MWH

BUILDING A BETTER WORLD

www.mwhglobal.com.au

BOGANGAR RUGBY LEAGUE FIELD - RECYCLED WATER REUSE SCHEME / TWEED SHIRE COUNCIL

REVIEW OF ENVIRONMENTAL FACTORS

This report has been prepared solely for the benefit of Tweed Shire Council. No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other person.

This disclaimer shall apply notwithstanding that the report may be made available to other persons for an application for permission or approval or to fulfil a legal requirement.

QUALITY ASSURANCE STATEMENT

PROJECT MANAGER: **Mark Hunting**	**REVIEWED BY:** **Kate Brown**
PREPARED BY: **Brigita Arrowsmith**	**APPROVED FOR ISSUE BY:** **Mark Hunting**

REVISION SCHEDULE

REV. NO.	DATE	DESCRIPTION	PREPARED BY	REVIEWED BY	APPROVED BY
1.0	28th September 2007	Review of Environmental Factors	Brigita Arrowsmith	Kate Brown Justin Adams	Mark Hunting

SYDNEY
Level 2, 39-41 Chandos St, St Leonards, NSW 2065
p +61 2 9493 9700 f +61 2 9493 9799

MELBOURNE
Level 15, 150 Lonsdale St, Melbourne, VIC 3000
p +61 3 9666 1333 f +61 3 9663 1410

BRISBANE
Level 2, 10 Finchley St, Milton, QLD 4064
p +61 7 3510 7300 f +61 7 3510 7350

GOLD COAST
Suite 4, 60 Nerang St, Nerang, QLD 4211
p +61 7 5596 9600 f +61 7 5578 4295

PINE RIVERS
Unit 27, 27-29 South Pine Road, Brendale, QLD 4500
p +61 7 3817 8500 f +61 7 3817 8555

PERTH
Level 7, 178 St Georges Terrace, Perth, WA 6000
p +61 8 9211 1400 f +61 8 9211 1411

SUNSHINE COAST
Level 1, 16 Ocean Street, Maroochydore, QLD 4558
p +61 7 5430 4200 f +61 7 5430 4222

EXECUTIVE SUMMARY

MWH was commissioned by Tweed Shire Council (TSC) to prepare a Review of Environmental Factors (REF) for the Bogangar Rugby League Field Recycled Water Scheme. This report provides a detailed environmental assessment of the proposed works, pursuant to Part V of the Environmental Planning and Assessment (EP&A) Act 1979.

The recycled water reuse scheme to be applied to the Bogangar Rugby League Field is part of Council's Recycled Water Reuse Strategy, which was adopted in July 2006. This Strategy is based on the report prepared by MWH titled 'Tweed Shire Council Recycled Water Opportunities Concept Report' February 2006, which identifies the opportunity of reusing up to 19 ML/year of recycled water from the Hastings Point STP at the Bogangar Rugby League Field. The use of recycled water on the sports fields represents an opportunity to reuse up to 2.2% of dry weather flows from Hastings Point STP.

There are a number of key objectives and drivers for the project's implementation. These are described below.

Increase use of Recycled Water

- ***Tweed Shire Council (TSC) is aiming to increase the level of recycled water usage throughout the Shire; and***
- ***The NSW Department of Environment and Conservation (DEC) encourages substituting recycled water (herein named recycled water) for potable water wherever it can be substituted for a purpose which is acceptable.***

Decrease demand on Potable Water Supply System

- ***Current planning indicates that growth within the Shire will have an impact on the availability of the current bulk water supply;***
- ***Encouraging substitution of recycled water for potable water is part of Tweed Shire Council's Integrated Water Management Planning Strategy that looks at the future water sustainability within the supply district;***
- ***The Bogangar Rugby League Fields have been operating an irrigation system with potable water for approximately ten (10) years; and***
- ***By substituting recycled water at Bogangar Rugby League Fields, the water savings will be the equivalent to 250 new homes (220kl/property per annum).***

Improve quality of Playing Surface

- ***Currently, only the main field is irrigated and due to the layout of the system, uniform irrigation is not provided.***
- ***The Tweed Shire Council, Recreation Services Unit are aware of the need to reduce water consumption and are impacted by the cost of supplying potable water on it's operating budget for the site.***
- ***Recycled water costs will be approximately 80% of potable water and therefore, provide a better opportunity to utilize the available resource.***
- ***Recycled water will also be available throughout drought periods. This will enable the playing surfaces to be fully irrigated throughout the driest periods without being subject to water restrictions.***

Community Awareness

- ***Given the current focus on water issues and sustainability of bulk water supplies across the region, the project offers an opportunity to demonstrate the benefits water recycling and Tweed Shire Council's commitment to the promotion of sustainable water use.***

Reduce Pressure on Existing Recycled Water Disposal System

- ***Recycled water from the Hasting point Sewage Treatment plant is currently discharged to a dune exfiltration system located east of Tweed Coast Road.***
- ***The discharge system is designed to distribute recycled water through a network of sub-surface drains located within a 400 m long strip of the sand dunes. The treated water peculates downward through the sand and is dispersed into the tidal subsurface sea water zone.***
- ***This system is limited by the hydraulic permeability of the saturated sand system and needs to be managed to ensure operation of the system is optimized.***
- ***Reduced flows to the dune exfiltration system will allow the system to function more efficiently.***

Proposed Works
The proposal consists of the upgrading of the existing irrigation system and the construction of subsidiary recycled water rising main, booster pump and recycled water storage tank adjacent to the Bogangar Rugby Field. The water will be irrigated to the field as required.

Risk Management
The following environmental and human health risks have been identified as potentially impacting on the project delivery:

Environmental

Discharge to groundwater
- ***Recycled water treated to high quality***
- ***Recycled Water Management Plan implemented to minimize risk of over irrigation***

Discharge to surface Water
- ***Recycled water treated to high quality***
- ***Recycled Water Management Plan implemented to minimize risk of over irrigation***

Occupational Health & Safety

Contamination of playing surface
- ***Recycled water treated to high quality***
- ***Irrigation only to be undertaken at night between 10pm and 2am***

Handling during maintenance
- ***Training to be provided to maintenance staff on hygiene requirements***

Aerosol drift during irrigation
- ***Irrigation not permitted during wind conditions***

The proposed development will have minimal impacts on the natural and human environment. Identified impacts have been quantified in the REF and accompanying Recycled Water Management Plan with appropriate mitigation measures recommended.

The principal finding of the REF is that the proposed activity, with the application of recommended mitigation measures, is unlikely to significantly affect the environment (including critical habitat) or threatened species, populations or ecological communities, or their habitats and the preparation of an Environmental Impact Statement is not warranted.

Commercial in Confidence

This REF contains information about MWH, particularly about the culture of our organisation and our approach to business, which would be a value to our competitors. We respectfully request, therefore, that it be considered commercially sensitive.

In line with our Quality System, this REF has been prepared by Brigita Arrowsmith. It has been reviewed by Kate Brown and signed off by Mark Hunting.

CONTENTS

BOGANGAR RUGBY LEAGUE FIELD - RECYCLED WATER REUSE SCHEME / TWEED SHIRE COUNCIL

REVIEW OF ENVIRONMENTAL FACTORS

FIGURES

TABLES

APPENDICES

1. INTRODUCTION

MWH has been commissioned by Tweed Shire Council (TSC) to prepare a Review of Environmental Factors (REF) for the Bogangar Rugby League Field Recycled Water Scheme. This REF has been undertaken to comply with relevant NSW planning and environment legislation, particularly pursuant to Part V of the Environmental Planning and Assessment (EP&A) Act 1979.

Bogangar Reuse Scheme

Recycled water reuse is an integral component of Tweed Shire Council's Integrated Water Cycle Management Strategy. Tweed Shire Council (TSC) has identified an area where treated recycled water from its Hastings Point STP could replace existing potable water irrigation at several nearby locations. The recycled water reuse scheme to be applied to the Bogangar Rugby League Field is part of Council's Recycled Water Reuse Strategy, which was adopted in July 2006. This Strategy is based on the report prepared by MWH titled 'Tweed Shire Council Recycled Water Opportunities Concept Report' February 2006 that identifies the opportunity of reusing recycled water from the Hastings Point STP at the Bogangar Rugby League Field.

Feasibility

Tweed Shire Council aims to maximise recycled water use and replace current potable water irrigation uses on Public Open Space. The NSW Department of Environment and Conservation (DEC) encourages substituting recycled water for potable water wherever it can be replaced for a purpose which is acceptable.

To determine the feasibility of the use of recycled water to irrigate the Bogangar Rugby League Field, Tweed Shire Council engaged MWH to investigate the following:

- Compatibility of surrounding land uses;
- Suitability of land for irrigation;
- Recycled water storage; and
- Irrigation Management requirements.

To satisfy these requirements, Medli modelling (Modelling for Recycled Water Disposal Using Land Irrigation) analysing the risk associated with the application of recycled water to the site was conducted by MWH in 2007 (Appendix A).

In addition, TSC engaged MWH to compile a Recycled Water Management Plan (RWMP) and a Design Report considering irrigation application methods and scheduling. The RWMP was compiled in accordance with the NSW Department of Environment and Conservation, Environmental Guidelines for the Use of Recycled water by Irrigation (2004). Specifically, the RWMP focussed on:

- Recycled water classification for environmental management;
- Recycled water quality and irrigation considerations;
- Approval and licensing requirements;
- Site considerations – land use compatibility and site suitability;
- Irrigation design and operational considerations;
- Assessment of the recycled water system;
- Hazard identification and risk assessment considering both public and ecological health;
- Environmental management checklists and reporting; and
- Monitoring review and auditing.

This REF (in association with Medli modelling considerations, the RWMP and accompanying design report) provide for a technically feasible, responsible use of recycled water by irrigation on the Bogangar Rugby League Fields.

1.1 SITE LOCATION

The Bogangar Rugby League Field is located just off the Tweed Coast Road at Bogangar in far northern NSW, within close proximity to the township of Bogangar and the Pacific Ocean. Existing site infrastructure comprises a club-house located on the western side of the field and behind that, a caretaker's residence. A council built skate-park is located to the south-east of the field. Residential development lies to the north and northwest and is screened by a natural dune system containing coastal heath vegetation. The location of the site in relation to the greater area is shown in Figure 1-1

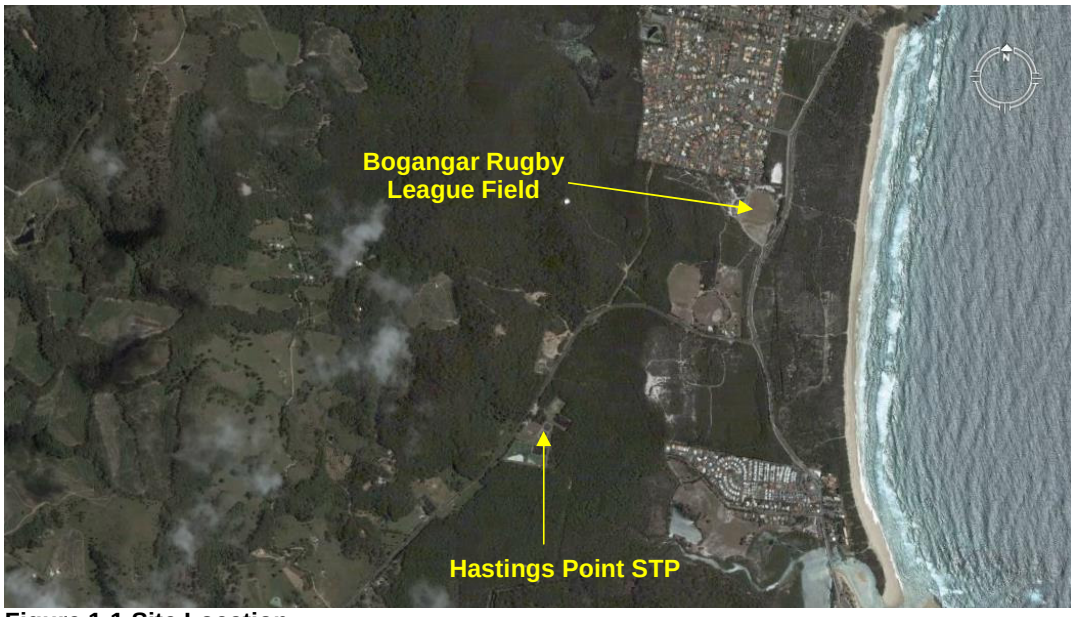


Figure 1-1 Site Location

The Tweed Local Environmental Plan 2000 identifies the Rugby League Field as '6a Open Space – Recreation'. Land use zoning surrounding the sports field comprise:

- '6b Open Space - Recreation'
- '2a & 2c Residential'
- '6a Open Space'
- '8a National Parks/Nature Reserves'

The site location and current council zonings are shown in a plan contained in Appendix B. Property description and related details for the subject land are outlined in Table 1.1

Table 1.1 Property Description

Proposed Structure	Lot Number	D.P	Zone	Tenure	Shire	Parish
Recycled water Rising Main	Road Reserve	N/A			Tweed	Cudgen
Booster Pump	Road Reserve	N/A			Tweed	Cudgen
Recycled water Storage Tank	498	726500	6(b) Open Space - Recreation	Community Land	Tweed	Cudgen
Sprinkler System Upgrade	499	726500	6(b) Open Space - Recreation	Council Administered Crown Land	Tweed	Cudgen
Sprinkler System Upgrade	1	1040811	6(b) Open Space - Recreation	Community Land	Tweed	Cudgen

1.2 PROPOSED WORKS

The proposal consists of the upgrading of the existing irrigation system and the construction of subsidiary recycled water rising main, booster pump and recycled water storage tank adjacent to the Bogangar Rugby Field. The water will be irrigated to the field as required.

The location of the proposed works is shown in Figure 1-1. The Design Report accompanying this REF contains detailed drawings of the specification of the system.

Components of the infrastructure required for this scheme include:

Recycled Water Rising Main

A new recycled water rising main, connecting from the existing recycled water main at the corner of Tweed Coast Road / Round Mountain Road to a new recycled water storage tank at the Rugby League Field.

The recycled water rising main will connect with an existing recycled water main at the corner of Tweed Coast and Round Mountain Roads, continuing 430 metres north along the western side of Tweed Coast Road between the road verge and footpath. The main will divert 190 metres to the northwest along the southern boundary of Lot 1 DP 1040811 to the recycled water storage tank located on Lot 498 DP 726500.

Lot 1 DP 1040811 contains a sealed access driveway to the Rugby League Clubhouse and the Skate Park. The proposed recycled water rising main will align to the south of the driveway.

The construction will involve:

- Trenching and pipe laying along the road verge adjacent to the footpath;
- Minor pruning of vegetation along the length of the works to accommodate the main (no substantial clearing of vegetation is required);
- Backfilling of trenches after laying of pipes;
- Reinstating of trenches to preconstruction condition; and
- Connecting to existing recycled water rising main.

Recycled water Booster Pump

A recycled water booster pump constructed adjacent to the rising main is required to boost the rising main pressures to the storage tank.

The recycled water booster pump will be located 35 metres from the connection point to the existing recycled water rising main from the Hastings Point Waste Water Treatment Plant.

The construction will involve:

- Underground (max depth 1 metre) small concrete chamber (4m x 1.5m) to house booster pump with galvanised iron lid.

Recycled Water Storage Tank

An above-ground regulation recycled water storage tank will be constructed at the Bogangar Rugby League Field. The tank will be sized to accommodate the equivalent of approximately one day's irrigation water for an area of 2.2 ha, at times of peak demand. Water will be stored in the tank for a maximum of 2 days over weekends.

The site will only use the amount of water required for adequate irrigation to promote growth of the sports turf. It is possible to irrigate every day of the week if weather conditions require, but scheduling of irrigation is only programmed for 6 days of the week at this stage. The water in the tank will be turned over once every day apart from the chosen non-irrigating day. Water will be received on demand from the treatment plant. Additional tanks may be required in the future if the site is expanded.

The proposed recycled water storage tank is to be located within the southern portion of Lot 498 DP 726500. This site was specifically chosen as it contains a cleared area of sufficient size to house the storage tank. No vegetation removal is required as part of site works.

The construction will involve:

- Installation of a galvanised steel panel tank with an inert plastic liner (fully enclosed with lockable entry); and
- Above ground tank to be placed on a concrete ring beam for support.

Sprinkler Upgrade

A sprinkler upgrade will be located at the Bogangar Rugby League Field consisting of a retrofitted system. Ancillary sprinklers will be included to service areas not currently covered by the existing sprinkler system. Irrigation will be provided to the Bogangar Rugby League Field (Lot 499 DP 726500) and a grassed portion of Lot 1 DP 1040811.

The construction will involve:

- Changing of sprinkler types to reduced spacing and operating pressures;
- Utilising a pumping system to operate more sprinklers through pressure regulating solenoid valves so as to irrigate the area in less time;
- Place sprinklers 3 metres away from public paths along main road;
- Place sprinklers to minimise overthrow onto access roads to site, buildings and paths;
- Utilise an anemometer to switch off the irrigation system at times of windy conditions in excess of 10 km/hr; and
- Use smaller sprinklers on the sportsfield viewing hills at closer spacing, taking advantage of the reduced height of stream trajectory.

1.3 ALTERNATIVES CONSIDERED

The feasibility of utilising treated recycled water from the Hastings Point STP was investigated by MWH (2006). A number of prospective users were identified during this investigation, including a nearby turf farm and the Bogangar Rugby League Field. Both options were considered to be feasible. TSC has recently implemented the recycled water scheme with the nearby turf farm.

1.4 SITE INSPECTIONS

Site inspections were undertaken to assist in the preparation of this REF. These inspections were attended by:

- Mr Mark Hunting, Operations Manager, MWH;
- Mr Grant Haywood, Design Engineer, MWH;
- Mr Edward Ollett, Civil Engineer, MWH;
- Ms Brigita Arrowsmith, Environmental Scientist, MWH;
- Mr Andrew Grant, Head Works Engineer, Tweed Shire Council; and
- Mr Stewart Brawley, Recreational Services Unit Manager, Tweed Shire Council

The site visit involved inspection of the proposed area for construction, assessing potential impacts of the proposed works and photographing significant features (Appendix C).

2. RELEVANT LEGISLATION AND REGULATIONS

The following Acts and Regulations are relevant to the proposed activity:

- Environmental Planning and Assessment Act 1979;
- Environmental Planning and Assessment Regulation 2000;
- The Wilderness Act 1987;
- National Parks and Wildlife Act 1974;
- Threatened Species Conservation Act 1995; and
- Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth Legislation).

2.1 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

The determination of this proposal is required under Part V of the Environmental Planning and Assessment Act 1979. Section 111 of the Act stipulates that the determining authority (i.e. Tweed Shire Council) must take into account a range of environmental matters to determine whether the proposed activity is likely to have a significant effect on the environment. These matters are detailed below. Section 111 of the Act also requires that the determining authority take into account a range of specific factors, as prescribed in Clause 228(2) of the Environmental Assessment and Planning Regulation 2000 (EP&A Reg.), in its decision to proceed with an 'activity' which does not require development consent. Clause 228 considerations are detailed in the following Section 2.2 of this REF.

2.2 ENVIRONMENTAL PLANNING AND ASSESSMENT REGULATION 2000

Under Section 82 Clause 228(2) of the Environmental Planning and Assessment Regulation 2000, specific factors need to be addressed to assess the environmental impact, under the determination to proceed with an 'activity' which does not require development consent. These factors are addressed as follows:

a) any environmental impact on a community

Comment: It is likely that changes will occur as a result of the construction and operation of the proposed works, as illustrated in Table 2.1.

Table 2.1 Potential Impacts of the Proposed Activity During Construction and Operation

Potential Impacts Short-Term During Construction	Potential Impacts Long-Term During Operation
• Traffic disturbance • Construction noise • Possible erosion and sedimentation increase • Minor dust generation	• A reduction of recycled water and its associated nutrient loads currently released within the sand dunes at Bogangar by using recycled water for irrigation. • Easing of peak demands on potable water supply, particularly during the dry (irrigation) season.

b) any transformation of a locality

Comment: The locality will be transformed through the operation of the recycled water scheme by providing an alternate water supply easing demand on potable water supplies. The rising main, booster pump and irrigation will have no impact on the visual amenity of the area as the infrastructure will be constructed entirely underground (See Section 5.4 Visual Amenity). Furthermore, the recycled water storage tank site contains surrounding vegetation which will provide a visual barrier and will not significantly alter the context of existing views.

c) any impact on the ecosystems of the locality

Comment: During the construction phase, there is potential for erosion and sedimentation to transport sediment off site. The development and implementation of a suitable erosion and sediment control plan will mitigate these potential affects (See Section 6.1 Sediment and Erosion).

d) any reduction of aesthetic, recreational, scientific or other environmental quality or value of a locality

Comment: During construction, there will be a short-term reduction of the aesthetic and environmental quality of the area. Construction will result in some increased noise and dust generation and will temporarily compromise visual amenity (See Sections 5.4 Visual Amenity, 6.5 Noise and 6.6 Air Quality). These impacts will be of a short-term nature, and will be mitigated by the implementation of a Construction Environmental Management Plan (CEMP).Use of the fields for sporting activities will not occur during construction with the infrastructure installed outside the sporting season.

During operation the proposed works will not cause any long-term reduction to aesthetic, recreational, scientific or other environmental quality of the area. Irrigation will only occur between 10pm and 6am (outside the hours of public use and access), with the exception of maintenance and testing access requirements. All irrigation scheduling, maintenance and testing will be in accordance with the site Recycled Water Management Plan.

e) any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations

Comment: The site is not considered to have any aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations (See Section 5.5 Cultural Heritage).

f) any impact on the habitat of protected fauna (within the meaning of the National Park and Wildlife Act 1974)

Comment: The proposal will have no impact upon any protected fauna under this Act (See Section 2.4 NPW Act 1974).

g) any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air

Comment: Only grass will be removed as a result of the proposed activity. There are no endangered, threatened or vulnerable flora or fauna species identified within the boundaries of the proposed site (See Section 5.6 Flora and Fauna).

h) any-long term effects on the environment

Comment: Potential long-term environmental effects associated with the proposal are considered to be entirely beneficial and include:

- A reduction of recycled water and its associated nutrient loads currently released within the sand dunes at Bogangar by using recycled water for irrigation; and
- Easing of peak demands on potable water supply, particularly during the dry (irrigation) season.

To mitigate any potential indirect environment and/or public health related impacts associated with the use of recycled effluent irrigation, Section 6 Potential for Accidents, Hazards and Disasters identifes an appropriate risk management strategy and groundwater quality monitoring programme that will be implemented throughout the duration of the scheme.

i) any degradation of the quality of the environment

There will be some short-term environmental impacts caused by the construction works. However, no persistent degradation will occur if the mitigation measures as detailed Section 6 Potential for Accidents, Hazards and Disasters are implemented.

j) any risk to the safety of the environment

Comment: The upgrade works will be undertaken according to the Tweed Shire Council Workplace Management System, which includes:

- occupational health and safety guidelines;
- site safety rules;
- material safety data sheets;
- a register of all staff on site;
- a preliminary workplace assessment;
- a register of training undertaken by staff;
- a site control plan;
- a check of licences and certificates held by staff; and
- safe work place procedures.

The designs and plans of the proposed development are consistent with current Australian Standards.

k) any reduction in the range of beneficial uses of the environment

Comment: The proposed activity will not reduce the existing range of beneficial uses of the environment. The area of disturbance for the rising main and booster pump will be limited between the road verge and footpath. The storage tank site was specifically chosen as it contains an unused cleared area of sufficient size to house the storage tank.

l) any pollution of the environment

Comment: The proposed activity will not pollute the environment if the mitigation measures, detailed in Section 6 Potential for Accidents, Hazards and Disasters, are implemented. Ongoing monitoring of the success of these measures will be required throughout the construction and operation of the scheme to ensure that the environment is not compromised.

m) any environmental problems associated with the disposal of waste

Comment: No environmental problems are anticipated with the disposal of waste (refer to Section 6.10 Waste Management and Minimisation). Due to the small scale of the proposed works, all soil will be reused on-site.

n) any increased demands on resources (natural or otherwise) that are, or likely to become, in short supply

Comment: There is no short-term increase in demand for resources expected and resources are not likely to become in short supply as a result of the construction of the recycled water scheme.

o) any cumulative environmental effect with other existing or likely future activities

Comment: No cumulative environmental effects should arise from the construction of this recycled water scheme if the recommended preventative measures detailed in Section 6 Potential for Accidents, Hazards and Disasters are applied. The installation will have a positive influence, socially, economically, and environmentally by ensuring the reduction of recycled water currently released within the sand dunes at Bogangar and by the reduction of potable water as an irrigation source.

2.3 THE WILDERNESS ACT 1997

There is no wilderness area, within the meaning of this Act, that will be impacted by the proposed works.

2.4 NATIONAL PARKS AND WILDLIFE ACT (NPW ACT 1974)

The proposed activity will not affect threatened species, populations and ecological communities or their habitat or critical habitat, as protected under this Act. Section 5.6 Flora and Fauna, addresses the details of any flora and fauna issues associated with the site.

The proposed activity will not affect any Aboriginal places or Aboriginal objects, as protected under this Act. Section 5.5 Cultural Heritage, and Appendix E AHIMS Search Results, details cultural heritage considerations relative to this project.

2.5 THREATENED SPECIES CONSERVATION ACT (TSC ACT 1995)

Section 5.6 Flora and Fauna, details flora and fauna issues associated with the site. On the basis of this assessment, the proposed development will not affect critical, endangered or threatened fauna or flora communities or their habitats.

2.6 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT (EPBC ACT 1999)

Section 5.6 Flora and Fauna, details flora and fauna issues over the site. On the basis of this assessment, the proposed development will not affect any Matters of National Environmental Significance, including threatened species and ecological communities.

