensive areas of mangrove and saltmarsh occur adjacent to the navigation channel, but these are set back from the channel and would not be disturbed directly by the capital dredging. There is some possibility, however, that a consequence of the capital dredging will be to cause erosion of adjacent (unvegetated) sand flats, which could ultimately affect nearby areas of mangrove and saltmarsh.

The rationale for monitoring marine flora in relation to dredging activities is to:

1. conduct periodic inspections of the areas adjacent to the navigational channel for potential establishment of seagrasses, which may indicate an improvement in the water quality of the river and which would then need to be considered as part of the dredging programme; and
2. compile accurate baseline maps of mangrove and saltmarsh habitat adjacent to the navigation channel which can be used to measure change in the area if erosion of adjacent sand flats occurs.

Moreover, given predicted rises in sea level, it would be highly desirable to obtain similar maps at the entrances to at least two river systems entering Moreton Bay – these would serve as controls to differentiate potential change due to the dredging and change due to other processes.

Objective/Target:

To manage capital dredging so that there is no net loss of marine flora.

Monitoring:

Commission the collection of periodic aerial photographs of high quality and resolution, to be ortho-rectified and geo-referenced and used as a basis for:

1. identifying the presence of any patches of seagrasses that may occur in or colonise the areas within or adjacent to the dredging footprint; and
2. mapping the position and area of mangroves and saltmarshes adjacent to the navigation channel and at the mouth of two control estuaries.

If potential seagrasses (i.e. dark patches within the channel) are observed, undertake an inspection to verify their presence, identify species and map their area occupied in relation to the navigation channel.

Table 19 details the requirements for marina flora monitoring.

Table 19 Navigational Dredging Marina Flora Monitoring Requirements

Location	Frequency	Type	Variables
Occurrence of seagrasses adjacent to dredging footprint Areas and seaward boundaries (position) of mangroves and saltmarshes in relation to navigation channel & at two control estuaries Pipeline route	Aerial Photographs – Prior to capital dredging Ground truthing – within 2 months of each aerial photograph	Aerial Photographs – ortho-rectified and geo-referenced, showing boundaries and areas occupied by of marine flora; measurements of seaward boundaries to navigation channel and high and low tide levels	Area (ha) of mangroves and saltmarshes and any seagrasses located; linear distances between flora boundaries

Responsibility: Northeast Business Park Pty Ltd or a suitably qualified Environmental Consultant.

3.1.5 Marine Fauna

Rationale:

The navigation channel and adjacent flats provide a very large area of habitat quite different to the upper parts of the Caboolture River and Deception Bay. They are utilised by bird waders, fish and invertebrates. Capital dredging will cause a temporary loss of productivity (i.e. invertebrates) in the area where dredging is occurring, but recolonisation is expected to be relatively rapid (timescales of months). Most fish would be expected to be able to avoid the dredge head, but may have a reduced food source. There is also some potential that adjacent flats, which are occupied by fish at high tide, will be subject to erosion. The rationale for monitoring entails surveys of invertebrates and fish using the same methodology as applied for the EIS, but also incorporating the use of control sites within at least two other estuaries.

The key issues will be to determine rates of benthic recovery following dredging and to understand any longer term changes to the assemblages of invertebrates and fishes within the lower estuary.

Objective/Target:

To measure rates of recovery of benthic invertebrates following dredging in different parts of the navigation channel and to determine longer-term changes in assemblage structure of invertebrates and fish in the navigation channel, assemblages prior to dredging and compared to control locations sampled concurrently.

Monitoring:

Rates of recolonisation following dredging and change in the structure of assemblages will be monitored using BACI designs (Before-After-Control-Impact) which represent best practice in ecological monitoring as detailed in Table 20.

Benthic invertebrates and sediment grain size would be sampled using a van Veen grab, while fish and crustaceans (e.g. prawns) would be sampled using a seine net.

Performance Indicators:

Rate of recolonisation of dredged areas, structure of assemblages and diversity and abundance of invertebrates and fish.