3. ENVIRONMENTAL PLANNING INSTRUMENTS

Within the framework of the EP&A Act, specific Environmental Planning Instruments (EPIs) are required to be addressed as part of the assessment, on a Local and State wide basis. These instruments are as follows:

- State Environmental Planning Policies (SEPP)
  - SEPP 11 – Traffic Generating Developments
  - SEPP 14 – Coastal Wetlands
  - SEPP 26 – Littoral Rainforest
  - SEPP 44 – Koala Habitat
  - SEPP 55 – Remediation of Land
  - SEPP 71 – Coastal Protection

- Tweed Shire Development Control Plan (DCP) 2007
  - Section A3 Development on Flood Liable Land
  - Section A6 Biting Midge and Mosquito Control
  - Section A11 Public Notification of Development Proposals

- Tweed Tree Preservation Orders
- North Coast Regional Environment Plan 1988
- Tweed Local Environment Plan (LEP) 2000
- Tweed Strategic Plan 2004-2024

3.1 STATE ENVIRONMENTAL PLANNING POLICIES

3.1.1 SEPP 11 – TRAFFIC GENERATING DEVELOPMENTS

The proposed development does not constitute a traffic generating development. Environmental matters relating to the construction impacts of the proposed development are addressed within Section 6.4 Traffic.

3.1.2 SEPP 14 – COASTAL WETLANDS

This policy is not applicable as the proposed works are not within a designated SEPP 14 coastal wetland area.

3.1.3 SEPP 26 – LITTORAL RAINFOREST

This policy is not applicable as the proposed works are not contained, adjacent to or within 100m of littoral rainforest.

3.1.4 SEPP 44 – KOALA HABITAT

The site does not support core or potential koala habitat, nor does it support any existing koala populations. The proposed development will not result in any loss of interconnectivity of significant habitat.

3.1.5 SEPP 55 – REMEDIATION OF LAND

3.1.5.1 CONTAMINATED SOILS

Under SEPP 55, planning authorities are required to consider the potential for contamination to adversely affect the suitability of a site for its proposed uses. Neither the site nor any surrounding properties were listed on the NSW Department of Environment and Conservation Contaminated Land Public Record. No evidence of potentially contaminating processes, such as cattle dips or industrial facilities, were observed in the vicinity of the site during the site inspection.

In addition, a radiological investigation was undertaken which shows that all measured gamma levels are lower than the action trigger levels recommended in the NSW EPA ***Clean-up and disposal of residues from commercial operations involving mineral sands, (Radiation Information Series No.12 (1984).*** Further detail is provided in Section 5.3 Soils.

3.1.6 SEPP 71 – COASTAL PROTECTION

A review of the NSW Department of Natural Resources maps for this policy indicates that part of the proposed development is contained within the coastal zone and mapped as a 'Sensitive Coastal Location'. Therefore, this policy is applicable.

Works that transverse SEPP 71 Coastal Protection land include a 100 metre portion of the recycled water rising main and the connection with an existing recycled water main at the corner of Tweed Coast and Round Mountain Roads.

- The proposal is not applicable under Part 1.3 of the policy (definitions), SEPP 71, sensitive coastal locations as the works are entirely within the road reserve; and
- Having regard to Clause 8 of SEPP 71 (discussed below), and based on the nature and scale of the development, the proposal is unlikely to have any adverse impacts in this coastal location. Specifically, the proposed development is considered compatible with the intent for the development of the locality. Comments are provided against Clause 8 conditions where relevant as follows:

SEPP 71 – Matters for Consideration

a) The aims of this Policy set out in Clause 2:

b) Existing public access to and along the coastal foreshore for pedestrians or persons with disability should be retained and, where possible, public access to and along the coastal foreshore for pedestrians or persons with a disability should be improved.

Comment: Existing access to and along the coastal foreshore will not be impacted from the proposal.

c) Opportunities to provide new public access to and along coastal foreshore for pedestrians or persons with a disability.

Comment: Due to the location of the proposal, opportunities to provide new public access to and along the coast are not applicable.

d) The suitability of the development given its type, location and design and its relationship with the surrounding area.

Comment: The development is an essential service for the locality.

e) Any detrimental impact that the development may have on the amenity of the coastal foreshore, including any significant overshadowing of the coastal foreshore and any significant loss of views from a public place to the coastal foreshore.

Comment: All works are underground and therefore would not impact on coastal views or amenity.

f) The scenic qualities of the New South Wales coast, and means to protect and improve these qualities.

Comment: the proposed development will not impact on scenic qualities.

g) Measures to conserve animals (within the meaning of the Threatened Species Conservation Act 1995) and plants (within the meaning of that Act), and their habitats.

Comments: The proposed development will not affect species, populations or communities scheduled under the TSC Act (See Sections 2.5 TSC Act 1995 and 5.6 Flora and Fauna). The proposed recycled water rising main and booster pump will traverse previously disturbed areas along the entire alignment and will therefore avoid any disturbance to vegetation communities. The proposed recycled water storage tank will be located in a previously cleared area. The upgrade of the Bogangar Rugby League Field sprinkler system is within the existing envelope of development, and it is highly unlikely that the site supports any endangered flora species.

h) Measures to conserve fish (within the meaning of Part 7A of the Fisheries Management Act 1994) and marine vegetation (within the meaning of that Part), and their habitats

Comment: The proposal will not disturb aquatic species. The nearest waterbody is Cudgen Creek 400m to the south and the Pacific Ocean 500m to the east. Sediment and erosion controls will mitigate any impacts to any aquatic systems.

i) Existing wildlife corridors and the impact of development on these corridors.

Comment: The alignment traverses a mapped regional fauna corridor. However, due to temporary nature of works and all works being underground and within existing disturbed areas, wildlife corridors are not considered to be impacted.

j) The likely impact of coastal process and coastal hazards on development and any likely impacts of development on coastal processes and coastal hazards.

Comment: Coastal processes are not considered to impact on the proposal and vice versa. Stormwater management and sediment and erosion controls will be implemented as part of all works (See Section 6.1 Erosion and Sedimentation).

k) Measures to reduce the potential for conflict between land-based and water-based coastal activities

Comment: Due to the location of the proposal, the development would not conflict with land-based and water-based coastal activities.

l) Measures to protect the cultural places, values, customs, beliefs, and traditional knowledge of Aboriginals.

Comment: It is unlikely that any cultural places, values, customs, beliefs, and traditional knowledge of Aboriginals would be impacted due to the previously disturbed nature of the site (See Sections 5.5 Cultural Heritage and Appendix E AHIMS Search Result). A 'stop work' procedure is in place should any cultural material be uncovered as part of works.

m) Likely impacts of development on the water quality of coastal water bodies

Comments: Stormwater management and sediment and erosion controls will be implemented as part of all works (See Section 6.1 Erosion and Sedimentation).

n) The conservation and preservation of items of heritage, archaeological or historic significance.

Comments: No known items of heritage, archaeological or historic significance are known to exist within the proposed development site (See Section 5.5 Cultural Heritage). A 'stop work' procedure is in place should any cultural material be uncovered as part of works.

o) Only in cases in which a council prepares a draft local environmental plan that applies to land to which this Policy applies, the means to encourage compact towns and cities.

Comment: No draft local environmental plan relating to coastal protection applies to the development area.

p) Only in cases which a development application in relation to proposed development is determined:

i. The cumulative impacts of the proposed development on the environment, and
ii. Measures to ensure the water and energy usage by the proposed development is efficient.

Comment: Not applicable

3.2 TWEED SHIRE DEVELOPMENT CONTROL PLAN 2007 PART A

3.2.1 SECTION A3 DEVELOPMENT ON FLOOD LIABLE LAND

The proposed works are consistent with the intent of TSC Development on Flood Liable Land DCP 2007 (See Section 6.2 Flooding). The project does not contravene any provisions of other components of the TSC DCP applying to the site.

3.2.2 SECTION A6 BITING MIDGE AND MOSQUITO CONTROL

Section A6 Biting Midge and Mosquito Control of the TSC DCP 2007, Subclause A6.2: The Outline of the Problem applying to the proposed development.

Section A6.2, Subclause A6.2.1 Background, outlines that any development which can reduce water quality through nutrient load may expand biting insect problems. Although, the subject site is not mapped by Council as a mosquito and biting midge breeding area and is not identified as having a biting insect problem it is recommended that any outbreak or occurrence be reported and incorporated into the site's Recycled Water Management Plan for the implementation of monitoring and controls i.e. no ponding of water.

3.2.3 SECTION A11 PUBLIC NOTIFICATION OF DEVELOPMENT PROPOSALS

Section A11 Public Notification of Development Proposals of the TSC DCP 2007, Subclause A11.2 Notification and Advertising of Applications, Subclause A11.2.1 Who is to be notified, applies to the proposed development as outlined below:

The Council will cause notice of an application to be sent to:

(a) All persons who, according to Council property rating records, own land immediately adjoining the application site; and
(b) Owners of any land that the Council or delegated staff consider may be detrimentally affected by the application.

3.3 TREE PRESERVATION ORDERS

There are no tree preservation orders within the proposed development area. The pipeline works are to be entirely within the road reserve and will not impact on any adjoining property. No trees are to be removed as part of the works.

3.4 NORTH COAST REGIONAL ENVIRONMENT PLAN (NCREP) 1988

Clause 15 under the NCREP requires consideration of the impact of development upon local waterways, wetlands and scenic qualities. Appropriate measures are proposed to satisfactorily manage these impacts, as detailed in Section 6 Potential for Hazards, Accidents and Disasters.

3.5 TWEED LOCAL ENVIRONMENT PLAN (TLEP) 2000

The proposed development does not require consent from Council under Part IV of the Environmental Planning and Assessment Act 1979.

3.5.1 CLAUSE 35 ACID SULFATE SOILS

Clause 35 of the LEP requires an assessment of the likely impacts of the proposed works on acid sulphate soils. This issue is addressed in Section 5.3.2 Acid Sulfate Soils of this REF and is not believed to trigger a development consent given existing mapping, landscape position and elevation. Depth of excavation will not exceed 1m below the ground level.

3.5.2 CLAUSE 39(A) BUSHFIRE PROTECTION

The site is mapped as 'Bushfire Prone Land – Vegetation Category 1' on the TLEP Bushfire Prone Map (2002) (Appendix I).

In accordance with Section 39(A) Bushfire Protection of the TLEP 2000 to minimise bushfire risk to built assets and people; and to reduce bushfire threat to ecological asset and environmental assets, the following objectives are addressed in relation to the proposal:

a) Whether the development is likely to have a significant adverse effect on the implementation of any strategies for bushfire control and fuel management adopted by the Bushfire Control Office established by the Council for the area.

   Comment: The development will not have any adverse effect on bushfire control and fuel management adopted by the Bushfire Control Office.

b) Whether a significant threat to the lives of residents, visitors or emergency services personnel may be created or increased as a result of the development (including any threat created or increased by the access arrangements to and from the development)

   Comment: The proposal (including its access arrangements) will not knowingly cause any threat to the lives of residents, visitors or emergency services. The road layout permits access for fire fighting vehicles.

c) Whether the increased demand for emergency services during bushfire events that is created by the development would lead to a significant decrease in the ability of the emergency services to effectively control major bushfires

   Comment: The development is unlikely to cause any increased demand for emergency services as a result of its construction and operation.

d) The adequacy of measures proposed to avoid or mitigate the threat from bushfires including:

   i. the siting of the development
   ii. the design of structures and the materials used
   iii. the importance of fuel-free and fuel-reduced areas

   Comment: The proposed works are sited in cleared areas. The rising main and pumping station will be laid underground. The water storage tank will be constructed as a steel panel tank and is deemed fire resistant.

e) Landscaping and fire control aids such as roads, reserves, access arrangements and on-site water supplies

   Comment: The proposal will not impede on any bushfire fighting protection in the event of a bushfire. The road layout permits access for fire fighting vehicles.

f) The environmental and visual impacts of the clearing of vegetation for bushfire hazard reduction

   Comment: The proposal does not warrant the clearing of vegetation for bushfire hazard reduction.

Planning for Bushfire Protection (2006) guidelines were used to determine bushfire hazard associated with the proposal. In summary, the recycled water storage tank site is predominantly flat with low health land to the south side and adjoins the cleared rugby league fields to the north. The position of the recycled water storage tank in relation to the surrounding vegetation and the construction materials (steel panel tank including submersible infrastructure) will not contribute to the bushfire susceptibility of the site and is unlikely to be subject to destruction by fire.

3.6 TWEED STRATEGIC PLAN 2004 – 2024

With the rapid increase in population occurring in Tweed Shire, there is expected to be a commensurate increase in demand on the potable supply system, resulting in the need for major expansion in water supply infrastructure. Recycled water use has a number of important water conservation and sustainability benefits. This proposal will provide a substitution of potable water currently used for irrigating the Bogangar Rugby League Field. This proposal is in line with the directions detailed for the future planning and infrastructure development for Tweed Shire.

3.7 PERMITS, APPROVALS AND ENVIRONMENTAL LICENSES

3.7.1 HASTINGS POINT SEWAGE TREATMENT PLANT

Under Schedule 1 of the ***Protection of the Environment Operations Act 1997*** the Hastings Point Sewage Treatment Plant is listed as a NSW Environmental Protection Agency (EPA) licensed activity No.3618 “processing by small plants (<10 000 ML per year)”.

A review of the Hastings Point Sewage Treatment Plant, Round Mountain Road, Hastings Point (September 2007), refer Appendix J, confirms that the WWTP is licensed to discharge to the locations outlined in Table 3.1 under Clause 2 Discharges to air and water and applications.

Table 3.1 Hastings Point Environment Protection Licence No.3618

Section 55 Protection of the Environment Operations Act 1997

Environment Protection Licence

Department of Environment & Climate Change NSW

Licence - 3618

Water and land

EPA identi-fication no.	Type of monitoring point	Type of discharge point	Description of location
1		Discharge to waters - dry weather	Exfiltration dune disposal area approximately 100 metres east of the junction of Coast and Round Mountain Roads as shown on locality plan submitted with Licence Information Form dated 20/12/99
2	Wet weather discharge and volume monitoring	Wet weather discharge and volume monitoring	Effluent disposal line to Christies Creek as shown on locality map submitted with Licence Information Form dated 20/12/99. Monitoring by calculation.
3	Effluent quality monitoring		Effluent pumping station
4	Total volume moitoring		Inlet to works
5	Effluent quality monitoring		The first effluent distribution box located at exfiltration dune disposal area approximately 100 metres east of the junction of Coast and Round Mountain Roads as shown on "Fig 2" submitted to the EPA with the Licence Information Form dated 20/12/99.

3.7.2 IRRIGATION SYSTEM

The proposed discharge of recycled water to the Bogangar Rugby League Fields is to be sought for license approval under the existing Hasting Point Licence No.3618.

4. STATUTORY SUMMARY

Review of the legislative, regulatory and or other relevant planning instruments and their requirements for the proposed works provides the following summary:

- The majority of the relevant legislative issues are not triggered by the proposed works;
- The proposed works can be allowed without development consent under TLEP 2000;
- An evaluation of factors concerning the impact of the activity on the environment must be taken into account, as required under Part V of the Environmental Planning and Assessment Act 1979; and
- The proposed discharge of recycled water to the Bogangar Rugby League Fields is to be sought for license approval under the existing Hasting Point Licence No.3618.

Based on the above review, the remaining matters for consideration are discussed in the following sections, along with preventative actions to mitigate environmental impacts.

5. ENVIRONMENTAL MATTERS

5.1 LANDUSE AND TENURE

5.1.1 LAND ZONING

The land zoning details of the proposed works site are provided within Table 1.1 Property Description of this REF.

The new recycled water rising main is proposed to be connected from the existing recycled water main at the corner of Tweed Coast Road / Round Mountain Road aligning within the Tweed Coast Road 'road reserve' to a recycled water storage tank at the Rugby League Field. The Tweed Local Environmental Plan 2000 identifies the Rugby League Field as '6a Open Space – Recreation'. Neighbouring land to the southwest is zoned as '6b Open Space - Recreation' and the surrounding land use to the north is zoned as '2a & 2c Residential'. To the east of Tweed Coast Road the land is zoned as '6a Open Space' and to the south of Round Mountain Road the land is zoned '8a National Parks/Nature Reserves'. The site location and current council zonings are shown in Appendix B.

The construction of the proposed works is not expected to have any short or long term impacts on these areas.

5.1.2 TENURE

The tenure details of the proposed works site are provided within Table 1.1 Property Description of this REF.

The construction of the proposed works is expected to have minor short term impacts on these areas, with no long term impacts expected.

5.2 LAND

5.2.1 TOPOGRAPHY

The site is predominantly flat with elevation less than 10m AHD. No environmental constraints due to the topography of the site have been identified during this assessment.

5.2.2 GEOLOGY

The geology of the Bogangar Rugby League Field consists of:

- ***Quaternary beach and dune sands from the Holocene period plus the Pleistocene Inner Barrier (Morand 1996).***

The geology of the Recycled Water Rising Main route comprises sediments of:

- ***The Palaeozoic Neranleigh-Fernvale Group (sand, silt, clay, gravel) and the Holocene dunes consisting of marine quartz sands forming the outer barrier system (Morand 1996).***

The proposal is generally compatible with the geology of the site. Potential impacts may arise from the highly permeable geological quaternary beach dunal sands of the site. This sand has the potential to transport nutrients through groundwater flow. This is discussed further within Section 5.3 Soils.

5.3 SOILS

5.3.1 SOIL TYPES

5.3.1.1 BOGANGAR RUGBY LEAGUE FIELD SOIL CHARACTER

Soils Mapping (Morand 1996), shows the Bogangar Rugby Fields to be situated on disturbed soils (xx). These soils are described by Morand (1996) as ***man made land varying from level plains to undulating terrain, which has been disturbed by human activity to a depth of at least 1 m. The soil may contain land-fill which includes soil, rock, building and waste material***.

To confirm Morand's description of the soils type, soil investigations on the field were conducted on the 5th and 6th February 2007 by MWH (Appendix A. Bogangar Rugby League Field Recycled Water Reuse Scheme Study (BRFRWS, 2007)) to confirm the presence/absence of fill. All sites were found to be uniformly sandy to the depth of auguring. The only differences between the sites were colour differences and the depths at which these layers were encountered.

The BRFRWS (2007), documented that the sites located on the western margin of the field (Sites 1 and 2) contained dark topsoil layers to a depth of 0.4 m overlying bleached sands to the depth of auguring (1.5 m and 1.0 m respectively). These soils appear to be naturally formed. Sites 3, 4 and 7 located on the eastern margin of the field, contained dark topsoil layers to a depth of 40 cm overlying dark brown layers to 1.0 m. At Site 4, (which was drilled to a depth of 1.5 m), the bleached layer was encountered from 1.0 to 1.5 m. The presence of darker sand layers at lower depths and the discontinuity in soil layering may indicate that the natural soil profile has been disturbed on this eastern margin of the field. No evidence of fill was encountered.

5.3.1.2 RECYCLED WATER RISING MAIN SOIL CHARACTER

The proposed pipeline route borders both the Billinudgel erosional (bi) and Bogangar aeolian (bo) landscapes (Morand, 1996). The Billinudgel landscape consists of erosional soil landscapes that have been primarily sculpted by the erosive action of running water. Soil depths are usually shallow with occasional deep patches, and mode of origin is variable and complex. Landscape limitations consist of water erosion hazard when cleared with soil exhibiting very strong to extreme acidity with high aluminium toxicity potential (Morand 1996).

The Bogangar landscapes are disturbed and generally reshaped and revegetated Holocene dunes flanking the Tweed-Byron Coast. These dunes have been sand mined. Most of the mining was carried out during the 1950's and 1960s. As mining ceased, dunes were rehabilitated, including restructuring and revegetation. Landscape limitations consist of extreme wind erosion hazard on non-cohesive soils with high soil erodibility (Morand 1996).

5.3.2 ACID SULFATE SOILS

The NSW Acid Sulfate Soil Manual (Stone ***et al*** 1998) defines Acid Sulfate Soils as:

- ***Acid sulfate soils are the common name given to naturally occurring sediments and soils containing iron sulfides (principally iron sulphide or iron disulfide or their precursors). The exposure of the sulfide in these soils to oxygen by drainage or excavation leads to the generation of sulfuric acid.***

Acid sulfate soils can have considerable effects on:

- ***Engineering and landscaping works (including affecting the type of concrete or steel required, the design of road, buildings, embankment and drainage system, extractive materials specifications, maintenance programs for drains, water and sewage pipelines and other structures); and***

- ***The conservation of biodiversity and protection of wetlands and shallow freshwater aquifer systems (in relation to the degradation of habitat or water quality, killing or disease of fish and other aquatic organisms).***

The proposed rising main, recycled water booster pump, storage tank and irrigation system is located within an area mapped as Class 3 on the Acid Sulfate Soil (ASS) planning maps (Appendix F). Under Clause 35 of the TLEP 2000, Class 3 works are specified as:

- ***works beyond 1 metre below the natural ground surface***
- ***works by which the watertable is likely to be lowered beyond 1 metre below the natural ground surface.***

Development consent and ASS preliminary investigations are not required for the proposed development as outlined under Clause 35 of the Tweed LEP (2000) as the development works are not proposed beyond 1 metre below the ground surface nor is the watertable likely to be lowered beyond 1 metre below the natural ground surface.

Since the depth of excavation will not extend 1m below ground surface level, it is determined that the development poses an insignificant ASS risk. The tops of pipes associated with the pipeline will not extent beyond 1 m of the natural ground surface.

There is a low probability of groundwater interception during construction. Furthermore, as a result of the proposed works it is unlikely that groundwater will be lowered beyond 1 metre below the natural ground surface. As outlined in the Hastings Point Recycled Management Plan (May 2007), geotechnical investigations associated with the construction of the nearby Hastings Point STP indicated that the groundwater table was not intercepted by the installation of the reactor tanks with boreholes drilled to a depth of five metres. In the instance of the Bogangar Rugby League Field, no ground water has been detected at 1.5m depth. Given that 5m boreholes at the STP indicated no groundwater, it is unlikely that groundwater will be intercepted at the proposed works site.

Should ASS or groundwater be intercepted at any point during construction appropriate controls will be implemented to mitigate against any potential adverse environmental impacts.

To ensure durability in a potential ASS landscape all works that are in contact with soils will use non-corrosive materials such as pvc pipe for the rising main and pvc lined booster pump.

5.3.3 CONTAMINATED SOILS

5.3.3.1 CONTAMINATED LAND

Under SEPP 55 – Remediation of Land, planning authorities are required to consider the potential for contamination to adversely affect the suitability of a site for its proposed use.

Based on the search results of public records and observations during the initial site inspection, the potential for contamination on site is considered to be highly unlikely. Neither the site nor any surrounding properties were listed on the NSW Department of Environment and Climate Change Contaminated Land Public Record. No evidence of potentially contaminating processes, such as cattle dips or industrial facilities, was observed in the vicinity of the site during the site inspection.

A search of the NSW Department of Primary Industries 'Cattle Dip Site Locater' found the nearest dip 'Cupitts' with a demolished status to be located approximately 2 km southwest of the site.

No evidence of contaminated land was encountered during the Bogangar Rugby Field Recycled Water Reuse Study conducted by MWH in 2007 (Appendix A).

Should contamination be intercepted at any point during construction appropriate controls are recommended to mitigate any potential adverse environmental impacts.

Soil investigations undertaken by MWH indicate it is unlikely the site has been filled or has be subject to contaminating activities. Furthermore, the Raiders sports team have played on the sports fields for twenty years. Discussions with Tweed Shire Council Recreational Services Division have indicated it is highly unlikely that the sports fields were ever filled beyond this timeframe.

5.3.3.2 RADIOLOGICAL INVESTIGATION

Historically the area has been subjected to sand mining and mineral sand processing, although there is no evidence that these processes were conducted in the immediate area. MWH commissioned Queensland Health Scientific Services (QHSS) to perform a radiological screening survey to establish the likelihood of high level surface radiation occurring due to historic sand mining in the area.

The surface gamma survey did not identify any areas that could be considered as being greater than typical background levels for the area. All measured gamma levels are less than the action level criteria recommended in the NSW EPA ***Clean-up and disposal of residues from commercial operations involving mineral sands, (Radiation Information Series No.12 (1984)).*** Radiological investigation No.07PQ267 results are contained within Appendix D of this REF.

5.4 VISUAL AMENITY

During construction, there will be a temporary impact on visual amenity within the local area. During operation, the rising main, booster pump and irrigation system will have a no impact on the visual amenity of the area as the infrastructure will be constructed entirely underground. The recycled water storage tank site contains surrounding vegetation which will provide a visual barrier and will not significantly alter the context of existing views.

5.5 CULTURAL HERITAGE

A search of the NSW Heritage Office database 'State Heritage Inventory', 'State Heritage Register' and Commonwealth Australian Heritage Database (May 2007) identified no places or items of European or Aboriginal cultural heritage occurring on or within the vicinity of the site.

An Aboriginal Heritage Information Management System (AHIMS) search accompanying this REF (Appendix E) confirms that the proposal will not affect any known places and buildings of archaeological or heritage significance, including Aboriginal relics and places. Nor is the proposal in the vicinity of any known places and buildings of archaeological or heritage significance, including Aboriginal relics and places.

Despite this, it is usual to caution that under Section 90(1) of the National Parks and Wildlife Act 1974 (NPW Act), it is an offence for a person who without obtaining the consent of the Director General, knowingly destroys, defaces or damages or knowingly causes or permits destruction or defacement or damage to a relic or Aboriginal place.

During construction, if materials are found, which are believed to be Aboriginal sites or cultural remains, the works at or adjacent to the material must stop and the National Parks and Wildlife Services (NPWS) Regional Archaeologist (Coffs Harbour) or the NPWS Sites Officer (Alstonville) must be notified immediately. They will advise the appropriate course of action.

This site has no heritage items listed in the TLEP 2000.

5.6 FLORA AND FAUNA

A search of the National Parks and Wildlife Service Atlas of NSW Wildlife (September 2007) for threatened fauna and flora listed under the ***Threatened Species Conservation Act 1995*** (TSC Act) identified 36 fauna and 21 flora recorded species within a ten kilometre radius of the subject site. A search of the EPBC Act Protected Matters Search tool in September 2007 found that of these species 6 fauna and 11 flora are also listed under the ***Environmental Protection and Biodiversity Conservation Act 1999*** (EPBC Act). The searches are included as Appendix G of this REF.

This site is located within a highly modified coastal environment providing limited habitat for flora and fauna. The subject site has been extensively cleared to accommodate recreational sporting grounds. Vegetation on the site comprised grassed areas and surrounded adjoining properties of coastal health land species.

No tree removal is required. All vegetation on the site will be left intact. Given the disturbed nature of the site, the development will not adversely affect the biodiversity of the area, nor impact upon fauna habitat or native vegetation.

Due to the highly modified and cleared nature of the proposed development area with limited habitat value, the proposal will not affect species, populations or communities scheduled under the TSC Act (See Section 2.5 TSC Act 1995). Therefore a Species Impact Statement not required.

The proposed development does not trigger any Matters of National Environmental Significance such as World Heritage Properties, National Heritage Places, Ramsar wetlands, or Threatened Species and Ecological Communities specified by the EPBC Act (Appendix G).

Vegetation disturbance within the proposed excavation area will be limited to grasses only, no disturbance to trees, shrubbery or other flora is anticipated. Further ground truthing Grass will be re-established on disturbed areas where required, immediately following construction completion. Site photos are included in Appendix C.

5.7 SOCIAL AND ECONOMIC

The local impact of the proposed irrigation of recycled water and all associated infrastructure will be positive for the environment and the community. The proposed installation of the recycled water system has the following triple bottom line benefits:

Economic Benefits
- Reduce potable water usage

Social Benefits
- Improved sustainability, which will benefit the local community, both now and in the future
- Improved public perception of the benefits of recycled water
- Improved visual amenity within the local community, such as greener sporting fields

Environmental Benefits
- Decreased amount of recycled water currently released within the sand dunes at Bogangar

In summary, this project clearly demonstrates:
- Provision of safe and secure water (recycled water) service
- Reduction in the discharge of nutrients into the sand dunes at Bogangar
- Encouragement in the beneficial re-use of recycled waters amongst the local community
- Establishment of a long term planning strategy for the use of recycled water

The construction phase will temporarily affect residents in the local area. Construction related impacts be appropriately managed through the development and implantation of a CEMP. Furthermore, any residual impacts during the construction phase will be offset by the long-term benefits realised by residents following implementation of the Recycled Water Scheme.

6. POTENTIAL FOR ACCIDENTS, HAZARDS AND DISASTERS

The proposed construction activity will not increase the potential for hazards, disasters or accidents if all applicable Council Standard Operating Procedures are adhered to.

6.1 EROSION AND SEDIMENTATION

Given the types of soils present and their associated physical and chemical properties, adequate erosion and sediment control measures should be taken in order to minimise erosion and prevent sedimentation off site. These measures include adopting preventative actions and implementing erosion and sediment control measures during construction in the form of a Construction Environmental Plan (CEMP). In addition, operations procedures to mitigate against potential erosion are to be included in the Recycled Water Management Plan.

During installation of the pipeline and associated works, there is some potential for cleared areas of soils to erode. Soils within the development area have sandy surface layers, which lack cohesion, making them susceptible to erosion. Additionally, water movement in the lower subsoil may also result in soil dispersion and structure decline. Given these limitations, there is potential for erosion to occur and associated sedimentation to be released from site.

Potential impacts associated with excavation, construction and operation of the proposal include:

- Reduced soil stability;
- Inferior re-vegetation from poor soil control;
- Reduced slope stability in areas of cut and/or fill;
- Damage to coastal marine areas; and
- Habitat disturbance.

Construction activities will be designed to maximise the retention of the protective groundcover. A grassy groundcover (which currently exists over the site) provides the best protection against soil erosion by overland flow and promotes infiltration. Further measures that will be adopted include:

- Restricting site clearing to the minimum area of disturbance required;
- Staging earthworks to manageable areas;
- Scheduling activities to occur during the least erosive winter months, if possible;
- Selecting suitable sites for stockpiling where runoff/runon is least expected; and
- Incorporating a staged rehabilitation plan as part of the construction design.

Effectively controlling erosion is reliant upon the development of erosion and sediment control measures during construction in the form of a CEMP. The following factors are to be implemented as part of the plan:

- Controlling soil erosion (sheet flow) by reducing slope length and gradient and protecting ground surfaces;
- Controlling soil erosion (concentrated flow) by addressing the capacity and lining of drains and outlet structures with the design and construction of energy dissipaters;
- Directing runoff to sediment fences and/or gully grate control devices to capture mobilised sediment;
- Constructing contour drains or diversion channels to divert stormwater runoff;
- Installing sediment traps along overland control paths within disturbed areas;
- Using a road sweeper where necessary to remove excess sediment;
- Locating stockpiles away from drainage lines to avoid erosion;
- Utilise geotextiles to stabilise unconsolidated spoil and soil surfaces;
- Clearing building rubble spoil on a regular basis; and
- Grading and re-turfing the area after completion of works.

- All sediment and erosion control devices will be visually inspected weekly
- Any damage to sediment and erosion control devices must be reported to the Construction Manager immediately
- Corrective action will be undertaken immediately

6.2 FLOODING

The proposed works are consistent with the intent of TSC Development on Flood Liable Land DCP 2007 (See Section 3.2.1 Section A3 Development on Flood Liable Land).

6.3 WATER QUALITY

Groundwater and surface water quality potential impacts are considered to be low during the construction phase of the project. It is anticipated that the project construction will not interfere with, nor impact on the groundwater resources within the area. There will be limited impact on catchment drainage patterns as only minor redirection of runoff as a result of the cut and fill during construction will occur.

6.3.1 WATER QUALITY – EROSION AND SEDIMENTATION

Construction of the project has some potential to cause erosion and sedimentation of disturbed areas. These issues have been addressed in Section 6.1 Erosion and Sedimentation of this report.

6.3.2 WATER QUALITY - ACID SULFATE SOIL

The potential interception of acid sulphate soils (ASS) and their potential to impact on aquatic ecology within the area is expected to be unlikely given that the proposed development will not intercept 1 m below the existing ground level and has been addressed within Section 5.3.2 Acid Sulfate Soils of this report.

In the unlikely event that ASS be intercepted at any point during construction appropriate controls as specified in the CEMP are recommended to be implemented to mitigate against any potential adverse environmental impacts.

6.3.3 GROUNDWATER QUALITY

6.3.3.1 INSTALLATION OF GROUNDWATER MONITORING WELLS

Preventative actions for managing groundwater potential impacts when using recycled water for irrigation on the playing fields included the establishment of baseline groundwater data. Two water quality monitoring bores were installed by Butler Partners Pty Ltd on the 27th and 28th of August 2007. Well installation and development was based upon the ARMCANZ (2003) Minimum Construction Requirements for Water Bores in Australia. A bore licence for the installation of the wells was issued by NSW Department of Natural Resources (DNR) on the 2nd August 2007 and completed logs were forwarded to NSW DNR to complete licence requirements. The results of the fieldwork are documented with a site plan of well locations, bore reports including a detailed summary of the wells construction and development within Appendix H of this report.

6.3.3.2 GROUNDWATER QUALITY MONITORING

Groundwater quality monitoring was undertaken by MWH on the 4th of September 2007 to establish baseline data prior to the application of recycled effluent to the playing fields. The water quality monitoring methodology and laboratory results are contained within Appendix H of this report.

The primary objective of the monitoring was to gather groundwater water quality data prior to the application of recycled water to establish existing groundwater quality.

The secondary objective of the monitoring was to gather information that will underpin the risk assessment process and provide a basis for assessing potential impacts of the use of recycled water on the environment and/or public health risks. Specifically the secondary objectives were to:

- Analyse results and provide verification that groundwater quality conditions prior to the application of recycled water by irrigation are in accordance with relevant environmental and public health guideline values;
- Provide sufficient supporting data to determine, with an acceptable level of confidence, the contamination status of the site relative to indicative guideline values; and
- To provide subsequent monitoring recommendations.

Results for seven indicators exceeded The Australian and New Zealand Environment Conservation Council, ***Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)*** guideline trigger values. The guidelines were used in the absence of any known groundwater trigger levels.

These exceedences were :

- Biological Oxygen Demand (BOD) and Copper in BH1 ; and
- pH, Zinc, Total Phosphorus, Total Nitrogen and Oxidised Nitrogen in both BH1 and BH2.

A summary of the groundwater quality results for these exceedences is presented in Table 6.1. The groundwater monitoring results indicate comparable groundwater characteristics in both monitoring wells, with the exception of Oxidised Nitrogen, where levels in bore hole one (BH2) were twenty two (22) times higher than in bore hole one (BH1).

The full laboratory results and discussion are contained within Appendix H of this report.

Table 6.1 Groundwater Laboratory Results where Constituents Exceeded ANZECC 2000 Trigger Levels

		Results	
Test	Trigger levels	BH-1	BH-2
pH (pH units)	6.5 – 8.5	5.4	5.4
BOD_5 mg/L	≤ 2 NTU	2.4	1.0
Copper (soluble) mg/L	1.3 µg/L	2 µg/L	1 µg/L
Zinc (soluble) mg/L	15 µg/L (C)	90 µg/L	30 µg/L
Total Phosphorus – P mg/L	25 µg L^{-1}	790 µg/L	80 µg /L
Total – N mg/L	120 µgNL^{-1}	3990 µgNL^{-1}	3070 µgNL^{-1}
Nitrogen – oxidised mg/L	5 µgNL^{-1}	86 µgNL^{-1}	1929 µgNL^{-1}

The slightly elevated levels of copper and zinc may be a result of stormwater runoff entering the groundwater system. Nitrates are one of the most widespread known contaminants of ground water in Australia. There are a number of reasons why the groundwater results are elevated for both nitrogen and phosphorus. Excess fertilizer may have been applied to the rugby field or through nearby agricultural practices which could have leached through to the groundwater. There is a possibility that the existing treatment plant outfall in the sand dunes approximately 500 m south of the site may be affecting the groundwater system.

While the total nitrogen levels are only marginally higher than the estuarine or lowland river trigger levels in ANZECC (2000), they are substantially higher than the marine trigger values.

BOD is only slightly above the trigger level in BH1 and may be related to catchment land use practices.

6.3.4 IRRIGATION WATER QUALITY

Hastings Point STP strives to produce recycled water to a quality that when used, complies with parameters in the NSW Environmental Guidelines for Use of Effluent by Irrigation (2004) considered relevant to the nature of its receivable, treatment and/or distribution operations. These guidelines complement other guidelines such as the ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Current licence load limits applied at the Hastings Point STP are outlined in Table 6.2.

Table 6.2 Hastings Point STP Current Licence Load Limits

Parameter Pollutant	Units	50th percentile conc. limit	90th percentile conc. limit	100th percentile conc. limit
Oil and Grease	mg/L	-	-	10
Total suspended solids	mg/L	20	25	40
Biochemical oxygen demand	mg/L	20	25	40

Analysis of the quality of recycled water from Hastings Point STP found that the "Classification of Effluent for Environmental Management" of the 'DEC (NSW) Environmental Guidelines: Use of Effluent by Irrigation' classifies the recycled water produced by the Hastings Point STP as low strength. Water quality data (from years 2006 and 2007) are compared against the NSW DEC 'Low Strength' classification in Table 6.3

Table 6.3 Comparison of Hastings Point STP Water Quality and NSW DEC Classification

Constituent	Low Classification (NSW DEC) (average concentration mg/L)	Hastings Point STP Recycled Water 2002- 2007 (average concentration mg/L)				
		Minimum	Mean	Maximum	50%ile	90%ile
Total nitrogen	<50	3.48	4.86	7.31	4.8	6.1
Total phosphorus	<10	0.45	1.39	3.22	1.1	2.5
BOD_5	<40	1.2	2.2	5.4	1.8	3.0
TDS	<600	311.3	410.7	468.7	413.3	443
Grease and Oil	< 1,500	2	2.5	5	2	4.4
Thermotolerant coilforms						
- municipal uncontrolled access	<10	2	892	23000	10	24
- municipal control access	<1,000					
- agricultural non-food (turf)	<10,000					

NB: The above constituents were the only measures that enabled direct comparison with the Guideline

The 'DEC (NSW) Environmental Guidelines: Use of Effluent by Irrigation' recommends that:

- Recycled water used to irrigate municipal land with uncontrolled access to have thermotolerant coliform levels of less than 10 cuf/100ml; and
- Irrigation with controlled access recommends termotolerant coliform levels of less than 1,000 cuf/100ml.

Current recycled water thermotolerant coliform levels from the Hastings Point STP exceed 10 cuf/100ml for only 10% of the samples reviewed. There is no apparent relationship between rainfall and high therrmotolerant coliform levels and the results of these exceedances may require further investigation.

Bogangar Rugby League Fields has uncontrolled public access. The application of irrigated water during the evening minimises public health distribution risks. Irrigation on municipal lands with uncontrolled public access is recommended to have thermotolerant coliform levels of less that 10 cuf/100ml. Several results have disproportionally affected the average cfu results for the plant. From the results of the majority of samples measured since the upgrade of the plant, cfu levels are less than or at the recommended guideline levels.

Mitigation strategies

Exceedances related to wet weather flows can be avoided by the practice of not irrigating during wet weather or when wet weather is imminent. Recycled water public health distribution risks can be prevented by activating irrigation systems at a time in the evening. Modifications to the existing irrigation system include closer sprinkler spacing for improved distribution uniformity, at reduced pressures to assist in improving the management of sprinkler spray drift on the site, which may be a problem under wind conditions. This has been done despite the site having reasonable buffer distances to residential areas. Spray drift has been a problem in the past and the new system and its management should minimise any further issues. Irrigation is to occur only on areas clearly identified as using recycled water for irrigation with appropriate buffer zones and signage in place.

The following strategies are recommended to ensure the long term viability of recycled water irrigation at the site:

- Regular water quality sampling (at least bi-annually);
- Ensuring that grass clippings are removed after mowing. These clippings may return N and P to the soil over the long term. If these clippings are not able to be removed from the site, then we recommend a regular soil sampling and monitoring program (every 3-5 years) is recommended to ensure accumulations of N and P in the soil do not exceed guideline levels; and
- Ensure application rates are sustainable. At 20ML/annum (which is the expected maximum amount of irrigation that will be applied at the site, the nutrient balance modelling (Appendix A) indicates that very low amounts of nutrient will enter groundwater. The vast majority of nutrient will be absorbed by the crop (ie grass) and the soil.
- Water movement may be restricted at depth in the soil profile due to the presence of coffee rock and excessive irrigation amounts may cause water tables to rise if permeability is restricted. In any case, regular monitoring of groundwater bore water levels and laboratory analysis of parameters such as nutrients, heavy metals, Ec and pH will be required to determine long term recycled water irrigation sustainability.

A Recycled Water Management Plan (RWMP) for the site has been developed. The implementation of this plan and its continual review and improvements provide a mechanism for managing and minimising risk over the site. In particular, the minimisation of over irrigation and ensuring that application rates are sustainable in the short and long term.

6.4 TRAFFIC

Vehicular traffic levels within the local area will increase during construction. Existing traffic levels will resume following completion of construction. Construction traffic will mainly involve delivery of materials, removal of spoils and workers commuting to/from the site. It is not anticipated that the volume of these truck movements will adversely impact upon existing road networks within the regional and local area.

A CEMP incorporating a traffic control plan is recommended to ensure that disturbance to local traffic is minimal and to ensure a safe working environment. Preventative actions during construction include:

- Limit construction and construction vehicle movements to working hours, as defined by TSC, from Monday to Saturday between the hours of 7.00 am and 7.00 pm;
- Wherever possible, schedule deliveries or removals outside of peak traffic times;
- Limit speed of heavy vehicle traffic; and
- Notify any nearby residents prior to the commencement of works and excessive noise activities taking place.

6.5 NOISE

6.5.1 CONSTRUCTION

Construction of the proposed works will result in a temporary increase in noise levels above what is currently experienced at the site. Surrounding land uses are predominantly coastal undeveloped landscape with the nearest residential areas located approximately 40 m north of the playing fields.

To mitigate increased noise levels during construction, the following measures are recommended:

- Limit construction and construction vehicle movements to working hours, as defined by TSC, from Monday to Saturday between the hours of 7.00 am and 7.00 pm;
- Limit speed of heavy vehicle traffic; and
- Notify any nearby residents prior to the commencement of works and excessive noise activities taking place.

6.5.2 MECHANICAL PLANT

The irrigation pump(s) are submerged in the storage tank and there is no machinery, engines or motors in the system. Noise from these installations is minimal even at close proximity to the tank. The tank / pump installation is over 150 m from nearest residences.

6.5.3 IRRIGATION SYSTEM

The operation of the irrigation system is very quiet. The site is relatively distant from residences (over 40 m from nearest sprinkler) and the potential for noise impact at these residences is very low. A 40 m scrub / bush buffer zone between the fields and nearest residences to the north of the fields assists in buffering any noise.

6.6 AIR QUALITY

No numerical air quality data is available for the Bogangar Rugby League Field. However, air quality in Bogangar is generally regarded as good and typical of coastal locations.

To mitigate air quality decline during construction the following measures are recommended:

- Ensure loads are covered;

- Limit construction and construction vehicle movements to working hours from Monday to Saturday (between 7.00 am and 5.00 pm);
- Limit speed of heavy vehicle traffic;
- Vehicle speed limits of 20km/hr will be strictly enforced;
- The noise level generated by plant and equipment on site will be in compliance with limits sets by AS2436 - Guide to noise control on construction, maintenance and demolition sites; and
- Council's Standard Operating Procedure 5 – Noise will be adhered to.

6.6.1 IRRIGATION SYSTEM

Air quality at the playing fields can deteriorate from the generation of dust from normal turf management operations and aerosols from spray drift from sprinklers. The accompanying Recycled Water Management Plan examines these two air quality parameters and provides measures to mitigate any deterioration of air quality.

6.7 CHEMICAL SPILLS

The risk of chemical spills is considered low.

Any spill response will be in accordance with Council's Standard Operating Procedure 67 Clean Up Spillages. Any dangerous goods and hazardous substances (including fuels or oils) will be used and stored in accordance with Council's Standard Operating Procedure 3 Dangerous Goods and Hazardous Substances.

6.8 BUSHFIRES

The proposal is not subject to fire hazard (See Section 3.5.2 Clause 39(A) Bushfire Protection of the TLEP 2000). The site is mapped as 'Bushfire Prone Land – Vegetation Category 1' on the TLEP Bushfire Prone Map (2002) (Appendix I).

The recycled water storage tank site is predominantly flat with low health land to the south side and adjoins the cleared rugby league fields to the north. The position of the recycled water storage tank in relation to the surrounding vegetation and the construction materials (steel panel tank including submersible infrastructure) will not contribute to the bushfire susceptibility of the site and is unlikely to be subject to destruction by fire.

6.9 OVERHEAD POWERLINES

The proposal is located in the vicinity of existing overhead powerlines. The use of machinery such as backhoes could pose a potential hazard to this power supply. Appropriate procedures should be put in place to minimise these risks during machinery operation.

6.10 WASTE MANAGEMENT AND MINIMISATION

The overall waste management objective is to prevent any adverse impacts from wastes generated due to construction of the works, through the implementation of waste management principles and best practice disposal strategies.

The hierarchy includes, but is not limited to waste avoidance, recycling, conversion of waste to energy, treatment and disposal. Without proper waste management, there is the potential for wastes to impact on workers' health and safety and the environment. Waste mitigation measures will be included in a CEMP with the impact of waste generation expected to be minimal.

7. RISK ASSESSMENT

A risk assessment will be carried out prior to the commencement of works. This assessment will ensure services potentially within and adjacent to the proposed site will not be disturbed during the works.

8. CONCLUSION

Tweed Shire Council's proposal to irrigate Bogangar Rugby League Field with recycled water is unlikely to have significant adverse environmental impacts, particularly in regard to Part V of the Environmental Planning and Assessment Act 1979. Therefore, it follows that an Environmental Impact Study is not required for this particular activity.

Statutory matters for consideration are outlined within Sections 2, 3, and 4 of this REF. Section 5 contains a comprehensive assessment of the environmental matters for consideration and Section 6 considers the potential for accidents, hazards and disasters associated with the proposed development. The matters are reliant upon the recommendations stipulated within this review (and the associated Recycled Water Management Plan) being implemented and conditional upon no significant alterations being made to the final design of the works reviewed in the preparation of this REF.

The practice of applying treated effluent to land at Bogangar rugby playing fields has substantial environmental and social sustainability benefits relating to:

- A reduction of recycled water and its associated nutrient loads currently released within the sand dunes at Bogangar, and
- Easing of peak demands on potable water supply during the dry season.

To ensure the application of recycled effluent to the sports fields are undertaken in a sustainable manner with minimal impacts on the environment it is essential that the recommendations outlined in this report and the Recycled Water Management Plan (MWH 2007) are adhered to.

9. REFERENCES

The following references were used during the preparation of this report:

ANZECC (2000) ***Australian and New Zealand Guidelines for Fresh and Marine Water Quality.*** The Australian and New Zealand Environment Conservation Council***.***

ARMCANZ (2003) ***Minimum Construction Requirements for Water Bores in Australia***

AS2436 (1981) ***Guide to noise control on construction, maintenance and demolition sites***

Commonwealth Government (1999) ***Environment Protection and Biodiversity Conservation Act***

Morand, D. T. (1996) ***Soil Landscapes of the Murwillumbah – Tweed heads, 1:100 000 Sheet.*** Department of Land and Water Conservation, Sydney

MWH Australia Pty Ltd (2006). ***Concept Designs – Final Report: Recycled Water Reuse Opportunities***. Prepared for Tweed Shire Council, February 2006

NSW Department of Environmental and Conservation (2004) ***Environmental Guidelines: Use of Recycled water by Irrigation***

NSW EPA ***Clean-up and disposal of residues from commercial operations involving mineral sands. Radiation Information Series No.12 (1984)***

NSW Government (1979). ***Environmental Planning and Assessment Act***

NSW Government (1988). ***North Coast Regional Environmental Plan***

NSW Government (2000). ***Environmental Planning and Assessment Regulation***

NSW Government. ***State Environmental Planning Policy No. 11 – Traffic Generating Developments***

NSW Government. ***State Environmental Planning Policy No. 14 - Coastal Wetlands***

NSW Government. ***State Environmental Planning Policy No. 26 – Littoral Rainforest***

NSW Government. ***State Environmental Planning Policy No. 44 – Koala Habitat***

NSW Government. ***State Environmental Planning Policy No. 55 – Remediation of Land***

NSW Government. ***State Environmental Planning Policy No. 71 – Coastal Protection***

Tweed Shire Council (2000). ***Tweed Local Environmental Plan***

Tweed Shire Council (2004). ***Draft Strategic Plan 2004-2024***

Tweed Shire Council (2007). ***Development Control Plan***

APPENDIX A

RECYCLED WATER REUSE SCHEME STUDY

Tweed Shire Council

Bogangar Rugby League Field Recycled Water Reuse Scheme - Study

May 2007

Quality Assurance Statement	
Tweed Shire Council **Bogangar Rugby League Field Recycled water Reuse Scheme**	**Prepared by:** Steven Cox **Reviewed by:** Justin Adams
Project Manager: Mark Hunting	**Approved for issue by:** Mark Hunting

Revision Schedule					
Rev. No	Date	Description	Prepared by	Reviewed by	Approved by
0	21/3/07		Steven Cox	Justin Adams	Mark Hunting

MWH Australia Pty Ltd
Level 2, 10 Finchley Street
P O Box 2148
Milton, QLD 4064
Tel: 61-7-3510 7300
Fax: 61-7-3510 7350

Tweed Shire Council

Bogangar Rugby League Field Recycled Water Reuse Scheme

Contents

List of Tables

List of Figures

List of Appendices

1. Introduction

Recycled water reuse is an integral component of Tweed Shire Council's Integrated Water Cycle Management Strategy. Tweed Shire Council (TSC) has identified an area where treated recycled water water from its Hastings Point STP could replace existing potable water irrigation at several nearby locations. The recycled water reuse scheme to be applied to the Bogangar Rugby League Field is part of Council's Recycled water Reuse Strategy, which was adopted in July 2006. This Strategy is based on the report prepared by MWH titled 'Tweed Shire Council Recycled Water Opportunities Concept Report' February 2006 that identifies the opportunity of reusing up to 55 ML/year of recycled water from the Hastings Point STP at the Bogangar Rugby League Field.

MWH was engaged by TSC to conduct a study to determine the sustainability of applying a portion of treated recycled water from the Hastings Point STP to the nearby Bogangar Rugby League Field. To achieve this outcome, a combination of soil descriptions, laboratory analysis and nutrient and water balance modelling was undertaken. A Recycled Water Management Plan has been developed by Hydroplan Pty. Ltd. to complement this report.

1.1 Location of the reuse site

The Bogangar Rugby League Field (Les Burger Oval) is located just off the Tweed Coast Road at Bogangar in far northern NSW, within close proximity to the township of Bogangar and the Pacific Ocean. In terms of infrastructure, a club-house is located on the western side of the field and behind that, a caretaker's residence. A council built skate-park is located to the south-east of the field. Residential development lies to the north and northwest and is screened by a natural dune system containing coastal heath vegetation. The location of the site in relation to the greater area is shown in Figure 1.

Figure 1. Site location

1.2 Bogangar reuse scheme

The feasibility of utilising treated recycled water from the Hastings Point STP was investigated by MWH (2006). A number of prospective users were identified during this investigation, including a nearby turf farm and the Bogangar Rugby League Field. Both options were considered to be feasible.