Long term structure of assemblages to be assessed against baseline (before data) and data obtained concurrently at control sites.

Table 20 Navigational Dredging Marina Fauna Monitoring Requirements

Location	Frequency	Type	Variables
Sites within and adjacent (i.e. on sand flats) to the navigation channel; sites in similar habitats in at least two other estuaries	Benthic recolonisation – once per month for two months prior to dredging a certain area, then once per month after dredging for 6 months or when recovery occurs – repeat for three areas	Van Veen sediment grab, invertebrates to be sieved though 1 mm mesh and identified to family level; additional samples (un-sieved in the field) collected for grain size analysis.	Species diversity and abundance of invertebrates and fish, grain size (passing various sieve sieves in the lab and classified as mud, sand, gravel, etc.

	within the dredge footprint. Assemblage structure – 6 monthly starting 1 yr before start of dredging and continuing during and for at least 1 yr after completion of capital dredging.	25 m long seine net with 3 mm mesh – designed to collect juvenile and slow-moving fishes and prawns. Fish to be identified in the field and released.	

Responsibility: Northeast Business Park Pty Ltd or a suitably qualified Environmental Consultant.

3.1.6 Acid Sulfate Soils

Rationale:	Appendix R2 of the EIS identified the presence of potential acid sulfate soils (PASS) in the proposed dredge area. Management of ASS is required to prevent environmental harm.
Objective/Target:	To minimise as much as reasonably practicable the detrimental impact on the receiving environment from PASS exposure through the effective identification, treatment and management.
Monitoring:	An Acid Sulfate Soil Management Plan (ASSMP) was prepared as part of the EIS and has been revised as part of the Supplementary EIS. Monitoring should be undertaken in accordance with the activity specific ASSMP for dredging works, which will include at a minimum: • identification of ASS through field and soil testing; • validation testing; and • daily visual assessment for iron staining, yellow efflorescence on soil surface and sulphurous odour.
Performance Indicators:	As per the activity specific ASSMP for dredging works.
Responsibility:	The appointed Contractor.

3.1.7 Shorebird Habitat

Rationale:

During the construction phase of the NEBP development a program of capital dredging works will be carried out within the defined navigation channel of the Caboolture River. The capital dredging works will occur in proximity to areas of intertidal sand flats that are foraging grounds, and adjacent high-tide roosting sites, for a diversity of migratory and resident shorebird species.

Monitoring of capital dredging operations is required to ensure that the impact mitigation measures specified in the Dredge SBMP are implemented and are effective.

Objective/Target:

Monitor shorebird responses to capital dredging operations to detect changes in foraging or roosting behaviour that may be caused by capital dredging operations.

Monitoring:

A formal shorebird monitoring program will be implemented as part of the capital dredging works within the Caboolture River.

This program will be carried out for the duration of the construction phase of development and will be designed to assess the response of shorebirds to the capital dredging operations. The shorebird monitoring program will involve the conduct of quarterly standardised shorebird surveys to be carried out at 10 (9 fixed and 1 variable) locations distributed along the length of the navigation channel. The variable location will coincide with the position of the dredge within the Caboolture River at the time of each survey.

The survey methodology to be used in the standardised shorebird surveys will be consistent with methodology used by the Queensland Wader Study Group (QWSG) which carries out regular shorebird population counts at various sites within Moreton Bay, including several sites within and adjacent to the Caboolture River. This will enable comparisons to be made between the capital dredging shorebird monitoring results and the long-term QWSG observations of shorebird numbers in the locality.

During the shorebird surveys information concerning prevailing climatic conditions, tide levels and boating activity within the relevant reach of the Caboolture River will be collated to assist in the interpretation of survey results. The results obtained from the shorebird monitoring program will enable an assessment to be made of the nature and magnitude any changes in the abundance or behaviour of shorebirds that may be attributable to the capital dredging program.