The proposed option for the Rugby League Field is to construct a pipeline from the STP to the field and pump treated recycled water to a holding tank. The water will be irrigated to the field as required. The holding tank will be sized to accommodate approximately one days worth of irrigation water, based on the maximum irrigation rate of approximately 20 mm/hour.

At this stage, recycled water irrigation is proposed only for the field and the immediately surrounding grassed areas. Vegetated dune areas to the north-west may receive treated recycled water in the future, as required.

2. Methodology

The recycled water reuse investigation was based on the '*Use of Recycled water by Irrigation*' guidelines developed by the Department of Environment and Conservation (DEC) for New South Wales (DEC, 2004). These guidelines recommend strategies for soil sampling, parameters required for analysis and methods to determine nutrient and water balances. Whilst these guidelines do not constitute a mandatory or regulatory tool, they were followed in order to meet 'due diligence' requirements with regard to the *Protection of the Environment Operations Act 1997* (NSW).

2.1 Soil descriptions

Soil investigations were conducted on the 5th and 6th February 2007 to obtain baseline data for the site, in order to determine the site's capability to absorb additional water and nutrients. A total of seven soil profiles were drilled (using a Jaret hand auger) and described to a maximum depth of 1.5 m. Five sites were located within the footprint of the Rugby League field, whilst two sites were located in the undisturbed dune areas to the north-west of the site. The soil sampling locations are shown in Figure 2.

The soil descriptions included recording characteristics such as colour, texture, structure, mottling and moisture content. pH readings were undertaken at specific intervals throughout the profile (0, 30 cm, 60 cm and 1.0 m).

Figure 2. Aerial photograph of Bogangar rugby league field with locations of soil sampling points

2.2 Laboratory analysis

Six of the seven soil profiles sites were sampled and analysed for a range of different soil parameters, as per the recommendation specified in the DEC, 2004 guidelines. Samples were taken at specific depths and analyses undertaken for the following parameters:

- Cation Exchange Capacity and soil sodicity;
- Phosphorous Sorption ;
- Electrical Conductivity ; and
- pH.

The Tweed Laboratory Centre (a NATA accredited testing laboratory) undertook the analysis of soil samples for the specified chemical parameters.

2.3 MEDLI

The soil and laboratory data was also used for input into the nutrient and water balance model MEDLI (Modelling Recycled water Disposal Using Land Irrigation). MEDLI was used to determine the long term sustainability of the site for recycled water irrigation to ensure no adverse effects on the surrounding environment.

Two scenarios were run to reflect the potentially different application amounts and rates of application of the treated recycled water. A summary of the key input data into MEDLI is listed in Table 1.

Table 1. MEDLI parameters for the two scenario runs

Model Parameter	Model Run	
	Scenario 1	Scenario 2
Irrigation trigger	30% of the drained upper limit	Daily irrigation
Irrigation application	To drained upper limit	To drained upper limit + 500 mm
Grass species	Coastal couch	Coastal couch
Nutrient concentrations (mg/L) [1]	N 4.2 P 0.85	N 4.2 P 0.85
Irrigation area (Ha)	2.2	2.2
Holding tank size (kilolitres) [2]	172	172
Maximum irrigation rates (mm/hr)	19.6	19.6

Model Parameter	Model Run Scenario 1	Scenario 2
Soil type	Sand	Sand
Saturated hydraulic conductivity (mm/hr)	120	120
Aquifer depth (m) [3]	5	5

Note 1: Nutrient concentrations based on N and P data received from Hastings Point STP. These were based on measurements after the plant was upgraded in 2004
Note 2: The holding tank is cylindrical in shape with a maximum water depth of approximately 1.8 m and a freeboard depth of 0.5 m
Note 3: Aquifer depths are estimates only. No watertable intercepted at any of the sites

3. Results

3.1 Soils

The soil profiles located on the Rugby League Field were found to be relatively undisturbed. Two sites (Sites 1 and 4) were drilled to a depth of 1.5 m, whilst Sites 2, 3 and 7 were drilled to a depth of 1.0 m. All sites were uniformly sandy to the depth of augering. The only differences between the sites were colour differences and the depths at which these layers were encountered.

The sites located on the western margin of the field (Sites 1 and 2) contained dark topsoil layers (10YR 2/1) to a depth of 0.4 m overlying bleached sands (10YR 6/1) to the depth of augering (1.5 m and 1.0 m respectively). These soils appear to be naturally formed and undisturbed. Sites 3, 4 and 7 contain dark topsoil layers to a depth of 40 cm overlying dark brown (10YR 3/2) layers to a depth of 1.0 m. At Site 4, (which was drilled to a depth of 1.5m), the bleached layer was encountered from 1.0 to 1.5 m. The presence of darker sand layers at depth and the discontinuity in soil layering may indicate that the natural soil profile has been disturbed on this eastern margin of the field.

Field pHs were moderately acid at all sites, ranging from 4.5 to 5 at the surface to between 5.0 and 5.5 in the lower layers. No watertable was intercepted at any of the sites. Representative profiles from the eastern and western margins of the field are shown in Figures 3 and 4.

Figure 3. Soil Profile 1

Figure 4. Soil Profile 4

The two sites located outside the footprint of the rugby league ground exhibited slightly different characteristics. The sites were uniformly sandy, but contained no topsoil layer. At Site 5, a watertable was intercepted at 1.2 m with evidence of mottling around this depth. The field pHs in the surface layers at these sites were also slightly lower at 4.5. Full borehole descriptions for all sites are given in Appendix 1.

3.2 Laboratory results

All sites exhibited similar characteristics in terms of the analysed soil parameters. The following trends were determined for the sites described:

- Cation Exchange Capacity (CEC) was very low for all sites. Results for the top 0 - 40 cm were slightly higher compared to the lower 60 cm for each profile. Calcium was the dominant cation at Sites 1 - 4 (maximum 2.83 meq/100g), whilst Magnesium was the dominant cation at Sites 5 and 6 (maximum 0.20 meq/100g). Exchangeable Sodium Percentages (ESPs) were very high at Sites 5 and 6, but actual Sodium Concentrations were extremely low. No dispersion is expected ;
- Electrical Conductivity (EC) readings were low for all samples analysed (range 0.01 – 0.07 ds/m) ;
- Phosphorus Sorption results were low for all sites (range < 1 to 18 mg/kg) ; and
- pHs at sites 1 - 4 in the upper 40 cm are acid to moderately acid and range from 4.9 - 5.1. The pHs in the upper 40cm at Sites 5 and 6 were extremely acid, ranging from 3.6 – 3.9.

The full laboratory results are given in Appendix 2.

3.3 Physical characteristics

The following physical characteristics were recorded or estimated:

- no evidence of dispersive soils
- high saturated hydraulic conductivity (120mm/hr)
- no evidence of bedrock

3.4 Summary

These results (excluding the low pH results at Sites 5 and 6) are typical for sandy profiles. These soils have the following attributes:

- have low fertility ;
- have low capacity for absorbing nutrients ; and
- are very well drained and have no restriction on water movement

Low pH, the inability to hold plant nutrients and high permeability may be the main limitations to the application of irrigated water at the site, The pHs at all sites are moderately acid, with Sites 5 and 6 being extremely acid. This will be the main limitation to irrigating

these soils. The soils will require the application of lime or some other neutralising agent to raise the soil pH. The high saturated hydraulic conductivity and low capacity for absorbing nutrients will mean that a large proportion of the irrigation water will be distributed to groundwater with little impediment which may result in an increase in N and P in the groundwater. This is investigated further in the following section.

3.5 Nutrient and Water Balance modelling

3.5.1 MEDLI results

Two modelling scenarios were run with a view to determining the sustainable loading of irrigation water and nutrients for the site. The differences in the scenarios relate to irrigation application and timing. The first scenario was run to reflect the most logical irrigation strategy, i.e. irrigate at 30% of the drained upper limit of the soil. The drained upper limit is the amount of water that a soil is able to hold after drainage has ceased, usually after 2-3 days. The second scenario was run to reflect conditions if irrigation occurred every day and at a nominal value of 500 mm above the drained upper limit of the soil. This was considered to be a high application rate. The key results of the scenario runs are given in Table 2. The full MEDLI Scenario runs are detailed in Appendix 3.

Table 2. MEDLI output parameters for the two Scenario runs

MEDLI Output parameters	Scenario 1	Scenario 2
Total irrigation (ML/year)	9.17	19.01
Irrigation (mm/year average)	416	847
Runoff (mm/year average)	17.5	17.5
Drainage (mm/year)	1190	1622
Soil evaporation (mm/year)	347.2	333.3
Soil transpiration (mm/year)	629.3	642.1
N added in irrigation (kg/ha/year)	15.9	29.8
N removed by crop (kg/ha/year)	41	52.2
P added in irrigation (kg/ha/year)	3.9	7.2
P removed by crop (kg/ha/year)	3.1	5.8
Dry matter yield (shoots) (kg/ha/year)	4207	4850
Avg Groundwater recharge (m^3/day)	71.7	97.7
Average Concentration of Nitrate N in groundwater (mg/L)	0.5	0.5

The most relevant results of the modeling relate to:

- Nutrient retention and the uptake of Nitrogen (N) and Phosphorus (P) by the grass ;
- Water movement ; and
- Plant growth.

These results are summarised in the following sections.

- ***Nutrients***

The grass uptake of N for both MEDLI Scenarios easily exceeds the amount applied during irrigation. Whilst current Nitrogen levels were not analysed, they are expected to be very low. In terms of the P results, the P added in irrigation will marginally exceed that being uptaken by grass for both MEDLI Scenarios. The laboratory results indicate that P sorption is comparatively low (maximum of 18 mg/kg). Nevertheless, given the small difference between the P applied in the irrigation and that being uptaken by the crop, the soil will be able to absorb the majority of P. Only a very limited amount of P will be leached to the groundwater annually (in the order of 0.2 kg/ha/year). This is a very minimal amount. Given that the model only allows for 3 harvests per annum, a more realistic situation would be that all P would be removed with regular mowing of the grass (i.e. weekly in summer).

- ***Water movement***

The modelling indicates that for both MEDLI Scenarios, excess irrigation water will result in deep drainage within the soil profile and eventually move through to the groundwater. The amounts of drainage for the two Scenarios are 1190 and 1622mm/year respectively. With this deep drainage, the amounts of run-off will be very minimal (17.5mm/year average). This means that with increased irrigation, the site can cope with the additional water supply without additional impact to the surrounding environment. Groundwater will be recharged at the amount of 98 m^3/per day for Scenario 2 compared to 72 m^3/day for Scenario 1. There may be an impediment to water movement in the deep parts of the soil profile (3 – 5 m) due to the presence of 'coffee rock' which typically underlie these sands. These coffee rock layers are typically indurated and can be poorly permeable. Over time and with excessive irrigation, water tables may rise close to the surface. Periodic monitoring of water levels in groundwater monitoring bores will determine the extent of this impact.

- ***Plant growth***

There are very few limitations to plant growth at the site. Electrical conductivity is low and will not impact upon plant yields. The soil pH may be a moderate limitation to growth but can be adjusted with lime or some other neutralising agent. The growth of the grass will be affected during the winter months due to temperature stress but this will be only for a short period.

4. Recommendations

The following strategies are recommended to ensure the long term viability of recycled water irrigation at the site:

- Install groundwater monitoring bores (at least two), up gradient and down gradient of the site. After their installation, we recommend regular sampling (at least bi-annually), one post winter and the other at some time during the summer months.

- Ensuring that grass clippings are removed after mowing. These clippings may return N and P to the soil over the long term. If these clippings are not able to be removed from the site, then we recommend a regular soil sampling and monitoring program (every 3-5 years) be put in place to ensure accumulations of N and P in the soil do not exceed guideline levels ; and
- Ensure application rates are sustainable. At 10ML/annum and 20ML/annum, the modelling indicates that
  very low amounts of nutrient will enter groundwaters [1]. Water movement may be restricted at depth in the soil profile due to the presence of coffee rock and excessive irrigation amounts may cause water tables to rise if permeability is restricted. In any case, regular monitoring of groundwater bore water levels and laboratory analysis of parameters such as nutrients, heavy metals, Ec and pH will be required to determine long term recycled water irrigation sustainability.

[1] Preliminary results from samples taken in groundwater monitoring bores (installed as part of the recommendations) indicate that current Total N and P levels in the groundwater exceed ANZECC guideline levels for marine waters.

5. References

Department of Environment and Conservation (NSW) (2004). *Environmental Guidelines: use of recycled water by irrigation.*

Appendix A. Soil profile descriptions

Site: 1

Date: 6th February 2007

Profile Morphology:

Depth (m)	Description
0.00 to 0.05	Brownish black (10YR3/1) Sand
0.05 to 0.40	Brownish black (10YR 3/1) Sand
0.40-0.60	Grey (10YR 5/1) Sand
0.6 to 1.5	Grey (10YR 6/1) Sand

Field Tests:

Depth (m)	EC (dS/m)	Dispersion	pH-A	pH-B	pH-C	pH-D	pH-C (pH using electrode probe),
0.0					5.5		
0.30					5.5		
0.60					5.5		
1.0					5.0		

Site: 2

Date: 6th February 2007

Profile Morphology:

Depth (m)	Description
0.00 to 0.40	Brownish black (10YR3/1) Sand
0.40-0.60	Grey (10YR 5/1) Sand
0.6 to 1.5	Grey (10YR 6/1) Sand

Field Tests:

Depth (m)	EC (dS/m)	Dispersion	pH-A	pH-B	pH-C	pH-D
0.0					5.0	
0.30					5.0	
0.60					5.5	
1.0				5.0		

pH-C (pH using electrode probe),

Site: 3

Date: 6th February 2007

Profile Morphology:

Depth (m)	Description
0.00 to 0.45	Brownish black (10YR3/1) Sand
0.45 – 0.70	Very dark greyish brown (10YR 3/2) Sand
0.70 – 1.0	Dark brown (7.5 YR 3/2) Sand

Field Tests:

Depth (m)	EC (dS/m)	Dispersion	pH-A	pH-B	pH-C	pH-D
0.0					5.0	
0.30					5.0	
0.60					5.0	
1.0				5.0		

pH-C (pH using electrode probe),

Site: 4

Date: 6th February 2007

Profile Morphology:

Depth (m)	Description
0.00 to 0.05	Brownish black (10YR3/1) Sand
0.05 – 0.35	Very dark grayish brown (10YR 3/1) Sand
0.35 – 0.50	Dark grey (10 YR 4/1) Sand
0.50 – 0.80	Dark brown (7.5YR 3/2) Sand
0.8 – 1.0	Brownish black (10YR 3/1) Sand
1.0-1.3	Grey (10YR 5/1) Sand
1.3-1.5	Grey (10YR 6/1) Sand

Field Tests:

Depth (m)	EC (dS/m)	Dispersion	pH-A	pH-B	pH-C	pH-D
0.0					5.0	
0.30					5.0	
0.60					5.0	
1.0				4.5		
1.5					5.0	

pH-C (pH using electrode probe),

Site: 5

Date: 7th February 2007

Profile Morphology:

Depth (m)	Description
0.00 to 0.05	Grey (10YR6/1) Sand
0.05 – 0.90	Light grey (10YR 7/1) Sand
0.90 – 1.1	Grey (10YR 6/1) Sand
1.1 – 1.2	Grey (10YR 5/1) Sand. Few (2-10%), Fine (< 5mm) faint orange mottles, Very few (< 2%), fine (< 5mm) distinct dark mottles

Field Tests:

Depth (m)	EC (dS/m)	Dispersion	pH-A	pH-B	pH-C	pH-D
0.0					4.5	
0.30					5.0	
0.60					5.0	
1.0				5.0		
1.5					5.0	

pH-C (pH using electrode probe),

Site: 6

Date: 7th February 2007

Profile Morphology:

Depth (m)	Description
0.00 to 0.10	Grey (10YR6/1) Sand
0.10 – 0.40	Grey (7.5 YR 6/1) Sand
0.4 – 1.0	Light grey (10YR 7/1) Sand

Field Tests:

Depth (m)	EC (dS/m)	Dispersion	pH-A	pH-B	pH-C	pH-D
0.0					4.5	
0.30					5.0	
0.60					5.0	
1.0				5.0		

pH-C (pH using electrode probe),

Site: 7

Date: 7th February 2007

Profile Morphology:

Depth (m) **Description**

As per Site 4

Field Tests:

Depth (m) **EC (dS/m)** **Dispersion** **pH-A** **pH-B** **pH-C** **pH-D** pH-C (pH using electrode probe),

As per Site 4

Appendix B. Soil analysis results

TWEED LABORATORY CENTRE
A COMMERCIAL UNIT OF THE TWEED SHIRE COUNCIL ABN 90 178 732 496

46 Enterprise Avenue,
Tweed Heads South NSW 2486.
Phone (07) 5569 3100
Fax (07) 5524 2676

All correspondence:
Tweed Shire Council
PO Box 816
Murwillumbah NSW 2484

LABORATORY REPORT

Page 1 of 4
Lab No: 1773-sw

Client: MWH Australia Pty Ltd
Address: Level 2
10 Finchley Street
MILTON
Q'LD 4060

Attention: Justin Adams
Fax No: 07 3510 7350
Email: Justin.adams@mwhglobal.com
Copy To: Peter Haywood and Andrew Grant (Tweed Shire Council)

Sample Description: Hastings Point Effluent Re-use Study.

Taken By: Client
Date Taken: As Indicated
Date Received: 06/02/2007
Date Testing Commenced: 06/02/2007
Date Testing Completed: 01/03/2007

		Results – BOG 1 (taken 05/02/2007)				
Test	**Method**	**0-40cm**	**40-100cm**	**0-70cm**	**70-100cm**	**0-100cm**
Exchangeable Sodium %	--	1.04	3.85	--	--	--
pH ($CaCl_2$)	S1	5.3	--	--	--	--
Conductivity dS/m^{-1}	S3	--	--	--	0.04	0.01
Cation Exchange Capacity meq/100g	M9	2.89	0.26	--	--	--
Phosphorus Sorption mg kg^{-1}/log_{10} $\mu g/L^{-1}$	--	--	--	--	--	<1
Calcium meq/100g	M8	2.38	0.21	--	--	--
Magnesium meq/100g	M8	0.46	0.04	--	--	--
Sodium meq/100g	M8	0.03	0.01	--	--	--
Potassium meq/100g	M8	0.02	<0.01	--	--	--
Aluminium meq/100g	M8	<0.01	<0.01	--	--	--

NATA ACCREDITED FOR TECHNICAL COMPETENCE

This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025.
Accreditation No: 12754

Edward Dickson
(Laboratory Coordinator)

Date of Report: 01 March 2007

WATER AND WASTEWATER ANALYSIS · SOIL TESTING · EPA COMPLIANCE MONITORING

LABORATORY REPORT

MWH Australia Pty Ltd – Hastings Point Effluent Re-use Study Page 2 of 4

Test	Method	Results – BOG 2 (taken 05/02/2007)				
		0-40cm	40-100cm	0-70cm	70-100cm	0-100cm
Exchangeable Sodium %	--	0.96	4.35	--	--	--
pH ($CaCl_2$)	S1	4.9	--	--	--	--
Conductivity dS/m^{-1}	S3	--	--	0.02	0.01	--
Cation Exchange Capacity meq/100g	M9	3.13	0.23	--	--	--
Phosphorus Sorption mg kg^{-1}/log_{10} $\mu g/L^{-1}$	--	--	--	--	--	4
Calcium meq/100g	M8	2.51	0.18	--	--	--
Magnesium meq/100g	M8	0.50	0.04	--	--	--
Sodium meq/100g	M8	0.03	0.01	--	--	--
Potassium meq/100g	M8	0.09	<0.01	--	--	--
Aluminium meq/100g	M8	<0.01	<0.01	--	--	--

Test	Method	Results – BOG 3 (taken 05/02/2007)				
		0-40cm	40-100cm	0-70cm	70-100cm	0-100cm
Exchangeable Sodium %	--	1.11	4.41	--	--	--
pH ($CaCl_2$)	S1	5.1	--	--	--	--
Conductivity dS/m^{-1}	S3	--	--	0.07	0.02	--
Cation Exchange Capacity meq/100g	M9	3.59	0.68	--	--	--
Phosphorus Sorption mg kg^{-1}/log_{10} $\mu g/L^{-1}$	--	--	--	--	--	18
Calcium meq/100g	M8	2.83	0.45	--	--	--
Magnesium meq/100g	M8	0.66	0.15	--	--	--
Sodium meq/100g	M8	0.04	0.03	--	--	--
Potassium meq/100g	M8	0.05	0.01	--	--	--
Aluminium meq/100g	M8	0.01	0.04	--	--	--

NATA TECHNICAL COMPETENCE

This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025.
Accreditation No: 12754

Edward Dickson
(Laboratory Coordinator)

Date of Report: 01 March 2007

WATER AND WASTEWATER ANALYSIS · SOIL TESTING · EPA COMPLIANCE MONITORING

LABORATORY REPORT

MWH Australia Pty Ltd – Hastings Point Effluent Re-use Study Page 3 of 4

		Results – BOG 4 (taken 05/02/2007)				
Test	**Method**	0-40cm	40-100cm	0-70cm	70-100cm	0-100cm
Exchangeable Sodium %	--	2.59	2.44	--	--	--
pH ($CaCl_2$)	S1	5.0	--	--	--	--
Conductivity dS/m^{-1}	S3	--	--	0.03	0.01	--
Cation Exchange Capacity meq/100g	M9	1.16	0.82	--	--	--
Phosphorus Sorption mg kg^{-1}/log_{10} $\mu g/L^{-1}$	--	--	--	--	--	11
Calcium meq/100g	M8	0.89	0.59	--	--	--
Magnesium meq/100g	M8	0.23	0.14	--	--	--
Sodium meq/100g	M8	0.03	0.02	--	--	--
Potassium meq/100g	M8	0.01	0.01	--	--	--
Aluminium meq/100g	M8	<0.01	0.06	--	--	--

		Results – BOG 5 (taken 06/02/2007)				
Test	**Method**	0-40cm	40-100cm	0-70cm	70-100cm	0-100cm
Exchangeable Sodium %	--	14.29	11.11	--	--	--
pH ($CaCl_2$)	S1	3.9	--	--	--	--
Conductivity dS/m^{-1}	S3	--	--	0.01	0.01	--
Cation Exchange Capacity meq/100g	M9	0.14	0.09	--	--	--
Phosphorus Sorption mg kg^{-1}/log_{10} $\mu g/L^{-1}$	--	--	--	--	--	5
Calcium meq/100g	M8	0.03	0.02	--	--	--
Magnesium meq/100g	M8	0.04	0.02	--	--	--
Sodium meq/100g	M8	0.02	0.01	--	--	--
Potassium meq/100g	M8	<0.01	<0.01	--	--	--
Aluminium meq/100g	M8	0.05	0.04	--	--	--

NATA TECHNICAL COMPETENCE

This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025.
Accreditation No: 12754

Edward Dickson
(Laboratory Coordinator) **Date of Report: 01 March 2007**

WATER AND WASTEWATER ANALYSIS · SOIL TESTING · EPA COMPLIANCE MONITORING

LABORATORY REPORT

MWH Australia Pty Ltd – Hastings Point Effluent Re-use Study **Page 4 of 4**

		Results – BOG 6 (taken 06/02/2007)				
Test	**Method**	**0-40cm**	**40-100cm**	**0-70cm**	**70-100cm**	**0-100cm**
Exchangeable Sodium %	--	15.79	33.33	--	--	--
pH ($CaCl_2$)	S1	3.6	--	--	--	--
Conductivity dS/m^{-1}	S3	--	--	0.02	0.01	--
Cation Exchange Capacity meq/100g	M9	0.38	0.06	--	--	--
Phosphorus Sorption mg kg^{-1}/log_{10} $\mu g/L^{-1}$	--	--	--	--	--	<1
Calcium meq/100g	M8	0.11	0.02	--	--	--
Magnesium meq/100g	M8	0.20	0.02	--	--	--
Sodium meq/100g	M8	0.06	0.02	--	--	--
Potassium meq/100g	M8	0.01	<0.01	--	--	--
Aluminium meq/100g	M8	<0.01	<0.01	--	--	--

Results refer to samples as received at the Laboratory.
All pages of this Report have been checked and approved.
This document may not be reproduced except in full.

This Report replaces the Interim Report faxed 23/02/2007.

NATA ACCREDITED FOR TECHNICAL COMPETENCE

This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025.
Accreditation No: 12754

Edward Dickson
(Laboratory Coordinator) **Date of Report: 01 March 2007**

WATER AND WASTEWATER ANALYSIS • SOIL TESTING • EPA COMPLIANCE MONITORING

Appendix C. MEDLI results

****
SUMMARY OUTPUT
MEDLI Version 1.30

Data Set: Hastings Point - SCENARIO 1
Run Date: 28/03/07 Time:05:02:35.95
****

GENERAL INFORMATION
****
Title: Hastings Points Reuse Study
Subject: Recycled water Irrigation
Client: Tweed Shire Council
User: J Adams
Time: Wed Mar 28 04:58:52 2007
Comments: [no entry]

RUN PERIOD
****

Starting Date 1/ 1/1957
Ending Date 31/12/2007
Run Length 51 years 0 days

CLIMATE INFORMATION
****

Enterprise site: Hastings -28.3 deg S 153.6 deg E
Weather station: Day MonthYear rad

ANNUAL TOTALS	10 Percentile	50 percentile	90 Percentile
Rainfall mm/year	1339.	1690.	2453.
Pan Evap mm/year	1366.	1448.	1584.