Performance Indicators:

Changes to the abundance and behaviour of shorebirds utilising those parts of the Caboolture River adjacent to the capital dredging operations are detected and documented.

Changes to the abundance and behaviour of shorebirds as a result of capital dredging operations within the Caboolture River are avoided or minimised.

Responsibility:	Northeast Business Park Pty Ltd will be responsible for appointing an appropriately qualified consultant to carry out the shorebird surveys.

3.1.8 Environmental Nuisance

Rationale: Capital dredging will involve the use of powered mechanical equipment to deepen the existing navigational channel and install the dredge spoil transfer pipeline. There is a potential for environmental nuisance as a result of excessive noise. Dust is not deemed as a potential nuisance issue due to the handling of wet material.

Objective/Target: To control noise and vibration generated by capital dredging and related tasks and to minimise the impact to ensure acceptable levels of amenity at the closest sensitive receptor(s).

Monitoring: When requested by the administering authority, vibration monitoring and recording must be undertaken to investigate any complaint of vibration nuisance, and the results notified within 14 days to the administering authority.

Monitoring must include:

- peak particle velocity (mm/s);
- location of the blast/s within the site (including which bench level);
- atmospheric conditions including temperature, relative humidity and wind speed and direction;
- the level and frequency of occurrence of impulsive or tonal noise;
- atmospheric conditions including wind speed and direction;
- effects due to extraneous factors; and
- location, date and time of recording.

Performance Indicators: The noise source (measured as $L_{A10,15minutes}$) at the closest sensitive place should not exceed background (measured as $L_{A90,15minutes}$) plus 5 dB(A) in the event of a complaint.

Responsibility: The appointed Contractor or a suitably qualified Environmental Consultant.

3.2 Operational Monitoring

The Dredge SBMP was also prepared for maintenance dredging episodes. Maintenance dredging of the Caboolture River navigation channel and marina entrance is required for continued access of marine vessels to the proposed NEBP development.

The Dredge SBMP provided mechanisms whereby the environmental performance associated with dredging can be measured. This EM Program presents that environmental monitoring proposed to achieve the objectives of the Dredge SBMP. Monitoring methods have been proposed where required to provide additional detail on new monitoring programs to address EIS Submissions.

Monitoring methods have been proposed where required to provide additional detail to address EIS Submissions for the following elements.

- *Water Quality.*
- *Hydraulics.*
- *Geomorphology.*
- *Marine Flora.*
- *Marine Fauna.*
- *Shorebird Habitat.*
- *Environmental Nuisance).*

3.2.9 Water Quality

Rationale: Maintenance dredging within the navigation channel will involve excavation of sediment which has the potential to increase suspended sediment and turbidity levels in and around the dredge areas.

Objective/Target: To ensure no degradation of the local aquatic environment

Monitoring: Water quality monitoring shall be undertaken for the parameters detailed in Table 20, and at the monitoring locations and frequency specified in Table 22.

Water quality parameters monitored must meet the acceptable water quality criteria detailed in Table 21.

Table 21 Off-site Operational (Maintenance) Dredging Water Quality Criteria

Parameter	Acceptable Criteria
At Dredge	
Turbidity	Less than 10% above background.
pH	8.0 – 8.4

Table 22 Off-site Operational (Maintenance) Dredging Monitoring Requirements

Location	Frequency	Type	Parameter
Background			
Mid-water column between 500 and 100 metres up current of the dredge apparatus	Daily on an outgoing tide during dredging works	Field sampling	pH Turbidity Dissolved Oxygen
At Dredge			
50 m distance from the boundary of the silt curtain at mid water column	Daily on an outgoing tide during dredging works	Field sampling	pH Turbidity Dissolved Oxygen

Responsibility: The appointed Contractor or a suitably qualified Environmental Consultant.

3.2.10 Hydraulics

Rationale:	The NEBP development includes a marina and capital dredging with the defined navigation channel of the Caboolture River. The tidal hydraulics of the Caboolture River may be affected by the additional storage and improve conveyance within the River.
Objective/Target:	To ensure the operational phase of the development does not adversely impact on the tidal water levels within the Caboolture River and associated wetlands.
Monitoring:	Install a water level meter within the Caboolture River adjacent to the site to collect water level information over a 60 day period. Analyse the collected water level information to obtain tidal harmonic constants for comparison with pre-construction predicted water levels.
Performance Indicators:	Water level at high and low tide no greater than 10% different to pre-development predicted water level.
Frequency:	At the commencement of the operational phase of the development.
Responsibility:	Northeast Business Park Pty Ltd or a suitably qualified Environmental Consultant.

3.2.11 Coastal Siltation

Rationale:	The NEBP development includes maintenance dredging within the defined navigation channel of the Caboolture River. The maintenance dredging has the potential to directly impact on the morphology of the lower reaches of the Caboolture River.
Objective/Target:	To ensure that the siltation rates within the navigation channel do not effect safe navigation.
Monitoring:	Monitoring of siltation rates within the dredged navigation channel of the Caboolture River by undertaking a monitoring program consisting of regular hydrographic surveys of the navigation channel and adjacent banks. Comparison of subsequent surveys will be undertaken to determine erosion and accretion trends and inform maintenance dredging requirements. Revegetation and rehabilitation of the Caboolture River shoreline downstream of the NEBP site shall be promoted with the Proponent to work with local community groups to determine acceptable solutions for riverbank protection, preferably in the form of a Revegetation and Rehabilitation Management Plan consistent with that implemented at the NEBP site.
Performance Indicators:	Maintenance dredging is undertaken when required to maintain safe navigational access.
Frequency:	Maintenance dredging as specified in the Caboolture River Siltation Study, existing as Appendix M1 of the NEBP EIS.
Responsibility:	Northeast Business Park Pty Ltd or the agreed entity following negotiations with Queensland Transport on responsibilities.

3.2.12 Marine Flora

Rationale: Operational components of dredging in the navigation channel entail maintenance dredging at periodic intervals. The rationale for environmental monitoring marine flora in relation to maintenance dredging is similar to that for capital dredging, but it is likely that it would be able to be scaled down significantly, preferably in the event of specific concerns raised by stakeholders. Therefore, the main approach would entail aerial photography and ground truthing. It should be recognised that, in the longer term, sea level rise is highly probable, hence the continued use of control areas will be the only means of differentiating between impacts caused by maintenance dredging and other processes (e.g. erosion from sea level rise).

Objective/Target: To manage maintenance dredging so that there is no net loss of marine flora.

Monitoring: Collect aerial photographs periodically in the same manner as per the capital dredging, with ground truthing triggered by environmental accident or specific concerns raised by stakeholders.

Responsibility: Northeast Business Park Pty Ltd or an entity created for maintenance dredging undertakings or Queensland Transport.

3.2.13 Marine Fauna

Rationale: Operational components of dredging in the navigation channel entail maintenance dredging at periodic intervals. The rationale for environmental monitoring marine fauna in relation to maintenance dredging is similar to that for capital dredging, but it is likely that it would be able to be scaled down significantly. In particular, once rates of recolonisation are established with confidence, it would not be necessary to undertake ongoing measurements of recolonisation unless there were a major alteration to the way in which dredging was done. Moreover, once any longer term changes in assemblages of invertebrates and fish are understood, it may be appropriate to discontinue sampling.

Objective/Target: To determine the longer term effects of dredging on assemblages of benthic invertebrates and fish.

Monitoring: A revised marine fauna monitoring program will be designed and implemented at the completion of the initial data analysis during capital dredging.

Responsibility: Northeast Business Park Pty Ltd or an entity created for maintenance dredging undertakings or Queensland Transport.