MONTHLY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall (mm)	194	211	249	176	162	128	95	79	51	114	144	165	1767
Pan Evap (mm)	169	132	125	96	75	66	74	96	123	146	155	172	1428
Ave Max Temp DegC	28	28	27	25	22	20	20	21	23	24	26	27	24
Ave Min Temp DegC	20	20	19	16	13	11	9	10	12	15	17	19	15
Rad (MJ/m2/day)	23	21	18	16	13	12	13	16	19	21	22	23	17

MONTHLY IRRIGATION
****

Irrigation (mm)	43	30	31	29	26	25	20	28	48	49	43	46	416

SOIL PROPERTIES
****

Soil type: Sand_Hastings point

SOIL WATER PROPERTIES

		Layer 1	Layer 2
Bulk Density	(g/cm3)	1.3	1.5
Porosity	(mm/layer)	50.6	597.0
Saturated Water Content	(mm/layer)	50.1	592.2
Drained Upper Limit	(mm/layer)	10.9	190.4
Lower Storage Limit	(mm/layer)	4.0	89.6
Air Dry Moisture Content	(mm/layer)	4.0	
Layer Thickness	(mm)	100.0	1400.0

		Profile	Max Rootzone
Total Saturated Water Content	(mm)	642.3	346.2
Total Drained Upper Limit	(mm)	201.3	106.1
Total Lower Storage Limit	(mm)	93.6	48.8
Total Air Dry Moisture Content	(mm)	5.4	4.7
Total Depth	(mm)	1500.0	800.0

Maximum Plant Available Water Capacity 57.3
Saturated Hydraulic Conductivity
At Surface (mm/hr) 120.0
Limiting (mm/hr) 120.0

RUNOFF

Runoff curve No II 70.0

SOIL EVAPORATION

CONA	(mm/day^0.5)	4.5
URITCH	(mm)	10.0

AVERAGE WASTE STREAM
****

Sewage treatment plant waste stream

(All values relate to influent after any screening and recycling, if applicable).

Inflow Volume (ML/year) 19.01
Nitrogen (tonne/year) 0.08
Phosphorus (tonne/year) 0.02
Salinity (tonne/year) 6.16

Nitrogen Concentration (mg/L) 4.22
Phosphorus Concentration (mg/L) 0.84
Salinity (mg/L) 323.96
Salinity (dS/m) 0.51

WASTE STREAM DETAILS (for last inflow event):
Nitrogen Concentration (mg/L) 5.00
Phosphorus Concentration (mg/L) 1.00
TDS Concentration (mg/L) 384.00
Salinity (dS/m) 0.60

IRRIGATION WATER
****

Irrigation triggered when plant available water falls to (%PAWC) 3000.0
Irrigating up to upper storage limit + 0 mm

AREA

Total Irrigation Area (ha) 2.20

VOLUMES

Total Irrigation (ML/year) 9.17
Minimum Volume Irrigated by Pump (ML/day) 0.00
Maximum Volume Irrigated by Pump (ML/day) 0.07
Maximum Vol. Available For Shandying (ML/yr) 0.00

IRRIGATION CONCENTRATIONS

Average salinity of Irrigation (dS/m) 0.56
Average salinity of Irrigation (mg/L) 355.46
Average Nitrogen Conc of Irrigation
Before ammonia loss (mg/L) 4.53
After ammonia loss (mg/L) 3.81
Average Phosphorus Conc of Irrigation (mg/L) 0.93

FRESH WATER USAGE
****

Irrigation (shandying) water (ML/yr) 0.00

Avg volume of fresh water used (ML/yr) 0.00

Annual allocation (ML/yr) N/A

POND INFORMATION
****

POND GEOMETRY

	Pond 1	
Final pond volume	(ML)	0.17
Final liquid volume	(ML)	0.17
Final sludge volume	(ML)	0.00
Average pond volume	(ML)	0.12
Average active volume	(ML)	0.12
Maximum pond volume	(ML)	0.17
Minimum allowable pond volume	(ML)	0.01
Average pond depth	(m)	1.92
Pond depth at outlet	(m)	2.30
Maximum water surface area	(m2 x1000)	0.07
Pond catchment area	(m2 x1000)	0.11
Pond footprint length	(m)	10.65
Pond footprint width	(m)	10.65

POND WATER BALANCE

Inflow of Recycled water to pond system	(ML/yr)	19.01
Recycle Volume from pond system	(ML/yr)	0.00
Rain water added to pond system	(ML/yr)	0.00
Evaporation loss from pond system	(ML/yr)	0.00
Seepage loss from pond system	(ML/yr)	0.00
Irrigation from last pond	(ML/yr)	9.17
Volume of overtopping	(ML/yr)	9.83
Sludge accumulated	(ML/yr)	0.00
Sludge accumulated	(t DM/yr)	0.00
Sludge removed	(ML/yr)	0.00
No of desludging events every 10 years		0.00
Increase in pond water volume	(ML/yr)	0.00

OVERTOPPING EVENTS

Volume of overtopping (ML/yr) 9.83
No. of days pond overtops per 10 years 2050.28
Average Length of overtopping events (days) 8.01
% Reuse 48.26
No. of overtopping events every 10 years
> 0.000 ML 256.09
> 0.000 ML* 255.89
> 1.000 ML 21.77
> 2.000 ML 7.65
> 5.000 ML 1.18
> 10.000 ML 0.00
> 20.000 ML 0.00
> 50.000 ML 0.00
* Volume equivalent to 1 mm depth of water

>>> NO-IRRIGATION EVENTS <<<

%Days rain prevents irrigation 39.59
%Days water demand too small to trigger irr. 12.60
No. periods/year without irrigable recycled water 0.00
Average Length of such periods (days) 0.00

POND NITROGEN BALANCE

Nitrogen Added by Recycled water (tonne/yr) 0.08 Irrig. from pond (ML/yr) 9.2
Nitrogen removed by Irrigation (tonne/yr) 0.04
Nitrogen removed by Volatilisation(tonne/yr) 0.00
Nitrogen removed by Seepage (tonne/yr) 0.00
Nitrogen accumulated in Sludge (tonne/yr) 0.00
Nitrogen lost by Overtopping (tonne/yr) 0.04
Nitrogen involved in Recycling (tonne/yr) 0.00
Increase in pond Nitrogen (tonne/yr) 0.00

POND PHOSPHORUS BALANCE

Phosphorus Added by Recycled water (tonne/yr) 0.02 Irrig. from pond (ML/yr) 9.2
Phosphorus removed by Irrigation (tonne/yr) 0.01
Phosphorus removed by Seepage (tonne/yr) 0.00
Phosphorus accumulated in Sludge (tonne/yr) 0.00
Phosphorus lost by Overtopping (tonne/yr) 0.01
Phosphorus involved in Recycling (tonne/yr) 0.00
Increase in pond Phosphorus (tonne/yr) 0.00

POND SALINITY BALANCE

Salinity Added by Recycled water (tonne/yr) 6.16
Salinity removed by Irrigation (tonne/yr) 3.26

Salinity removed by Seepage (tonne/yr) 0.00
Salinity lost by Overtopping (tonne/yr) 2.90
Salinity involved in Recycling (tonne/yr) 0.00
Increase in pond Salinity (tonne/yr) 0.00

POND CONCENTRATIONS

Pond 1

Average Nitrogen Conc of Pond Liquid (mg/L) 4.1
Average Phosphorus Conc of Pond Liquid(mg/L) 0.8
Average TDS Conc of Pond Liquid (mg/L) 323.5
Average Salinity of Pond Liquid (dS/m) 0.5
Average Potassium Conc of Pond Liquid (mg/L) 12.6

(On final day of simulation)
Nitrogen Conc of Pond Liquid (mg/L) 4.9
Phosphorus Conc of Pond Liquid (mg/L) 1.0
TDS Conc of Pond Liquid (mg/L) 384.0
EC of Pond Liquid (dS/m) 0.6
Potassium Conc of Pond Liquid (mg/L) 15.0

REMOVED SLUDGE - NUTRIENT & SALT CONCENTRATIONS

Nitrogen in removed Sludge (db) (kg/tonne) 0.00
Phosphorus in removed Sludge (db) (kg/tonne) 0.00
Salt in removed Sludge (db) (kg/tonne) 0.00
Potassium in removed Sludge (db) (kg/tonne) 0.00

REMOVED SLUDGE - NUTRIENT & SALT MASSES

Nitrogen in removed Sludge (tonne/yr) 0.00
Phosphorus in removed Sludge (tonne/yr) 0.00
Salt in removed Sludge (mass bal.)(tonne/yr) 0.00
Salt in removed Sludge (tonne/yr) 0.00
Potm. in removed Sludge (mass bal.)(tonne/yr 0.00
Potassium in removed Sludge (tonne/yr) 0.00

LAND DISPOSAL AREA
****

WATER BALANCE

(Initial soil water assumed to be at field capacity)
(Irrigated up to 3.39% of field capacity)
Rainfall (mm/year) 1767.5 Irrigation Area (ha) 2.2

Irrigation	(mm/year)	416.8
Soil Evaporation	(mm/year)	347.2
Transpiration	(mm/year)	629.3
Runoff	(mm/year)	17.5
Drainage	(mm/year)	1190.2
Change in soil moisture	(mm/year)	0.0

ANNUAL TOTALS

Year	Rain (mm)	Irrig (mm)	Sevap (mm)	Trans (mm)	Runoff (mm)	Drain (mm)	Change (mm)
1957	1401.0	526.6	768.3	223.8	7.5	956.4	-28.4
1958	1725.0	433.3	500.2	542.8	20.1	1070.0	25.2
1959	1966.0	323.3	463.1	537.5	6.9	1288.3	-6.6
1960	1103.0	477.6	489.9	448.1	0.6	654.5	-12.6
1961	1837.0	355.6	528.6	449.7	1.5	1213.9	-0.9
1962	2202.0	379.4	420.1	559.2	5.2	1568.3	28.6
1963	2228.0	349.3	483.6	466.4	14.7	1625.2	-12.6
1964	1468.0	452.0	48.4	940.9	0.0	925.2	5.5
1965	1430.0	390.2	352.4	513.8	4.8	963.1	-14.0
1966	1410.0	429.2	382.3	494.1	10.9	933.2	18.6
1967	2394.0	333.4	397.4	465.5	0.9	1894.1	-30.3
1968	1239.0	422.3	344.1	453.3	0.4	865.8	-2.3
1969	1778.0	451.4	549.3	509.8	9.3	1144.7	16.3
1970	1767.0	488.0	544.8	592.9	41.2	1063.1	13.1
1971	1527.0	338.9	370.7	478.9	0.0	1026.3	-10.0
1972	2929.0	332.3	454.5	494.1	149.2	2188.9	-25.5
1973	2188.0	449.3	60.3	1036.6	26.7	1483.1	30.6
1974	3027.0	334.3	394.0	471.5	146.2	2349.6	0.0
1975	1971.0	423.0	103.3	943.6	7.1	1337.6	2.4
1976	2268.0	390.3	0.0	1025.1	52.8	1584.1	-3.6
1977	1497.0	548.6	507.3	573.1	5.3	998.9	-39.0
1978	2072.0	404.9	460.3	636.0	11.2	1315.0	54.4
1979	1544.0	434.1	479.6	497.7	0.0	1057.6	-56.8
1980	1744.0	483.6	439.2	633.0	1.5	1066.8	87.1
1981	1522.0	481.4	495.2	590.1	0.0	951.3	-33.2
1982	1491.0	375.3	442.6	492.5	12.9	940.0	-21.6
1983	2512.0	364.3	516.0	516.3	24.8	1781.3	37.8
1984	2044.0	453.8	515.7	463.2	127.3	1411.3	-19.6
1985	1655.0	356.1	499.4	464.3	11.3	1062.4	-26.3
1986	968.0	459.3	427.3	513.6	0.0	475.5	11.0
1987	2166.0	402.7	428.4	501.8	42.7	1558.9	36.8
1988	2555.0	384.6	58.0	903.1	2.0	2003.2	-26.8
1989	2051.0	283.2	334.9	449.5	7.5	1555.1	-12.8
1990	2032.0	317.9	421.2	427.1	6.9	1489.5	5.2
1991	1479.0	387.1	385.9	489.2	8.6	969.8	12.7

1992	1405.0	389.8	487.8	429.7	3.6	892.3	-18.6
1993	1332.0	479.6	572.0	536.2	4.4	727.9	-28.9
1994	1590.0	403.4	419.5	540.3	0.8	1017.7	15.0
1995	1485.0	515.8	517.1	597.9	0.0	866.8	19.1
1996	2007.0	466.0	64.6	1032.3	2.3	1375.0	-1.1
1997	1345.0	458.1	0.0	1015.9	0.0	779.6	7.6
1998	1506.0	476.6	0.0	1034.9	0.0	952.1	-4.4
1999	3113.0	375.5	499.6	522.9	30.8	2436.8	-1.5
2000	1358.0	487.5	103.6	986.9	0.0	744.5	10.5
2001	1468.0	523.8	0.0	1089.9	30.6	895.1	-23.7
2002	1226.0	525.5	413.1	662.4	0.2	661.7	14.1
2003	1873.0	421.1	447.9	539.0	5.3	1320.2	-18.2
2004	1478.0	515.3	116.1	1038.7	2.8	823.3	12.4
2005	1641.0	439.9	0.0	1051.4	41.6	1006.1	-18.2
2006	1939.0	494.8	0.0	1020.3	3.1	1389.1	21.4
2007	184.0	67.2	0.0	197.0	0.0	42.0	12.2

NUTRIENT BALANCE

NITROGEN

Total N irrigated from ponds (kg/ha/year) 18.9 % of Total as ammonium 80.0
Nitrogn lost by ammonia volat.(kg/ha/year) 3.0 Deep Drainage (mm/year) 1190.2
Nitrogen added in irrigation (kg/ha/year) 15.9
Nitrogen added in seed (kg/ha/year) 0.5
Nitrogen removed by crop (kg/ha/year) 41.0
Denitrification (kg/ha/year) 0.1
Leached NO3-N (kg/ha/year) 5.5
Change in soil organic-N (kg/ha/year) -27.1
Change in soil solution NH4-N (kg/ha/year) 0.0
Change in soil solution NO3-N (kg/ha/year) -3.1
Change in adsorbed NH4-N (kg/ha/year) 0.0
Initial soil organic-N (kg/ha) 1522.5
Final soil organic-N (kg/ha) 139.7
Initial soil inorganic-N (kg/ha) 158.1
Final soil inorganic-N (kg/ha) 0.1
Average N03-N conc in the root zone (mg/L) 0.5
Average N03-N conc below root zone (mg/L) 0.7
Average N03-N conc of deep drainage (mg/L) 0.5

PHOSPHORUS

Phosphorus added in irrigatn (kg/ha/year) 3.9 % of Total as phosphate 100.0
Phosphorus added in seed (kg/ha/year) 0.1

Phosphorus removed by crop (kg/ha/year) 3.1
Leached PO4-P (kg/ha/year) 0.1
Change in dissolved PO4-P (kg/ha/year) 0.0
Change in adsorbed PO4-P (kg/ha/year) 0.7
Average P04-P conc in the root zone (mg/L) 0.0
Average P04-P conc below root zone (mg/L) 0.0

SOIL P STORAGE LIFE

Year	YearNo.	Tot P stored kg/ha	P leached in year kg/ha
1957	1	372.6	0.1
1958	2	376.9	0.1
1959	3	379.8	0.1
1960	4	383.7	0.1
1961	5	385.9	0.1
1962	6	387.9	0.1
1963	7	389.7	0.1
1964	8	392.7	0.1
1965	9	393.2	0.1
1966	10	395.1	0.1
1967	11	396.1	0.2
1968	12	398.6	0.1
1969	13	399.5	0.1
1970	14	400.9	0.1
1971	15	401.3	0.1
1972	16	402.5	0.2
1973	17	401.5	0.1
1974	18	400.8	0.2
1975	19	401.5	0.1
1976	20	401.5	0.1
1977	21	401.1	0.1
1978	22	402.8	0.1
1979	23	402.9	0.1
1980	24	405.0	0.1
1981	25	404.9	0.1
1982	26	405.1	0.1
1983	27	405.5	0.2
1984	28	406.4	0.1
1985	29	405.8	0.1
1986	30	406.4	0.0
1987	31	406.3	0.1
1988	32	406.8	0.2
1989	33	403.8	0.1
1990	34	403.6	0.1
1991	35	404.3	0.1

1992	36	405.5	0.1
1993	37	405.6	0.1
1994	38	406.1	0.1
1995	39	406.6	0.1
1996	40	407.4	0.1
1997	41	405.1	0.1
1998	42	404.5	0.1
1999	43	404.1	0.2
2000	44	405.9	0.1
2001	45	404.6	0.1
2002	46	405.5	0.1
2003	47	406.5	0.1
2004	48	407.8	0.1
2005	49	405.6	0.1
2006	50	404.8	0.1
2007	51	404.9	0.0

PLANT

Plant species: Coastal couch grass (Cynodon dac

PLANT WATER USE

Irrigation (mm/year) 417. Totl Irrigation Area(ha) 2.2
Pan coefficient (%) 1.0
Maximum crop coefficient (%) 0.8
Average Plant Cover (%) 57.
Average Plant Total Cover (%) 73.
Average Plant Rootdepth (mm) 532.
Average Plant Available Water Capacity (mm) 108.
Average Plant Available Water (mm) 104.
Yield produced per unit transp. (kg/ha/mm) 7.

PLANT NUTRIENT UPTAKE

Dry Matter Yield (Shoots) (kg/ha/yr) 4207.
Net nitrogen removed by plant (kg/ha/yr) 41. Shoot Concn (%DM) 0.96
Net phosphorus removed by plant (kg/ha/yr) 3. Shoot Concn (%DM) 0.07

AVERAGE MONTHLY GROWTH STRESS (0=no stress, 1=full stress)

Month	Yield kg/ha	Nitr	Temp	Water Defic	Water Logging
1	777.	0.5	0.0	0.0	0.0
2	601.	0.6	0.0	0.0	0.0
3	555.	0.6	0.0	0.0	0.0
4	461.	0.7	0.1	0.0	0.0
5	317.	0.6	0.5	0.0	0.0
6	145.	0.6	0.8	0.0	0.0
7	65.	0.3	0.9	0.0	0.0
8	68.	0.2	0.8	0.0	0.0
9	137.	0.2	0.5	0.1	0.0
10	199.	0.2	0.3	0.1	0.0
11	297.	0.2	0.1	0.1	0.0
12	585.	0.3	0.0	0.1	0.0

>>> NO-PLANT EVENTS <<<

%Days due to temperature stress	6.5
%Days due to water stress	0.9
%Days due to nitrogen stress	0.2
No. of forced harvests per year	0.8
No. of normal harvests per year	1.9

SALINITY

Salt tolerance - plant species: tolerant

Average EC of Irrigation Water (dS/m) 0.6 Irrigation (mm/year) 416.8
Average EC of Rainwater (dS/m x10) 0.3 Rainfall (mm/year) 1767.5
Average EC of Infiltrated water (dS/m) 0.1
Av. water-upt-weightd rootzone EC(dS/m s.e.) 0.1
EC soil soln (FC) at base of rootzone (dS/m) 0.2 Deep Drainage (mm/year) 1190.2
Reduction in Crop yield due to Salinity (%) 0.0
Percentage of yrs that crop yld falls below
90% of potential because of soil salinity 0.0

Period	ECrootzone sat ext (dS/m)	ECbase in situ (dS/m)	Rel Yield (%)
1957 - 1961	0.11	0.27	100.
1958 - 1962	0.09	0.23	100.
1959 - 1963	0.08	0.21	100.

1960 - 1964	0.09	0.23	100.
1961 - 1965	0.08	0.21	100.
1962 - 1966	0.09	0.23	100.
1963 - 1967	0.08	0.21	100.
1964 - 1968	0.10	0.25	100.
1965 - 1969	0.09	0.24	100.
1966 - 1970	0.10	0.24	100.
1967 - 1971	0.09	0.23	100.
1968 - 1972	0.09	0.22	100.
1969 - 1973	0.08	0.21	100.
1970 - 1974	0.07	0.17	100.
1971 - 1975	0.07	0.16	100.
1972 - 1976	0.06	0.16	100.
1973 - 1977	0.08	0.19	100.
1974 - 1978	0.08	0.20	100.
1975 - 1979	0.09	0.24	100.
1976 - 1980	0.10	0.25	100.
1977 - 1981	0.11	0.29	100.
1978 - 1982	0.10	0.27	100.
1979 - 1983	0.10	0.25	100.
1980 - 1984	0.09	0.24	100.
1981 - 1985	0.09	0.23	100.
1982 - 1986	0.09	0.24	100.
1983 - 1987	0.09	0.22	100.
1984 - 1988	0.09	0.22	100.
1985 - 1989	0.08	0.20	100.
1986 - 1990	0.07	0.18	100.
1987 - 1991	0.07	0.17	100.
1988 - 1992	0.07	0.18	100.
1989 - 1993	0.09	0.23	100.
1990 - 1994	0.10	0.26	100.
1991 - 1995	0.12	0.32	100.
1992 - 1996	0.11	0.31	100.
1993 - 1997	0.12	0.32	100.
1994 - 1998	0.11	0.31	100.
1995 - 1999	0.09	0.24	100.
1996 - 2000	0.09	0.24	100.
1997 - 2001	0.10	0.27	100.
1998 - 2002	0.10	0.28	100.
1999 - 2003	0.10	0.26	100.
2000 - 2004	0.13	0.36	100.
2001 - 2005	0.12	0.34	100.
2002 - 2006	0.11	0.30	100.
2003 - 2007	0.10	0.28	100.

GROUNDWATER

****

Average Groundwater Recharge (m3/day) 71.7
Average Nitrate-N Conc of Recharge (mg/L) 0.5

Thickness of the Aquifer (m) 5.0
Distance (m) from Irrigation Area to where
Nitrate-N Conc in Groundwater is Calculated 200.0

Concentration of NITRATE-N in Groundwater (mg/L)

Year	Depth Below Water Table Surface		
	0.0 m	3.0 m	4.0 m
1961	0.4	0.4	0.4
1966	0.4	0.4	0.4
1971	0.5	0.5	0.5
1976	0.5	0.5	0.5
1981	0.5	0.5	0.5
1986	0.5	0.5	0.5
1991	0.5	0.5	0.5
1996	0.5	0.5	0.5
2001	0.5	0.5	0.5
2006	0.5	0.5	0.5
Last 2007	0.5	0.5	0.5

ACKNOWLEDGMENTS
****
This run brought to you courtesy of:

MEDLIEXE.EXE : 1300468 bytes Fri Mar 12 10:26:56 1999

CRCPROJ.EXE : 1286656 bytes Wed Apr 28 15:18:26 1999

GRAPHS.EXE : 439296 bytes Fri Dec 11 12:28:08 1998

STP INPUT PARAMETERS - DATA SUMMARY

Equivalent persons 195
Dry weather Production (ML/day) 0.0439
Recycled water per person (L/day) 224.9
Recycled water per person (L/yr) 82088.5
Recycled water volume per 1000 EPs per year (ML) 82.1

Infiltration average

UNCONDITIONAL FINISH

****
SUMMARY OUTPUT
MEDLI Version 1.30

Data Set: Hastings Point - SCENARIO 2
Run Date: 28/03/07 Time:05:10:07.82
****

GENERAL INFORMATION
****
Title: Hastings Points Reuse Study
Subject: Recycled water Irrigation
Client: Tweed Shire Council
User: J Adams
Time: Wed Mar 28 05:07:12 2007
Comments: [no entry]

RUN PERIOD
****

Starting Date 1/ 1/1957
Ending Date 31/12/2007
Run Length 51 years 0 days

CLIMATE INFORMATION
****

Enterprise site: Hastings -28.3 deg S 153.6 deg E
Weather station: Day Month Year rad

ANNUAL TOTALS 10 Percentile 50 percentile 90 Percentile

Rainfall mm/year 1339. 1690. 2453.
Pan Evap mm/year 1366. 1448. 1584.

MONTHLY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall (mm)	194	211	249	176	162	128	95	79	51	114	144	165	1767
Pan Evap (mm)	169	132	125	96	75	66	74	96	123	146	155	172	1428
Ave Max Temp DegC	28	28	27	25	22	20	20	21	23	24	26	27	24
Ave Min Temp DegC	20	20	19	16	13	11	9	10	12	15	17	19	15
Rad (MJ/m2/day)	23	21	18	16	13	12	13	16	19	21	22	23	17

MONTHLY IRRIGATION
****

Irrigation (mm)	75	70	77	71	73	68	68	68	64	69	70	73	847

SOIL PROPERTIES
****

Soil type: Sand_Hastings point

SOIL WATER PROPERTIES

		Layer 1	Layer 2
Bulk Density	(g/cm3)	1.3	1.5
Porosity	(mm/layer)	50.6	597.0
Saturated Water Content	(mm/layer)	50.1	592.2
Drained Upper Limit	(mm/layer)	10.9	190.4
Lower Storage Limit	(mm/layer)	4.0	89.6
Air Dry Moisture Content	(mm/layer)	4.0	
Layer Thickness	(mm)	100.0	1400.0

		Profile	Max Rootzone
Total Saturated Water Content	(mm)	642.3	346.2
Total Drained Upper Limit	(mm)	201.3	106.1
Total Lower Storage Limit	(mm)	93.6	48.8
Total Air Dry Moisture Content	(mm)	5.4	4.7
Total Depth	(mm)	1500.0	800.0

Maximum Plant Available Water Capacity 57.3
Saturated Hydraulic Conductivity
At Surface (mm/hr) 120.0
Limiting (mm/hr) 120.0

RUNOFF

Runoff curve No II 70.0

SOIL EVAPORATION

CONA (mm/day^0.5) 4.5
URITCH (mm) 10.0

AVERAGE WASTE STREAM
****

Sewage treatment plant waste stream
(All values relate to influent after any screening and recycling, if applicable).