3.2.14 Shorebird Habitat

Rationale:

During the operational phase of the NEBP development a program of maintenance dredging works will be carried out within the defined navigation channel of the Caboolture River. It is also anticipated that there will be an increase in the number and size of vessels using the Caboolture River. These maintenance dredging and boating activities will occur in proximity to areas of intertidal sand flats that are foraging grounds, and adjacent high-tide roosting sites, for a diversity of migratory and resident shorebird species.

As part of the NEBP Marina operations a program of community education and awareness of the environmental values of the Caboolture River and Moreton Bay will be implemented, including information concerning shorebirds. Monitoring of the response of shorebirds to changes in the number and types of vessels using the Caboolture River will be required to assess the effectiveness of community education and other boating controls (e.g. speed restricts) in minimising disturbance to local shorebird populations.

Objective/Target:

Monitor shorebird response to maintenance dredging operations to detect changes in foraging or roosting behaviour that may be caused by dredging operations.

Monitor shorebird response to boating activity within the Caboolture River to detect changes in foraging or roosting behaviour that may be caused by increased boat traffic numbers, the size of vessels or manner of operation of vessels.

Monitoring:

A revised shorebird monitoring program will be designed and implemented at the completion of the initial five (5) years of the operational phase monitoring program.

Performance Indicators:

Changes to the abundance and behaviour of shorebirds utilising those parts of the Caboolture River adjacent to the defined navigation channel are detected and documented.

Changes to the abundance and behaviour of shorebirds as a result of maintenance dredging operations or changes in boating activity within the Caboolture River are avoided or minimised.

Responsibility:

The entity with legal tenure of the Open Space Precinct will assume responsibility for the on-going monitoring of terrestrial fauna populations.

3.2.15 Environmental Nuisance

Rationale: Construction of the NEBP development will involve the use of powered mechanical equipment and increased vehicle movements to capital dredge the navigational channel and install the dredge spoil transfer pipeline. There is a potential for environmental nuisance as a result of excessive noise. Dust is not deemed as a potential nuisance issue because handled materials will be wet.

Objective/Target: To control noise and vibration generated by capital dredging and related tasks and to minimise the impact to ensure acceptable levels of amenity at the closest sensitive receptor(s).

Monitoring: When requested by the administering authority, vibration monitoring and recording must be undertaken to investigate any complaint of vibration nuisance, and the results notified within 14 days to the administering authority. Monitoring must include:

- peak particle velocity (mm/s);
- location of the blast/s within the site (including which bench level);
- atmospheric conditions including temperature, relative humidity and wind speed and direction;
- the level and frequency of occurrence of impulsive or tonal noise;
- atmospheric conditions including wind speed and direction;
- effects due to extraneous factors; and
- location, date and time of recording.

Performance Indicators: The noise source (measured as $L_{A10,15minutes}$) at the closest sensitive place should not exceed background (measured as $L_{A90,15minutes}$) plus 5 dB(A) in the event of a complaint.

Responsibility: The appointed Contractor or a suitably qualified Environmental Consultant.

4. CONCLUSION

Northeast Business Park Pty Ltd proposes to develop the NEBP for which an Environmental Impact Statement was required. As part of a Supplementary EIS an Environmental Monitoring program has been compiled to provide clarity on the commitments made in the NEBP EIS and inform decision makers of the monitoring rigor.

The EM Program includes monitoring on and off-site where potential environmental impacts have been forecast in the NEBP EIS. In particular the EM Program will provide a significant data set for determining the ecosystem health of the Caboolture River and the effectiveness of sustainable land uses practices and best practice marine management in improving the ecosystem health of the (currently degraded) Caboolture River.

Environmental monitoring proposed is extensive in comparison to similar development requirements as the Proponent is committed to improving the health of the Caboolture River through sustainable land use practices, as the NEBP development affronts 9km of riverbank. The Proponent therefore designs to monitor the effect of such practices on improving water quality within a waterway that is significantly degraded due to both natural and anthropogenic causes.

In conclusion this EM Program will make a valuable contribution to coastal management and surveillance monitoring in the northern part of Moreton Bay.