Inflow Volume (ML/year) 19.01
Nitrogen (tonne/year) 0.08
Phosphorus (tonne/year) 0.02
Salinity (tonne/year) 6.16

Nitrogen Concentration (mg/L) 4.22
Phosphorus Concentration (mg/L) 0.84
Salinity (mg/L) 323.96
Salinity (dS/m) 0.51

WASTE STREAM DETAILS (for last inflow event):
Nitrogen Concentration (mg/L) 5.00
Phosphorus Concentration (mg/L) 1.00
TDS Concentration (mg/L) 384.00
Salinity (dS/m) 0.60

IRRIGATION WATER
****

Irrigation triggered every 1 days
Irrigating up to upper storage limit + 500 mm

AREA

Total Irrigation Area (ha) 2.20

VOLUMES

Total Irrigation (ML/year) 18.65

Minimum Volume Irrigated by Pump (ML/day) 0.00
Maximum Volume Irrigated by Pump (ML/day) 0.07
Maximum Vol. Available For Shandying (ML/yr) 0.00

IRRIGATION CONCENTRATIONS

Average salinity of Irrigation (dS/m) 0.51
Average salinity of Irrigation (mg/L) 327.90
Average Nitrogen Conc of Irrigation
Before ammonia loss (mg/L) 4.18
After ammonia loss (mg/L) 3.51
Average Phosphorus Conc of Irrigation (mg/L) 0.85

FRESH WATER USAGE
****

Irrigation (shandying) water (ML/yr) 0.00

Avg volume of fresh water used (ML/yr) 0.00

Annual allocation (ML/yr) N/A

POND INFORMATION
****

POND GEOMETRY

Pond 1

Final pond volume (ML) 0.01
Final liquid volume (ML) 0.01
Final sludge volume (ML) 0.00
Average pond volume (ML) 0.02
Average active volume (ML) 0.02
Maximum pond volume (ML) 0.17
Minimum allowable pond volume (ML) 0.01
Average pond depth (m) 0.97
Pond depth at outlet (m) 2.30
Maximum water surface area (m2 x1000) 0.07
Pond catchment area (m2 x1000) 0.11
Pond footprint length (m) 10.65
Pond footprint width (m) 10.65

POND WATER BALANCE

Inflow of Recycled water to pond system (ML/yr) 19.01
Recycle Volume from pond system (ML/yr) 0.00
Rain water added to pond system (ML/yr) 0.00
Evaporation loss from pond system (ML/yr) 0.00
Seepage loss from pond system (ML/yr) 0.00
Irrigation from last pond (ML/yr) 18.65
Volume of overtopping (ML/yr) 0.36
Sludge accumulated (ML/yr) 0.00
Sludge accumulated (t DM/yr) 0.00
Sludge removed (ML/yr) 0.00
No of desludging events every 10 years 0.00
Increase in pond water volume (ML/yr) 0.00

OVERTOPPING EVENTS

Volume of overtopping (ML/yr) 0.36
No. of days pond overtops per 10 years 90.40
Average Length of overtopping events (days) 3.39
% Reuse 98.11
No. of overtopping events every 10 years
> 0.000 ML 26.67
> 0.000 ML* 26.67
> 1.000 ML 0.00
> 2.000 ML 0.00
> 5.000 ML 0.00
> 10.000 ML 0.00
> 20.000 ML 0.00
> 50.000 ML 0.00
* Volume equivalent to 1 mm depth of water
No. periods/year without irrigable recycled water 0.00
Average Length of such periods (days) 0.00

POND NITROGEN BALANCE

Nitrogen Added by Recycled water (tonne/yr) 0.08 Irrig. from pond (ML/yr) 18.6
Nitrogen removed by Irrigation (tonne/yr) 0.08
Nitrogen removed by Volatilisation(tonne/yr) 0.00
Nitrogen removed by Seepage (tonne/yr) 0.00
Nitrogen accumulated in Sludge (tonne/yr) 0.00
Nitrogen lost by Overtopping (tonne/yr) 0.00
Nitrogen involved in Recycling (tonne/yr) 0.00
Increase in pond Nitrogen (tonne/yr) 0.00

POND PHOSPHORUS BALANCE

Phosphorus Added by Recycled water (tonne/yr) 0.02 Irrig. from pond (ML/yr) 18.6
Phosphorus removed by Irrigation (tonne/yr) 0.02
Phosphorus removed by Seepage (tonne/yr) 0.00

Phosphorus accumulated in Sludge (tonne/yr) 0.00
Phosphorus lost by Overtopping (tonne/yr) 0.00
Phosphorus involved in Recycling (tonne/yr) 0.00
Increase in pond Phosphorus (tonne/yr) 0.00

POND SALINITY BALANCE

Salinity Added by Recycled water (tonne/yr) 6.16
Salinity removed by Irrigation (tonne/yr) 6.11
Salinity removed by Seepage (tonne/yr) 0.00
Salinity lost by Overtopping (tonne/yr) 0.04
Salinity involved in Recycling (tonne/yr) 0.00
Increase in pond Salinity (tonne/yr) 0.00

POND CONCENTRATIONS

Pond 1

Average Nitrogen Conc of Pond Liquid (mg/L) 3.6
Average Phosphorus Conc of Pond Liquid(mg/L) 0.8
Average TDS Conc of Pond Liquid (mg/L) 297.3
Average Salinity of Pond Liquid (dS/m) 0.5
Average Potassium Conc of Pond Liquid (mg/L) 11.6

(On final day of simulation)
Nitrogen Conc of Pond Liquid (mg/L) 4.5
Phosphorus Conc of Pond Liquid (mg/L) 1.0
TDS Conc of Pond Liquid (mg/L) 384.0
EC of Pond Liquid (dS/m) 0.6
Potassium Conc of Pond Liquid (mg/L) 15.0

REMOVED SLUDGE - NUTRIENT & SALT CONCENTRATIONS

Nitrogen in removed Sludge (db) (kg/tonne) 0.00
Phosphorus in removed Sludge (db) (kg/tonne) 0.00
Salt in removed Sludge (db) (kg/tonne) 0.00
Potassium in removed Sludge (db) (kg/tonne) 0.00

REMOVED SLUDGE - NUTRIENT & SALT MASSES

Nitrogen in removed Sludge (tonne/yr) 0.00
Phosphorus in removed Sludge (tonne/yr) 0.00
Salt in removed Sludge (mass bal.)(tonne/yr) 0.00
Salt in removed Sludge (tonne/yr) 0.00
Potm. in removed Sludge (mass bal.)(tonne/yr 0.00
Potassium in removed Sludge (tonne/yr) 0.00

LAND DISPOSAL AREA
****

WATER BALANCE

(Initial soil water assumed to be at field capacity)
(Irrigated up to 3.33% of field capacity)
Rainfall (mm/year) 1767.5 Irrigation Area (ha) 2.2
Irrigation (mm/year) 847.5
Soil Evaporation (mm/year) 333.3
Transpiration (mm/year) 642.1
Runoff (mm/year) 17.5
Drainage (mm/year) 1622.0
Change in soil moisture (mm/year) 0.0

ANNUAL TOTALS

Year	Rain (mm)	Irrig (mm)	Sevap (mm)	Trans (mm)	Runoff (mm)	Drain (mm)	Change (mm)
1957	1401.0	833.6	741.4	261.6	7.7	1251.7	-27.7
1958	1725.0	850.7	501.0	554.7	20.1	1472.4	27.5
1959	1966.0	872.2	476.0	545.8	6.9	1816.5	-7.0
1960	1103.0	814.6	480.6	460.3	0.6	991.2	-15.2
1961	1837.0	862.6	521.6	465.9	1.2	1711.2	-0.2
1962	2202.0	870.6	416.0	572.6	5.5	2047.3	31.1
1963	2228.0	876.7	491.0	477.1	17.1	2130.5	-11.1
1964	1468.0	837.0	39.5	949.5	0.0	1312.9	3.2
1965	1430.0	828.8	370.3	512.8	4.8	1387.4	-16.5
1966	1410.0	828.8	382.6	500.3	10.9	1323.5	21.6
1967	2394.0	888.8	386.6	470.0	0.9	2458.7	-33.4
1968	1239.0	816.6	340.5	462.8	0.4	1255.3	-3.4
1969	1778.0	854.3	545.9	520.8	10.6	1532.5	22.5
1970	1767.0	846.2	540.3	595.8	40.7	1425.0	11.4
1971	1527.0	839.2	347.6	478.7	0.0	1552.8	-12.9
1972	2929.0	898.5	450.2	493.5	149.3	2752.6	-18.1
1973	2188.0	866.0	38.8	1046.5	26.7	1918.6	23.3
1974	3027.0	865.2	397.2	471.2	146.3	2874.5	3.0
1975	1971.0	859.2	85.2	946.5	7.1	1789.4	2.0
1976	2268.0	883.3	0.0	1033.2	52.8	2065.5	-0.2
1977	1497.0	825.2	501.1	585.5	5.3	1279.4	-49.2
1978	2072.0	854.8	449.0	638.0	11.1	1767.4	61.4
1979	1544.0	841.7	448.7	517.9	0.0	1468.2	-49.2
1980	1744.0	838.3	408.7	650.0	1.5	1446.0	76.1
1981	1522.0	846.3	484.2	595.0	0.0	1319.4	-30.3
1982	1491.0	841.1	428.6	504.2	12.9	1401.3	-14.8

1983	2512.0	888.5	483.4	543.3	24.2	2318.1	31.5
1984	2044.0	851.7	502.2	474.9	127.2	1811.2	-19.8
1985	1655.0	844.0	482.2	485.0	11.3	1547.7	-27.3
1986	968.0	802.2	401.7	528.7	0.0	827.9	12.0
1987	2166.0	850.6	404.7	518.1	43.2	2011.3	39.3
1988	2555.0	890.6	33.0	906.2	2.0	2534.1	-29.9
1989	2051.0	875.9	326.0	445.9	7.4	2159.1	-11.5
1990	2032.0	866.2	381.1	450.8	5.8	2052.6	7.9
1991	1479.0	838.0	361.4	513.5	8.4	1425.1	8.6
1992	1405.0	835.2	459.6	457.1	3.6	1333.5	-13.6
1993	1332.0	828.5	536.9	559.9	4.1	1099.5	-40.0
1994	1590.0	844.1	410.6	568.6	0.7	1430.3	23.9
1995	1485.0	829.6	464.1	640.9	0.0	1193.5	16.0
1996	2007.0	871.8	43.5	1038.2	1.9	1795.8	-0.6
1997	1345.0	830.0	0.0	1010.0	0.0	1155.6	9.4
1998	1506.0	840.7	0.0	1024.2	0.0	1331.0	-8.5
1999	3113.0	919.4	502.2	546.1	31.1	2952.2	0.9
2000	1358.0	832.4	52.1	1029.1	0.0	1098.3	10.9
2001	1468.0	815.7	0.0	1089.6	30.6	1181.0	-17.5
2002	1226.0	822.4	391.5	684.6	0.3	963.0	9.0
2003	1873.0	858.6	424.2	576.1	5.3	1752.8	-26.8
2004	1478.0	826.8	65.1	1081.0	2.8	1128.8	27.2
2005	1641.0	821.8	0.0	1049.8	41.6	1390.6	-19.2
2006	1939.0	856.9	0.0	1032.0	3.1	1746.6	14.3
2007	184.0	742.3	0.0	184.1	0.0	730.3	11.9

NUTRIENT BALANCE

NITROGEN

Total N irrigated from ponds (kg/ha/year) 35.4 % of Total as ammonium 80.0
Nitrogn lost by ammonia volat.(kg/ha/year) 5.7 Deep Drainage (mm/year) 1622.0
Nitrogen added in irrigation (kg/ha/year) 29.8
Nitrogen added in seed (kg/ha/year) 0.5
Nitrogen removed by crop (kg/ha/year) 52.2
Denitrification (kg/ha/year) 0.1
Leached NO3-N (kg/ha/year) 7.6
Change in soil organic-N (kg/ha/year) -26.9
Change in soil solution NH4-N (kg/ha/year) 0.4
Change in soil solution NO3-N (kg/ha/year) -3.1
Change in adsorbed NH4-N (kg/ha/year) 0.0
Initial soil organic-N (kg/ha) 1522.5
Final soil organic-N (kg/ha) 149.4
Initial soil inorganic-N (kg/ha) 158.1

Final soil inorganic-N (kg/ha) 19.8
Average N03-N conc in the root zone (mg/L) 0.5
Average N03-N conc below root zone (mg/L) 0.8
Average N03-N conc of deep drainage (mg/L) 0.5

PHOSPHORUS

Phosphorus added in irrigatn (kg/ha/year) 7.2 % of Total as phosphate 100.0
Phosphorus added in seed (kg/ha/year) 0.1
Phosphorus removed by crop (kg/ha/year) 5.8
Leached PO4-P (kg/ha/year) 0.2
Change in dissolved PO4-P (kg/ha/year) 0.0
Change in adsorbed PO4-P (kg/ha/year) 1.3
Average P04-P conc in the root zone (mg/L) 0.0
Average P04-P conc below root zone (mg/L) 0.0

SOIL P STORAGE LIFE

Year	YearNo.	Tot P stored kg/ha	P leached in year kg/ha
1957	1	373.9	0.2
1958	2	380.7	0.2
1959	3	386.9	0.2
1960	4	393.8	0.1
1961	5	398.2	0.2
1962	6	402.3	0.3
1963	7	406.0	0.3
1964	8	410.0	0.2
1965	9	410.5	0.2
1966	10	413.4	0.2
1967	11	415.9	0.3
1968	12	419.6	0.2
1969	13	420.8	0.2
1970	14	422.0	0.2
1971	15	423.1	0.2
1972	16	425.5	0.3
1973	17	424.5	0.2
1974	18	424.1	0.3
1975	19	425.3	0.2
1976	20	425.2	0.2
1977	21	424.6	0.2
1978	22	426.3	0.2
1979	23	427.0	0.2
1980	24	429.1	0.2
1981	25	428.5	0.2
1982	26	429.3	0.2

1983	27	430.4	0.3
1984	28	431.9	0.2
1985	29	432.0	0.2
1986	30	433.1	0.1
1987	31	433.5	0.2
1988	32	433.9	0.3
1989	33	431.4	0.3
1990	34	432.5	0.2
1991	35	433.7	0.2
1992	36	435.3	0.2
1993	37	434.9	0.2
1994	38	435.3	0.2
1995	39	435.3	0.2
1996	40	435.2	0.2
1997	41	432.1	0.1
1998	42	431.1	0.2
1999	43	431.3	0.4
2000	44	433.4	0.1
2001	45	431.3	0.1
2002	46	431.7	0.1
2003	47	433.3	0.2
2004	48	434.4	0.1
2005	49	431.4	0.2
2006	50	430.5	0.2
2007	51	432.9	0.1

PLANT

Plant species: Coastal couch grass (Cynodon dac

PLANT WATER USE

Irrigation (mm/year) 848. Totl Irrigation Area(ha) 2.2
Pan coefficient (%) 1.0
Maximum crop coefficient (%) 0.8
Average Plant Cover (%) 57.
Average Plant Total Cover (%) 74.
Average Plant Rootdepth (mm) 540.
Average Plant Available Water Capacity (mm) 108.
Average Plant Available Water (mm) 107.
Yield produced per unit transp. (kg/ha/mm) 8.

PLANT NUTRIENT UPTAKE

Dry Matter Yield (Shoots) (kg/ha/yr) 4850.
Net nitrogen removed by plant (kg/ha/yr) 52. Shoot Concn (%DM) 1.07
Net phosphorus removed by plant (kg/ha/yr) 6. Shoot Concn (%DM) 0.12

AVERAGE MONTHLY GROWTH STRESS (0=no stress, 1=full stress)

Month	Yield kg/ha	Nitr	Temp	Water Defic	Water Logging
1	909.	0.5	0.0	0.0	0.0
2	681.	0.6	0.0	0.0	0.0
3	620.	0.6	0.0	0.0	0.0
4	542.	0.6	0.1	0.0	0.0
5	371.	0.6	0.5	0.0	0.0
6	163.	0.5	0.8	0.0	0.0
7	74.	0.3	0.9	0.0	0.0
8	79.	0.1	0.8	0.0	0.0
9	161.	0.1	0.5	0.1	0.0
10	228.	0.2	0.3	0.1	0.0
11	333.	0.2	0.1	0.1	0.0
12	689.	0.3	0.0	0.1	0.0

>>> NO-PLANT EVENTS <<<

%Days due to temperature stress 6.5
%Days due to water stress 0.7
%Days due to nitrogen stress 0.2
No. of forced harvests per year 0.8
No. of normal harvests per year 2.4

SALINITY

Salt tolerance - plant species: tolerant

Average EC of Irrigation Water (dS/m) 0.5 Irrigation (mm/year) 847.5
Average EC of Rainwater (dS/m x10) 0.3 Rainfall (mm/year) 1767.5
Average EC of Infiltrated water (dS/m) 0.2
Av. water-upt-weightd rootzone EC(dS/m s.e.) 0.1
EC soil soln (FC) at base of rootzone (dS/m) 0.3 Deep Drainage (mm/year) 1622.0
Reduction in Crop yield due to Salinity (%) 0.0
Percentage of yrs that crop yld falls below

90% of potential because of soil salinity 0.0

Period	ECrootzone sat ext (dS/m)	ECbase in situ (dS/m)	Rel Yield (%)
1957 - 1961	0.13	0.33	100.
1958 - 1962	0.12	0.30	100.
1959 - 1963	0.12	0.28	100.
1960 - 1964	0.12	0.30	100.
1961 - 1965	0.12	0.28	100.
1962 - 1966	0.12	0.30	100.
1963 - 1967	0.12	0.28	100.
1964 - 1968	0.13	0.31	100.
1965 - 1969	0.12	0.30	100.
1966 - 1970	0.12	0.30	100.
1967 - 1971	0.12	0.30	100.
1968 - 1972	0.12	0.29	100.
1969 - 1973	0.11	0.27	100.
1970 - 1974	0.10	0.24	100.
1971 - 1975	0.09	0.23	100.
1972 - 1976	0.09	0.22	100.
1973 - 1977	0.10	0.25	100.
1974 - 1978	0.10	0.25	100.
1975 - 1979	0.12	0.29	100.
1976 - 1980	0.12	0.30	100.
1977 - 1981	0.13	0.33	100.
1978 - 1982	0.13	0.33	100.
1979 - 1983	0.12	0.31	100.
1980 - 1984	0.12	0.29	100.
1981 - 1985	0.12	0.29	100.
1982 - 1986	0.12	0.31	100.
1983 - 1987	0.12	0.29	100.
1984 - 1988	0.11	0.28	100.
1985 - 1989	0.11	0.27	100.
1986 - 1990	0.11	0.26	100.
1987 - 1991	0.10	0.24	100.
1988 - 1992	0.11	0.26	100.
1989 - 1993	0.12	0.30	100.
1990 - 1994	0.13	0.33	100.
1991 - 1995	0.15	0.37	100.
1992 - 1996	0.14	0.35	100.
1993 - 1997	0.14	0.36	100.
1994 - 1998	0.13	0.35	100.
1995 - 1999	0.11	0.29	100.
1996 - 2000	0.12	0.29	100.
1997 - 2001	0.12	0.32	100.
1998 - 2002	0.13	0.32	100.

1999 - 2003	0.12	0.31	100.
2000 - 2004	0.15	0.39	100.
2001 - 2005	0.14	0.37	100.
2002 - 2006	0.13	0.35	100.
2003 - 2007	0.14	0.35	100.

GROUNDWATER
****

Average Groundwater Recharge (m3/day) 97.7
Average Nitrate-N Conc of Recharge (mg/L) 0.5

Thickness of the Aquifer (m) 5.0
Distance (m) from Irrigation Area to where
Nitrate-N Conc in Groundwater is Calculated 200.0

Concentration of NITRATE-N in Groundwater (mg/L)

Year	Depth Below Water Table Surface 0.0 m	3.0 m	4.0 m
1961	0.4	0.4	0.4
1966	0.5	0.5	0.5
1971	0.5	0.5	0.5
1976	0.5	0.5	0.5
1981	0.5	0.5	0.5
1986	0.5	0.5	0.5
1991	0.5	0.5	0.5
1996	0.5	0.5	0.5
2001	0.5	0.5	0.5
2006	0.5	0.5	0.5
Last 2007	0.5	0.5	0.5

ACKNOWLEDGMENTS
****
This run brought to you courtesy of:

MEDLIEXE.EXE : 1300468 bytes Fri Mar 12 10:26:56 1999

CRCPROJ.EXE : 1286656 bytes Wed Apr 28 15:18:26 1999

GRAPHS.EXE : 439296 bytes Fri Dec 11 12:28:08 1998

STP INPUT PARAMETERS - DATA SUMMARY

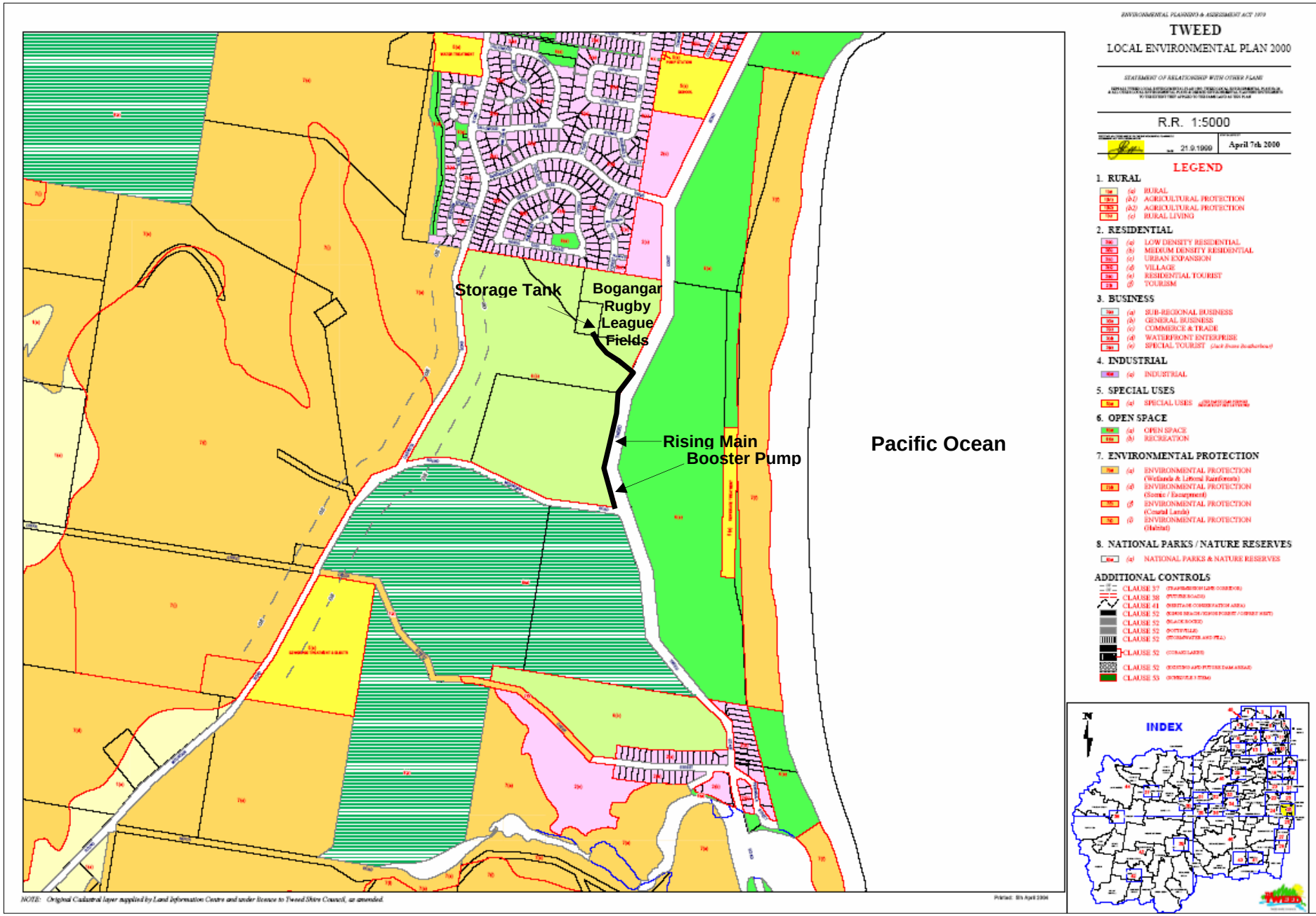
Equivalent persons	195
Dry weatherProduction (ML/day)	0.0439
Recycled water per person (L/day)	224.9
Recycled water per person (L/yr)	82088.5
Recycled water volume per 1000 EPs per year (ML)	82.1

Infiltration	average

UNCONDITIONAL FINISH

APPENDIX B

TWEED LOCAL ENVIRONMENTAL PLAN (2000) - ZONING MAP


Storage Tank
Bogangar Rugby League Fields
Rising Main
Booster Pump
Pacific Ocean
TWEED
LOCAL ENVIRONMENTAL PLAN 2000
R.R. 1:5000
21.9.1999
April 7th 2000
LEGEND
1. RURAL
2. RESIDENTIAL
3. BUSINESS
4. INDUSTRIAL
5. SPECIAL USES
6. OPEN SPACE
7. ENVIRONMENTAL PROTECTION
8. NATIONAL PARKS / NATURE RESERVES
ADDITIONAL CONTROLS
INDEX
N
NOTE: Original Cadastral layer supplied by Land Information Centre and under licence to Tweed Shire Council, as amended.

APPENDIX C

SITE PHOTOGRAPHS

Site Photographs

Photo 1: Corner of Round Mountain Road and Tweed Coast Road – New recycled water main to connect from the existing recycled water main

Photo 2: Tweed Coast Road – New recycled main to be installed for 430m along the western side of Tweed Coast Road between the road verge and footpath. The recycled water booster pump will constructed adjacent to the rising main 35m from the connection point at the corner of Tweed Coast and Round Mountain Roads

Photo 3: Tweed Coast Road – New recycled main to be installed for 430m along the western side of Tweed Coast Road between the road verge and footpath

Photo 4: The main will diver 190 metres to the northwest to the recycled water storage tank

Photo 5: Cleared site to accommodate an above-ground regulation recycled water storage tank.

Photo 6: Cleared site to accommodate an above-ground regulation recycled water storage tank.

Site Photographs

Photo 7: Bogangar Rugby League Fields Clubhouse

Photo 8: Bogangar Rugby League Fields – Trees buffering northern residential properties

Photo 9: Bogangar Rugby League Fields – north-eastern view

Photo 10: Bogangar Rugby League Fields – eastern view

Photo 11: Bogangar Rugby League Fields –eastern view with skate park to the right

Photo 12: Adjoining skate park and additional irrigation area

APPENDIX D

RADIOLOGICAL INVESTIGATION

Enquiries: Ross Kleinschmidt
Telephone: 07 3274 9124
Facsimile: 07 3274 9123

Requested by: Brigita Arrowsmith
Environmental Scientist
MWH Australia Pty Ltd
Suite 4, 60 Nerang Street
NERANG Q 4211

Reference: Job No. A1055100

RADIOLOGICAL INVESTIGATION No. 07PQ267

Bogangar Rugby League Field – Bogangar, NSW

Date Request Received: 28 August 2007

Report / Site Description: Surface Radiation Survey of playing fields and immediate areas, Bogangar, NSW.

---

1 SCOPE OF WORK

A radiological survey was conducted for the client pending building works / development of the site.

Queensland Health Scientific Services (QHSS) was commissioned by MWH Australia to perform the radiological screening survey for inclusion in a report to the Tweed Shire Council.

Assessment of contaminants other than radiological material, for example heavy metals, does not form part of the scope of this work.

2 RADIOLOGICAL INVESTIGATION METHOD

2.1 Site Background

The subject site is a recreational reserve including playing and training fields, a clubhouse and car park. The site is part of a general area that has historically been subjected to sand mining and mineral sand processing, although there is no evidence that these processes were conducted in the immediate area. Site layout and areas for investigation are shown in Figure 1, as provided by the client.

2.2 Radiological Survey

A walk over survey strategy based on a 10 m square grid was used to measure the external, or surface, gamma radiation levels and enable comparison with guideline radiation level values.

An Eberline E600 survey meter (serial number 02888) and Eberline SSPA6 plastic scintillation detector (serial number 0594) was used to measure surface gamma radiation levels. The instrument package is calibrated by QHSS, traceable to the primary Australian Standard, specifically for environmental measurements in microGray per hour ($\mu Gy.h^{-1}$). All site radiation level measurements were performed approximately one metre above the ground surface. Using this measurement geometry and with typical soil

Queensland Health Scientific Services
39 Kessels Road **PO Box 594** **Phone: 07 3274 9106** **Fax: 07 3274 9123**
COOPERS PLAINS Q 4108 **ARCHERFIELD Q 4108**

densities, approximately 90 % of the measured exposure rate originates from the top 200 mm of material over an 8 m radii. Soil moisture corrections can be considered as negligible under the weather conditions experienced during the survey.

3 RESULTS

3.1 Inspection

The subject site was surveyed by Gordon Gee, Physics Technical Officer, of QHSS on 11 September 2007.

There was no obvious evidence of mineral sand staining or contamination in the survey area.

3.2 Radiological survey

All surface gamma radiation levels measured over the site were typical of background levels (less than $0.1\mu G.h^{-1}$) for the area.

4 CONCLUSIONS

The surface gamma survey did not identify any areas that could be considered as being greater than typical background levels for the area. All measured gamma radiation levels are less than the action level criteria recommended in the NSWEPA document *Clean-up and disposal of residues from commercial operations involving mineral sands. Radiation Safety Information Series No. 12. 1984*.

Note that these conclusions do not include consideration of non-radioactive contaminants that may be present on the site.

5 LIMITATIONS OF REPORT

Queensland Health Scientific Services has prepared this report for use by MWH Australia, and the Tweed Shire Council in accordance with generally accepted consulting practice. It may not contain sufficient information for the purposes of other parties or other uses.

To the best of our knowledge the information contained in this report is accurate at the date of issue.

R Kleinschmidt
Senior Health Physicist
State Radiation Analyst
MARPS, SPERA

18 September 2007

Queensland Health Scientific Services
39 Kessels Road **PO Box 594** **Phone: 07 3274 9106** **Fax: 07 3274 9123**
COOPERS PLAINS Q 4108 **ARCHERFIELD Q 4108**

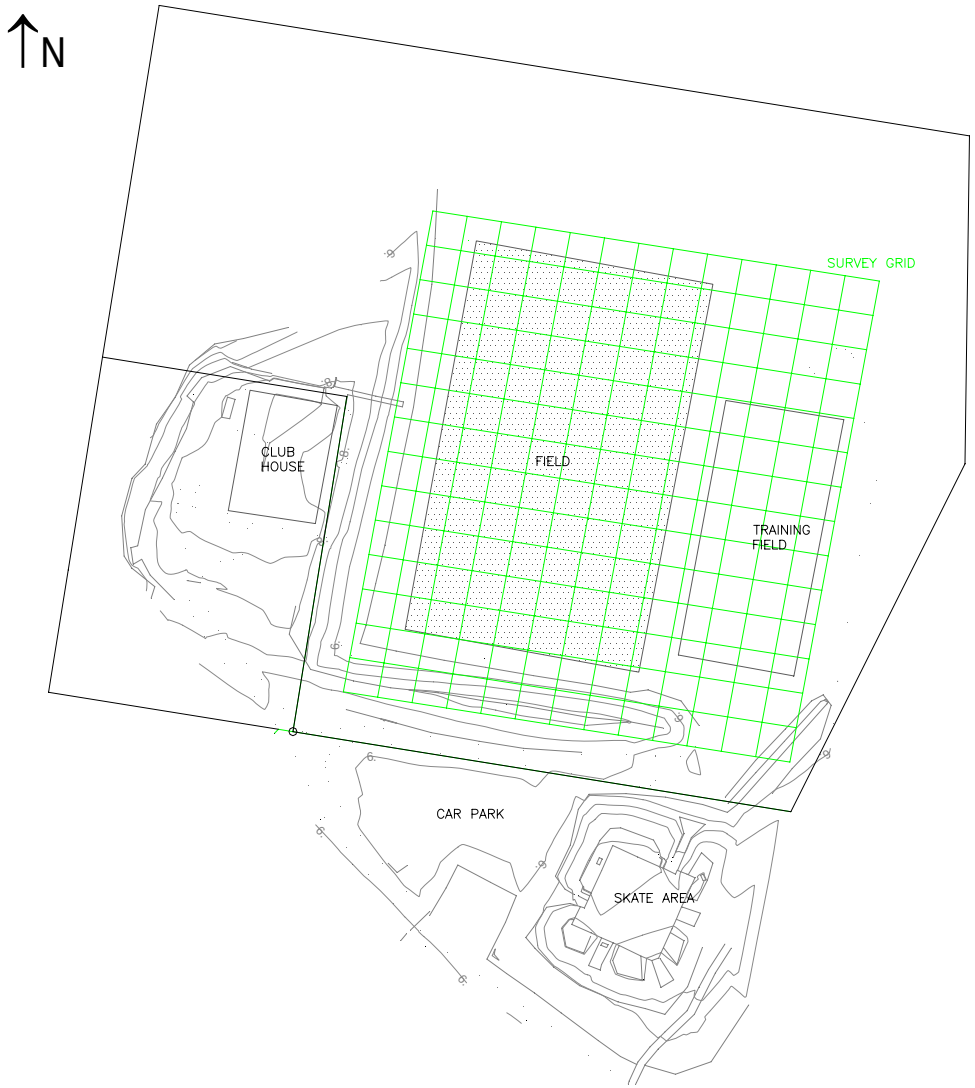
Notes:

Survey conducted by: G Gee
Date of survey: 11 September 2007
Survey Instrument: Eberline E 600 (S/N 02888)
Eberline SSPA6 (S/N 594)

All measurements in $nGy.h^{-1}$ unless otherwise stated

Base drawing provided by client.
Dawn by Hydro-Plan, Southport. Drawing ref: WT06031/10

SURVEY RESULTS:
ALL RESULTS LESS THAN 100 $nGy.h^{-1}$ ($0.1\mu Gy.h^{-1}$)



Drawn	Scale
HPU:RK	DNS (A4)
Job/Lab No.	Date
07PQ267	18/09/2007

File: C:\Documents and Settings\Brigita Arrowsmith\Desktop\Final REF\Appendix F - Radiological Investigation\07PQ267_Figure1.doc

ABN: 66 329 169 412

Queensland Government
Queensland Health

Forensic & Scientific Services
PO Box 594 ARCHERFIELD Q 4108
Phone: 07 3274 9124 Fax: 07 3274 9123
e-mail: Ross_Kleinschmidt@health.qld.gov.au

Project: BOGANGAR RUGBY LEAGUE FIELD
CLIENT JOB No. A1055100

Title: SURFACE GAMMA DOSE RATE SURVEY

Client: MWH AUSTRALIA PTY LTD

Drawing No.: FIGURE 1

Rev: 1.0

APPENDIX E

ABORIGINAL HERITAGE INFORMATION SYSTEM (AHIMS) SEARCH RESULTS

Department of
Environment and Conservation (NSW)

Your reference : Bogangar
Our reference : AHIMS #16858

MWH Australia Pty Ltd
PO Box 2148
Milton QLD 4064

Wednesday, 09 May 2007

Attention: Brigita K Arrowsmith

Dear Sir or Madam:

Re: AHIMS Search for the following area at Bogangar

I am writing in response to your recent inquiry in respect to Aboriginal objects and Aboriginal places registered with the NSW Department of Environment and Conservation (DEC) at the above location.

A search of the DEC Aboriginal Heritage Information Management System (AHIMS) has shown that *0* Aboriginal objects and Aboriginal places are recorded in or near the above location. Please refer to the attached report for details.

The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not to be made available to the public.

The following qualifications apply to an AHIMS search:

- AHIMS only includes information on Aboriginal objects and Aboriginal places that have been provided to DEC;
- Large areas of New South Wales have not been the subject of systematic survey or recording of Aboriginal history. These areas may contain Aboriginal objects and other heritage values which are not recorded on AHIMS;
- Recordings are provided from a variety of sources and may be variable in their accuracy. When an AHIMS search identifies Aboriginal objects in or near the area it is recommended that the exact location of the Aboriginal object be determined by re-location on the ground; and
- The criteria used to search AHIMS are derived from the information provided by the client and DEC assumes that this information is accurate.

All Aboriginal places and Aboriginal objects are protected under the *National Parks and Wildlife Act 1974* (NPW Act) and it is an offence to destroy, damage or deface them without the prior consent of the DEC Director-General. An Aboriginal object is considered to be known if:

- It is registered on AHIMS;

PO Box 1967 Hurstville NSW 2220
43 Bridge Street Hurstville NSW 2220
Telephone (02) 9585 6345
Facsimile (02) 9585 6094
ABN 30 841 387 271
ahims@environment.nsw.gov.au
www.environment.nsw.gov.au

- It is known to the Aboriginal community; or
- It is located during an investigation of the area conducted for a development application.

If you considering undertaking a development activity in the area subject to the AHIMS search, DEC would recommend that an Aboriginal Heritage Assessment be undertaken. You should consult with the relevant consent authority to determine the necessary assessment to accompany your development application.

Yours Sincerely

Freeburn, Sharlene
Administrator
Information Systems Section
Cultural Heritage Division
Phone: (02) 9585 6471
Fax: (02) 9585 6094

AHIMS
Aboriginal Heritage Information Management System

Department of
Environment
& Conservation

List of Sites (List - Short)

Bogangar

Grid Reference Type = AGD (Australian Geodetic Datum), Zone = 56, Easting From = 554786, Easting to = 556467, Northing From = 6862635, Northing to = 6864624, Requestor like 6417%, Service ID = 10858, Feature Search Type = AHIMS Features

Site ID	Site Name	Datum	Zone	Easting	Northing	Site Features	Site Types (recorded prior to June 2001)	Recording (Primary)	Reports (Catalogue Number)	State Archive Box Number

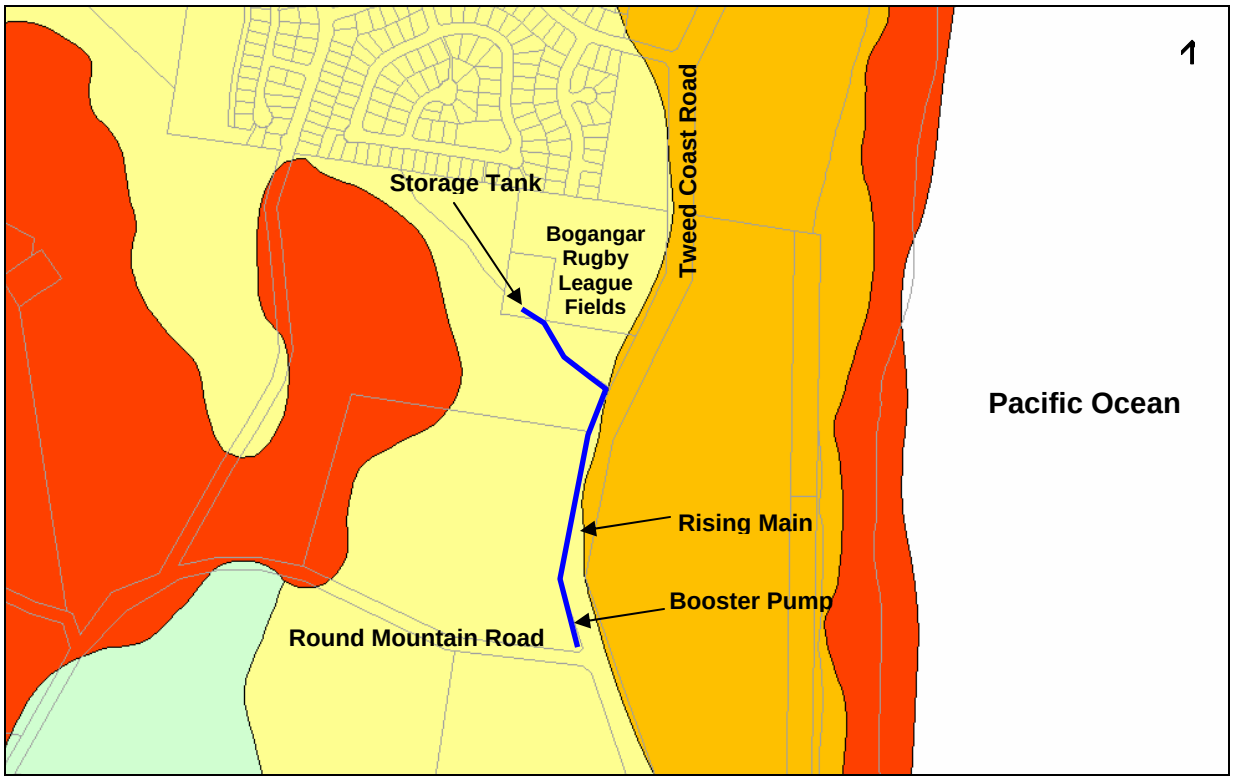
No Site Recorded

Number of Sites : 0

09/05/2007 13:48:51

APPENDIX F

ACID SULFATE SOILS PLANNING MAP



SOIL CLASSES
1 (554)
2 (3315)
3 (2403)
4 (1018)
5 (1038)

Bogangar Rugby League Field, Acid Sulfate Soils Classification Map
Cadastral Details: 499//726500, 1//1040811, 498//726500
Soil Class: 3
Department of Infrastructure, Planning and Natural Resources (DIPNR) NSW (26 June 2007) http://canri.nsw.gov.au/nrdd/records/ANZNS0359000004.html

APPENDIX G

FLORA AND FAUNA SEARCHES

NPWS home

Search Results

Your selection: Flora, threatened species, Selected Area - 153.51500,-28.39000,153.61500,-28.29000 returned a total of 62 records of 21 species.
Report generated on 01/10/2007 - 14:43 (Data valid to 23/09/2007)

view map search again clear selection search aga clear selecti

Choose up to 3 species to map.

** Exotic (non-native) species*

Plants	Map	Scientific Name	Common Name	Legal Status	Count	Info
Apocynaceae						
	☐	Ochrosia moorei	Southern Ochrosia	E1	2	
Davidsoniaceae						
	☐	Davidsonia jerseyana	Davidson's Plum	E1	2	
	☐	Davidsonia johnsonii	Smooth Davidson's Plum	E1	1	
Fabaceae (Caesalpinioideae)						
	☐	Cassia brewsteri var. marksiana	Brush Cassia	E1	6	
Fabaceae (Faboideae)						
	☐	Desmodium acanthocladum	Thorny Pea	V	1	
Fabaceae (Mimosoideae)						
	☐	Acacia bakeri	Marblewood	V	8	
	☐	Archidendron hendersonii	White Lace Flower	V	1	
Flacourtiaceae						
	☐	Xylosma terrae-reginae	Queensland Xylosma	E1	1	
Lauraceae						
	☐	Cryptocarya foetida	Stinking Cryptocarya	V	7	
	☐	Endiandra floydii	Crystal Creek Walnut	E1	1	
	☐	Endiandra hayesii	Rusty Rose Walnut	V	1	
Myrtaceae						
	☐	Syzygium hodgkinsoniae	Red Lilly Pilly	V	1	
	☐	Syzygium moorei	Durobby	V	9	
Orchidaceae						
	☐	Geodorum densiflorum	Pink Nodding Orchid	E1	2	
	☐	Peristeranthus hillii	Brown Fairy-chain Orchid	V	2	
Poaceae						

Elyonurus citreus	Lemon-scented Grass	E1	1	
Polypodiaceae				
Drynaria rigidula	Basket Fern	E1	1	
Rubiaceae				
Hedyotis galioides	Sweet False Galium	E1	1	
Randia moorei	Spiny Gardenia	E1	2	
Rutaceae				
Acronychia littoralis	Scented Acronychia	E1	11	
Urticaceae				
Dendrocnide moroides	Gympie Stinger	E1	1	

** Exotic (non-native) species*

Choose up to 3 species to map.

DISCLAIMER: The Atlas of New South Wales Wildlife contains data from a number of sources including government agencies, non-government organisations and private individuals. These data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Find out more about the Atlas.

NPWS home

Search Results

Your selection: Fauna, threatened species, Selected Area - 153.51000,-28.39000,153.61000,-28.29000 returned a total of 340 records of 37 species.
Report generated on 01/10/2007 - 14:39 (Data valid to 23/09/2007)

view map | search again | clear selection

Choose up to 3 species to map.

** Exotic (non-native) species*

Amphibia	Map	Scientific Name	Common Name	Legal Status	Count	Info
Hylidae						
	☐	Litoria olongburensis	Olongburra Frog	V	1	
Myobatrachidae						
	☐	Crinia tinnula	Wallum Froglet	V	25	

Aves	Map	Scientific Name	Common Name	Legal Status	Count	Info
Accipitridae						
	☐	Pandion haliaetus	Osprey	V	11	
Anseranatidae						
	☐	Anseranas semipalmata	Magpie Goose	V	2	
Ardeidae						
	☐	Ixobrychus flavicollis	Black Bittern	V	4	
Burhinidae						
	☐	Burhinus grallarius	Bush Stone-curlew	E1	3	
	☐	Esacus neglectus	Beach Stone-curlew	E1	1	
Cacatuidae						
	☐	Calyptorhynchus banksii	Red-tailed Black-Cockatoo	V	2	
	☐	Calyptorhynchus lathami	Glossy Black-Cockatoo	V	20	
Ciconiidae						
	☐	Ephippiorhynchus asiaticus	Black-necked Stork	E1	18	
Columbidae						
	☐	Ptilinopus magnificus	Wompoo Fruit-Dove	V	2	
	☐	Ptilinopus regina	Rose-crowned Fruit-Dove	V	1	
Dicruridae						
	☐	Monarcha leucotis	White-eared Monarch	V	2	

Diomedeidae					
	Thalassarche melanophris	Black-browed Albatross	V	1	
Haematopodidae					
	Haematopus fuliginosus	Sooty Oystercatcher	V	4	
	Haematopus longirostris	Pied Oystercatcher	V	4	
Halcyonidae					
	Todiramphus chloris	Collared Kingfisher	V	1	
Laridae					
	Gygis alba	White Tern	V	1	
	Sterna albifrons	Little Tern	E1	4	
Rallidae					
	Amaurornis olivaceus	Bush-hen	V	3	
Scolopacidae					
	Calidris alba	Sanderling	V	1	
	Calidris tenuirostris	Great Knot	V	1	
Tytonidae					
	Tyto capensis	Grass Owl	V	2	

Mammalia Map	Scientific Name	Common Name	Legal Status	Count	Info
Dasyuridae					
	Planigale maculata	Common Planigale	V	17	
Molossidae					
	Mormopterus norfolkensis	Eastern Freetail-bat	V	1	
Phascolarctidae					
	Phascolarctos cinereus	Koala	V	133	
Potoroidae					
	Potorous tridactylus	Long-nosed Potoroo	V	4	
	Potorous tridactylus	Long-nosed Potoroo, Cobaki Lakes and Tweed Heads West population	E2	4	
Pteropodidae					
	Pteropus alecto	Black Flying-fox	V	5	
	Pteropus poliocephalus	Grey-headed Flying-fox	V	19	
	Syconycteris australis	Common Blossom-bat	V	15	
Vespertilionidae					
	Miniopterus australis	Little Bentwing-bat	V	17	
	Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	1	
	Myotis adversus	Large-footed Myotis	V	5	
		Eastern Long-eared			

	Nyctophilus bifax	Bat	V	2	

Reptilia	Map	Scientific Name	Common Name	Legal Status	Count	Info
Cheloniidae						
		Caretta caretta	Loggerhead Turtle	E1	2	
		Chelonia mydas	Green Turtle	V	1	

** Exotic (non-native) species*

Choose up to 3 species to map.

DISCLAIMER: The Atlas of New South Wales Wildlife contains data from a number of sources including government agencies, non-government organisations and private individuals. These data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Find out more about the Atlas.

Australian Government
Department of the Environment and Water Resources

Protected Matters Search Tool

You are here: Environment Home > EPBC Act > Search

1 October 2007 14:28

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

You may wish to print this report for reference before moving to other pages or websites.

The Australian Natural Resources Atlas at http://www.environment.gov.au/atlas may provide further environmental information relevant to your selected area. Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

Search Type: Point
Buffer: 10 km
Coordinates: -28.345,153.56973

Report Contents:

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance: (Ramsar Sites)	None
Commonwealth Marine Areas:	Relevant
Threatened Ecological Communities:	None
Threatened Species:	53
Migratory Species:	39

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html.

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.au/epbc/permits/index.html.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Places on the RNE:	None
Listed Marine Species:	60
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	2
Other Commonwealth Reserves:	None
Regional Forest Agreements:	1

Details

Matters of National Environmental Significance

Commonwealth Marine Areas [Dataset Information]

Approval may be required for a proposed activity that is likely to have a significant impact on the environment in a Commonwealth Marine Area, when the action is outside the Commonwealth Marine Area, or the environment anywhere when the action is taken within the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

EEZ and Territorial Sea

Threatened Species [Dataset Information]	Status	Type of Presence
Birds		
*Cyclopsitta diophthalma coxeni** Coxen's Fig-Parrot	Endangered	Species or species habitat likely to occur within area
Diomedea dabbenena * Tristan Albatross	Endangered	Foraging may occur within area
Lathamus discolor * Swift Parrot	Endangered	Species or species habitat may occur within area
Macronectes giganteus * Southern Giant-Petrel	Endangered	Species or species habitat may occur within area
Macronectes halli * Northern Giant-Petrel	Vulnerable	Species or species habitat may occur within area
*Poephila cincta cincta** Black-throated Finch (southern)	Endangered	Species or species habitat likely to occur within area
*Pterodroma neglecta neglecta** Kermadec Petrel (western)	Vulnerable	Species or species habitat may occur within area
Rostratula australis * Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
Thalassarche impavida * Campbell Albatross	Vulnerable	Species or species habitat may occur within area
Turnix melanogaster * Black-breasted Button-quail	Vulnerable	Species or species habitat likely to occur within area
Xanthomyza phrygia * Regent Honeyeater	Endangered	Species or species habitat may occur within area
Frogs		

Litoria olongburensis * Wallum Sedge Frog	Vulnerable	Species or species habitat likely to occur within area
Mixophyes iteratus * Southern Barred Frog, Giant Barred Frog	Endangered	Species or species habitat likely to occur within area
Insects		
*Phyllodes imperialis (southern subsp. - ANIC 3333)** a moth	Endangered	Species or species habitat likely to occur within area
Mammals		
Balaenoptera musculus * Blue Whale	Endangered	Species or species habitat may occur within area
Chalinolobus dwyeri * Large-eared Pied Bat, Large Pied Bat	Vulnerable	Species or species habitat may occur within area
*Dasyurus maculatus maculatus (SE mainland population)** Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Endangered	Species or species habitat may occur within area
Eubalaena australis * Southern Right Whale	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae * Humpback Whale	Vulnerable	Species or species habitat known to occur within area
*Potorous tridactylus tridactylus** Long-nosed Potoroo (SE mainland)	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus * Grey-headed Flying-fox	Vulnerable	Roosting known to occur within area
Reptiles		
Caretta caretta * Loggerhead Turtle	Endangered	Breeding known to occur within area
Chelonia mydas * Green Turtle	Vulnerable	Species or species habitat may occur within area
Coeranoscincus reticulatus * Three-toed Snake-tooth Skink	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea * Leathery Turtle, Leatherback Turtle, Luth	Vulnerable	Species or species habitat may occur within area
Sharks		
*Carcharias taurus (east coast population)** Grey Nurse Shark (east coast population)	Critically Endangered	Species or species habitat may occur within area
Carcharodon carcharias * Great White Shark	Vulnerable	Species or species habitat may occur within area
Rhincodon typus * Whale Shark	Vulnerable	Species or species habitat may occur within area
Snails, slugs		
Thersites mitchellae * Mitchell's Rainforest Snail	Critically Endangered	Species or species habitat likely to occur within area
Plants		
Acronychia littoralis * Scented Acronychia	Endangered	Species or species habitat likely to occur within area

Bosistoa selwynii * Heart-leaved Bosistoa	Vulnerable	Species or species habitat likely to occur within area
Bosistoa transversa * Three-leaved Bosistoa	Vulnerable	Species or species habitat likely to occur within area
Corokia whiteana *	Vulnerable	Species or species habitat likely to occur within area
Cryptocarya foetida * Stinking Cryptocarya, Stinking Laurel	Vulnerable	Species or species habitat likely to occur within area
Davidsonia jerseyana * Davidson's Plum, Ooray	Endangered	Species or species habitat likely to occur within area
Davidsonia johnsonii * Smooth Davidsonia, Smooth Davidson's Plum, Small-leaved Davidson's Plum	Endangered	Species or species habitat likely to occur within area
Desmodium acanthocladum * Thorny Pea	Vulnerable	Community likely to occur within area
Diospyros mabacea * Red-fruited Ebony, Silky Persimmon, Ebony	Endangered	Species or species habitat likely to occur within area
Diploglottis campbellii * Small-leaved Tamarind	Endangered	Species or species habitat likely to occur within area
Elaeocarpus williamsianus * Hairy Quandong	Endangered	Species or species habitat likely to occur within area
Endiandra floydii * Floyd's Walnut	Endangered	Species or species habitat likely to occur within area
Endiandra hayesii * Rusty Rose Walnut, Velvet Laurel	Vulnerable	Species or species habitat likely to occur within area
Floydia praealta * Ball Nut, Possum Nut, Big Nut, Beefwood	Vulnerable	Species or species habitat likely to occur within area
Fontainea australis * Southern Fontainea	Vulnerable	Species or species habitat likely to occur within area
Gossia fragrantissima * Sweet Myrtle, Small-leaved Myrtle	Endangered	Species or species habitat likely to occur within area
Hicksbeachia pinnatifolia * Monkey Nut, Bopple Nut, Red Bopple, Red Bopple Nut, Red Nut, Beef Nut, Red Apple Nut, Red Boppel Nut, Ivory Silky Oak	Vulnerable	Species or species habitat likely to occur within area
Macadamia tetraphylla * Rough-shelled Bush Nut, Macadamia Nut, Rough-shelled Macadamia, Rough-leaved Queensland Nut	Vulnerable	Species or species habitat likely to occur within area
Marsdenia longiloba * Clear Milkvine	Vulnerable	Species or species habitat likely to occur within area
Ochrosia moorei * Southern Ochrosia	Endangered	Species or species habitat likely to occur within area
Randia moorei * Spiny Gardenia	Endangered	Species or species habitat likely to occur within area
Syzygium hodgkinsoniae * Smooth-bark Rose Apple, Red Lilly Pilly	Vulnerable	Species or species habitat likely to occur within area
Syzygium moorei *	Vulnerable	Species or species habitat likely to

Rose Apple, Coolamon, Robby, Durobby, Watermelon Tree, Coolamon Rose Apple		occur within area
Tinospora tinosporoides * Arrow-head Vine	Vulnerable	Species or species habitat likely to occur within area
Migratory Species [Dataset Information]	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
*Cyclopsitta diophthalma coxeni** Coxen's Fig-Parrot	Migratory	Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Migratory	Species or species habitat may occur within area
Merops ornatus * Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Migratory	Breeding may occur within area
Monarcha trivirgatus Spectacled Monarch	Migratory	Breeding likely to occur within area
Myiagra cyanoleuca Satin Flycatcher	Migratory	Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail	Migratory	Breeding may occur within area
Xanthomyza phrygia Regent Honeyeater	Migratory	Species or species habitat may occur within area
Migratory Wetland Species		
Birds		
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area
Gallinago hardwickii * Latham's Snipe, Japanese Snipe	Migratory	Species or species habitat may occur within area
Nettapus coromandelianus albipennis Australian Cotton Pygmy-goose	Migratory	Species or species habitat may occur within area
Numenius phaeopus Whimbrel	Migratory	Species or species habitat likely to occur within area
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Species or species habitat may occur within area
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift	Migratory	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area

Calonectris leucomelas Streaked Shearwater	Migratory	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross	Migratory	Foraging may occur within area
Macronectes giganteus Southern Giant-Petrel	Migratory	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel	Migratory	Species or species habitat may occur within area
Puffinus leucomelas Streaked Shearwater	Migratory	Species or species habitat may occur within area
Sterna albifrons Little Tern	Migratory	Breeding likely to occur within area
Thalassarche chlororhynchos Yellow-nosed Albatross, Atlantic Yellow-nosed Albatross	Migratory	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross	Migratory	Species or species habitat may occur within area
Migratory Marine Species		
Mammals		
Balaenoptera edeni Bryde's Whale	Migratory	Species or species habitat may occur within area
Balaenoptera musculus * Blue Whale	Migratory	Species or species habitat may occur within area
Dugong dugon Dugong	Migratory	Species or species habitat likely to occur within area
Eubalaena australis * Southern Right Whale	Migratory	Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin	Migratory	Species or species habitat may occur within area
Megaptera novaeangliae * Humpback Whale	Migratory	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca	Migratory	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin	Migratory	Species or species habitat may occur within area
Reptiles		
Caretta caretta * Loggerhead Turtle	Migratory	Breeding known to occur within area
Chelonia mydas * Green Turtle	Migratory	Species or species habitat may occur within area
Dermochelys coriacea * Leathery Turtle, Leatherback Turtle, Luth	Migratory	Species or species habitat may occur within area
Sharks		
Carcharodon carcharias Great White Shark	Migratory	Species or species habitat may occur within area
Rhincodon typus Whale Shark	Migratory	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Dataset Information]	Status	Type of Presence
Birds		
Anseranas semipalmata Magpie Goose	Listed - overfly marine area	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine area	Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater	Listed	Species or species habitat may occur within area
Catharacta skua Great Skua	Listed	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross	Listed	Foraging may occur within area
Gallinago hardwickii * Latham's Snipe, Japanese Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Listed - overfly marine area	Species or species habitat may occur within area
Lathamus discolor * Swift Parrot	Listed - overfly marine area	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel	Listed	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel	Listed	Species or species habitat may occur within area
Merops ornatus * Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Listed - overfly marine	Breeding may occur within area

	area	
Monarcha trivirgatus Spectacled Monarch	Listed - overfly marine area	Breeding likely to occur within area
Myiagra cyanoleuca Satin Flycatcher	Listed - overfly marine area	Breeding likely to occur within area
Nettapus coromandelianus albipennis Australian Cotton Pygmy-goose	Listed - overfly marine area	Species or species habitat may occur within area
Numenius phaeopus Whimbrel	Listed	Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail	Listed - overfly marine area	Breeding may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Sterna albifrons Little Tern	Listed	Breeding likely to occur within area
Thalassarche chlororhynchos Yellow-nosed Albatross, Atlantic Yellow-nosed Albatross	Listed	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross	Listed	Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong	Listed	Species or species habitat likely to occur within area
Ray-finned fishes		
Acentronura tentaculata Hairy Pygmy Pipehorse	Listed	Species or species habitat may occur within area
Campichthys tryoni Tryon's Pipefish	Listed	Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish	Listed	Species or species habitat may occur within area
Corythoichthys ocellatus Orange-spotted Pipefish, Ocellated Pipefish	Listed	Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish	Listed	Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish	Listed	Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish	Listed	Species or species habitat may occur within area
Hippichthys cyanospilos	Listed	Species or species habitat may occur

Blue-speckled Pipefish, Blue-spotted Pipefish		within area
Hippichthys heptagonus Madura Pipefish, Reticulated Freshwater Pipefish	Listed	Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish	Listed	Species or species habitat may occur within area
Hippocampus kelloggi Kellogg's Seahorse	Listed	Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse	Listed	Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse	Listed	Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse	Listed	Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish	Listed	Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish	Listed	Species or species habitat may occur within area
Micrognathus andersonii Anderson's Pipefish, Shortnose Pipefish	Listed	Species or species habitat may occur within area
Micrognathus brevirostris Thorn-tailed Pipefish	Listed	Species or species habitat may occur within area
Microphis manadensis Manado River Pipefish, Manado Pipefish	Listed	Species or species habitat may occur within area
Solegnathus dunckeri Duncker's Pipehorse	Listed	Species or species habitat may occur within area
Solegnathus hardwickii Pipehorse	Listed	Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse	Listed	Species or species habitat may occur within area
Solenostomus cyanopterus Blue-finned Ghost Pipefish, Robust Ghost Pipefish	Listed	Species or species habitat may occur within area
Solenostomus paradoxus Harlequin Ghost Pipefish, Ornate Ghost Pipefish	Listed	Species or species habitat may occur within area
Stigmatopora nigra Wide-bodied Pipefish, Black Pipefish	Listed	Species or species habitat may occur within area
Syngnathoides biaculeatus Double-ended Pipehorse, Alligator Pipefish	Listed	Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bend Stick Pipefish, Short-tailed Pipefish	Listed	Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish	Listed	Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish	Listed	Species or species habitat may occur within area

Reptiles

Astrotia stokesii Stokes' Seasnake	Listed	Species or species habitat may occur within area
Caretta caretta * Loggerhead Turtle	Listed	Breeding known to occur within area
Chelonia mydas * Green Turtle	Listed	Species or species habitat may occur within area
Dermochelys coriacea * Leathery Turtle, Leatherback Turtle, Luth	Listed	Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake	Listed	Species or species habitat may occur within area
Pelamis platurus Yellow-bellied Seasnake	Listed	Species or species habitat may occur within area
Whales and Other Cetaceans [Dataset Information]	Status	Type of Presence
Balaenoptera acutorostrata Minke Whale	Cetacean	Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale	Cetacean	Species or species habitat may occur within area
Balaenoptera musculus * Blue Whale	Cetacean	Species or species habitat may occur within area
Delphinus delphis Common Dolphin	Cetacean	Species or species habitat may occur within area
Eubalaena australis * Southern Right Whale	Cetacean	Species or species habitat likely to occur within area
Grampus griseus Risso's Dolphin, Grampus	Cetacean	Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin	Cetacean	Species or species habitat may occur within area
Megaptera novaeangliae * Humpback Whale	Cetacean	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca	Cetacean	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin	Cetacean	Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin	Cetacean	Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin	Cetacean	Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin	Cetacean	Species or species habitat may occur within area
Commonwealth Lands [Dataset Information]		
Communications, Information Technology and the Arts - Telstra Corporation Limited		

Extra Information

State and Territory Reserves [Dataset Information]

Cudgen Nature Reserve, NSW

Wooyung Nature Reserve, NSW

Regional Forest Agreements [Dataset Information]
Note that all RFA areas including those still under consideration have been included.

Upper North East NSW RFA, New South Wales

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the *Environment Protection and Biodiversity Conservation Act 1999*. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under "type of presence". For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the migratory and marine provisions of the Act have been mapped.

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgments

This database has been compiled from a range of data sources. The Department acknowledges the following custodians who have contributed valuable data and advice:

- New South Wales National Parks and Wildlife Service
- Department of Sustainability and Environment, Victoria
- Department of Primary Industries, Water and Environment, Tasmania
- Department of Environment and Heritage, South Australia Planning SA
- Parks and Wildlife Commission of the Northern Territory
- Environmental Protection Agency, Queensland
- Birds Australia
- Australian Bird and Bat Banding Scheme
- Australian National Wildlife Collection
- Natural history museums of Australia
- Queensland Herbarium
- National Herbarium of NSW
- Royal Botanic Gardens and National Herbarium of Victoria
- Tasmanian Herbarium
- State Herbarium of South Australia
- Northern Territory Herbarium
- Western Australian Herbarium
- Australian National Herbarium, Atherton and Canberra
- University of New England
- Other groups and individuals

ANUCliM Version 1.8, Centre for Resource and Environmental Studies, Australian National University was used extensively for the production of draft maps of species distribution. Environment Australia is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Last updated:

Department of the Environment and Water Resources
GPO Box 787 Canberra ACT 2601 Australia
Telephone: +61 (0)2 6274 1111

APPENDIX H

WATER QUALITY MONITORING – INSTALLATION OF WQM WELLS, SAMPLING METHODOLOGY, RESULTS AND DISCUSSION

BOGANGAR RECYCLED WATER REUSE SCHEME

TWEED SHIRE COUNCIL

GROUNDWATER QUALITY MONITORING

REVISION: 1.0 | **PROJECT NUMBER:** A1055100
OUR REFERENCE: Groundwater Quality Monitoring

Bogangar Groundwater Quality Monitoring

Tweed Shire Council engaged MWH to conduct water quality monitoring as part of the Bogangar Recycled Water Reuse Scheme.

Objectives

Primary Objective

To gather groundwater water quality data prior to the application of recycled water by irrigation to establish benchmark groundwater quality.

Secondary Objective

To gather information that will underpin the risk assessment process and provide a basis for assessing potential impacts of the use of recycled water on the environment and/or public health risks.

- To analyse results and provide verification that groundwater quality conditions prior to the application of recycled water by irrigation are in accordance with relevant environmental and public health guideline values;
- To provide sufficient supporting data to determine, with an acceptable level of confidence, the contamination status of the site relative to indicative guideline values; and
- To provide subsequent monitoring recommendations.

Methodology

The following guidelines were used to develop this water quality monitoring methodology:

- NSW Department of Environment and Conservation (2004) *Environmental Guidelines: Use of Effluent by Irrigation*
- NSW Department of Environment and Conservation (2005) *Marine Water Quality Objectives for NSW Ocean Waters*
- National Resource Management Ministerial Council, Environmental Protection and Heritage Council, and Australian Health Ministers Conference (2006) *National Water Quality Management Strategy: Australian Guidelines for Water Recycling – Managing Health and Environmental Risks (Phase 1)*
- ANZECC The Australian and New Zealand Environment Conservation Council *(2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality*
- AS/NZS 5667.11: *Water Quality Sampling Guidance on Sampling of Groundwater*
- AS/NZS 5667.1:1998 Water Quality – Sampling Part 1: *Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples*

Location

Two water quality monitoring bores were installed, one up gradient and one down gradient of the site, by Butler Partners Pty Ltd on the 27th August 2007. Well installation and development was based upon the ARMCANZ (2003) Minimum Construction Requirements for Water Bores in Australia. A bore licence for the installation of the wells was issued by NSW Department of Water and Energy on 2nd August 2007 and bore logs were forwarded to NSW DNR to complete licence requirements.

A site plan of well locations and bore reports including a detailed summary of the wells construction and development are documented in Appendix A of this Groundwater Quality Monitoring document.

Sample Collection

As illustrated in Appendix A of the document, water quality samples were collected from monitoring bores 1 and 2.

The following sampling methodology was used:

- Prior to sample collection the bore was purged to ensure that all stagnant water was removed. Bore purging was conducted in accordance with Groundwater Monitoring, Waterwatch Australia Technical Manual, 2005 and the AS/NZS 5667.11: Water Quality Sampling Guidance on Sampling of Groundwater.
- Sample collection was conducted in accordance with AS/NZS 5667.11: Water Quality Sampling Guidance on Sampling of Groundwater.
- Each well has its own disposable PVC 1 L bailer which was thoroughly cleaned and rinsed between each sample.
- Sample bottles were provided from the Tweed Laboratory Centre consisting of 2 x 220 ml bacterial analysis bottles and 2 x 1 L bottles.
- Two water samples were collected at each well consisting of 1 x 220 ml bacterial analysis bottle and 1 x 1 L bottle.
- Bottles were sealed, labelled with a unique identifier and placed into chilled receptacles for transportation to the laboratory under standard chain of custody protocol.
- Samples were delivered directly to the laboratory within four hours of sampling.

Laboratory Analysis

Laboratory analysis was undertaken by Tweed Laboratory Centre, 46 Enterprise Avenue, Tweed Heads South, NSW. Tweed Laboratory Centre is a NATA accredited laboratory.

Target Criteria / Critical Limits

Due to the site's proximity to the Pacific Ocean and the topography of the land, the Pacific Ocean is the appropriate endpoint for groundwater. Marine water quality objectives from the *Marine Water Quality Objectives for NSW Ocean Waters (DEC 2005)* and indicative guideline levels from the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)* were used to provide a point of reference for establishing the groundwater baseline data. Where indicative guideline levels were not available under the ANZECC 2000 guidelines then the NSW Environmental Guidelines: Use of Effluent 2004 levels were used.

Indicative guideline levels with a 95% level of protection value were used from the ANZECC 2000 Guidelines as the use of the statistically based 95% protection provides a more defensible basis for decisions than use of assessment factors alone. In addition, the 95% protection level is most commonly applied in the ANZECC 2000 Guidelines to ecosystems that could be classified as slightly too moderately disturbed. Due to the disturbed nature of the site, the area generally corresponds with the slightly too moderately disturbed classification as outline in the guidelines.

Constituents

Table 1. Constituents

Constituents	Indicative Guideline Levels	Reference
Dissolved major anions		
Nitrite	-	-
Nitrate	ID[1]	Table 3.4.1[2]
Sulfate	-	-
Chloride	-	-
Fluoride	-	-
Bromide	-	-
Alkalinity	-	-

[1] Insufficient data to derive a reliable trigger value (ANZECC 2000)
[2] Table 3.4.1 Toxicant values for toxicants at alternative levels of protection - Trigger values for marine water (μgL^{-1})[2] Level of protection 95% species[2] (ANZECC 2000)

Constituents	Indicative Guideline Levels	Reference
Total metals		
Iron	ID	Table 3.4.1
Dissolved metals		
Aluminium pH >6.5 pH <6.5	ID	Table 3.4.1
Arsenic - total	ID	Table 3.4.1
Cadmium	5.5 µg/L (B[3]C[4])	Table 3.4.1
Chromium - total	-	-
Copper	1.3 µg/L	Table 3.4.1
Lead	4.4 µg/L	Table 3.4.1
Manganese	ID	Table 3.4.1
Nickel	70 µg/L (C)	Table 3.4.1
Zinc	15 µg/L (C)	Table 3.4.1
Total Mercury Mercury - total Inorganic Methyl	 - 0.4 µg/L (C) ID	 - Table 3.4.1 Table 3.4.1
Ammonia as N Ammonia[5]	 910 µg/L	 Table 3.4.1
Total Nitrogen	120 µgNL^{-1}	Table 3.3.2[6]
Nitrite plus Nitrate as NO_x	5 µgNL^{-1} ([K7])	Table 3.3.2
Total Phosphorus as P	25 µg L^{-1} (N[8])	Table 3.3.2
Biochemical Oxygen Demand (BOD) Municipal uncontrolled access[9] Municipal control access Agricultural non-food (turf)	 ≤2 NTU - -	Table A1[10]
Faecal coliforms	150/100 mL	Table Marine WQO[11]
Electrical conductivity (dS/m)	-	-
pH Lower limit Upper limit	 6.5 8.5	 Table 3.3.2 Table 3.3.2
SAR (mg/L) Sodium Calcium Magnesium	 - - -	 - - -
Potassium	-	-

[3] B = Chemicals for which bioaccumulation and secondary poisoning effects should be considered (ANZECC 2000)

[4] C = Figure may not protect key test species from acute toxicity (and chronic) (ANZECC 2000)

[5] Ammonia as TOTAL ammonia as [NH_3-N] at pH 8 (ANZECC 2000)

[6] Table 3.3.2 Default trigger values for physical and chemical stressors for south-east Australia for slightly disturbed ecosystems[6] (ANZECC 2000)

[7] K = values of 25 ugL^{-1} for NO_x and 20 ugL^{-1} for NH_4^+ for NSW are elevated due to frequent upwelling events (ANZECC 2000)

[8] Values are 20 ugL^{-1} for TP for offshore waters (ANZECC 2000)

[9] Limit met prior to disinfection. 24 hour mean value. 5 NTU maximum value not to be exceeded (Environmental Guidelines: Use of Effluent by Irrigation, NSW 2004)

[10] Table A1: Guidelines for treatment, disinfection and irrigation controls for the spray application of municipal sewage effluent (Environmental Guidelines: Use of Effluent by Irrigation, NSW 2004)

[11] Table: Primary Contact Recreation - Marine Water Quality Objectives for NSW Ocean Waters (DEC 2005)

Results

Groundwater samples were taken from the bores and submitted for testing and reference should be made to the detailed results included in Appendix B. Table 2. compares the results against trigger levels.

Table 2. Comparison of results against trigger levels

				Results	
Test	Method	Trigger levels	Reference	BH-1	BH-2
Faecal coliforms (membrane presumptive) cfu/100mL	B1	150/100 mL	WQO	<10	<10
pH (pH units)	P1	6.5 – 8.5	Table 3.3.2	5.4	5.4
BOD_5 mg/L	C1	≤ 2 NTU	Table A1	2.4	1.0
Conductivity @ 25ºC μScm^{-1}	P2	-	-	82	178
Sodium Absorption Ratio				1.2	1.0
Sodium mg/L	M8	-	-	12	15
Calcium mg/L	M8	-	-	3.8	9.5
Magnesium mg/L	M8	-	-	2.1	4.6
Potassium mg/L	M8	-	-	<5	<5
Nitrite – N mg/L	C4	ID	Table 3.4.1	<0.05	<0.05
Nitrate – N mg/L	C4	5 μgNL^{-1}	Table 3.4.1	0.09 (90 μgNL^{-1})	1.93 (1930 μgNL^{-1})
Sulphate mg/L	M8	-	-	5.9	32.3
Chloride mg/L	C24	-	-	14.7	25.9
Fluoride mg/L	C36	-	-	<0.1	<0.1
Total Phosphorus – P mg/L	C17	25 $\mu g\ L^{-1}$	Table 3.3.2	0.79 (790µg/L)	0.08 (80µg/L)
Bromide mg/L	M8	-	-	0.05	0.04
Alkalinity mg/L as CaCO3	C10	-	-	13	11
Iron (total) mg/L	M8	ID	Table 3.4.1	3.40	1.31
Aluminium (soluble) mg/L	M8	ID	Table 3.4.1	1.79	1.43

				Results	
Test	Method	Trigger levels	Reference	BH-1	BH-2
Arsenic (soluble) mg/L	M8	ID	Table 3.4.1	<0.005	<0.005
Cadmium (soluble) mg/L	M7	5.5 µg/L	Table 3.4.1	<0.001 (<1 µg/L)	<0.001 (<1 µg/L)
Chromium (soluble) mg/L	M8	-	-	<0.01	<0.01
Copper (soluble) mg/L	M7	1.3 µg/L	Table 3.4.1	0.002 (2 µg/L)	<0.001(<1 µg/L)
Lead (soluble) mg/L	M7	4.4 µg/L	Table 3.4.1	<0.001(<1 µg/L)	<0.001(<1 µg/L)
Manganese (soluble) mg/L	M8	ID	Table 3.4.1	0.02	0.02
Nickel (soluble) mg/L	M8	70 µg/L (C)	Table 3.4.1	<0.01 (<10 µg/L)	0.01 (10 µg/L)
Zinc (soluble) mg/L	M8	15 µg/L (C)	Table 3.4.1	0.09 (90 µg/L)	0.03 (30 µg/L)
Ammonia – N mg/L	C3	910 µg/L	Table 3.4.1	0.08 (800 µg/L)	0.28 (280 µg/L)
Total – N mg/L	C55	120 μgNL^{-1}	Table 3.3.2	3.99 (3990 μgNL^{-1})	3.07 (3070 μgNL^{-1})
Nitrogen – oxidised mg/L	C4	5 μgNL^{-1}	Table 3.3.2	0.086 (86 μgNL^{-1})	1.929 (1929 μgNL^{-1})

Discussion

Results for seven indicators exceeded The Australian and New Zealand Environment Conservation Council, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)* guideline trigger values. The laboratory results and discussion are contained within Appendix I of this report. These were biological oxygen demand (BOD) and copper in BH1 and pH, zinc, total phosphorus, total nitrogen and oxidized nitrogen in both BH1 and BH2.

The elevated levels of copper and zinc may be a result of stormwater runoff entering the groundwater system. There are a number of reasons why the groundwater results are elevated for both nitrogen and phosphorus. Excess fertilizer may have been applied to the rugby field or through nearby agricultural practices which could have leached through to the groundwater. There is a possibility that the existing treatment plant outfall in the sand dunes approximately 500 m south of the site may be affecting the groundwater system.

While the total nitrogen levels are only marginally higher than the estuarine or lowland river trigger levels in ANZECC (2000), they are substantially higher than the marine trigger values.

BOD is only slightly above the trigger level in BH1 and may be related to catchment land-use practices.

Recommendations

The following strategies are recommended to ensure the long term viability of recycled water irrigation at the site:

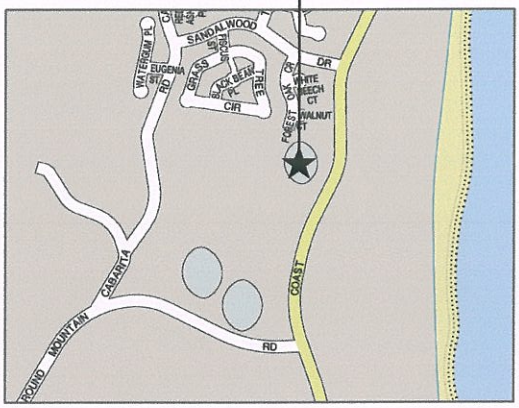
- Regular water quality sampling (at least bi-annually);
- Ensuring that grass clippings are removed after mowing. These clippings may return N and P to the soil over the long term. If these clippings are not able to be removed from the site, then we recommend a regular soil sampling and monitoring program (every 3-5 years) is recommended to ensure accumulations of N and P in the soil do not exceed guideline levels; and
- Ensure application rates are sustainable. At 10ML/annum and 20ML/annum, the modelling indicates that very low amounts of nutrient will enter groundwaters. Water movement may be restricted at depth in the soil profile due to the presence of coffee rock and excessive irrigation amounts may cause water tables to rise if permeability is restricted. In any case, regular monitoring of groundwater bore water levels and laboratory analysis of parameters such as nutrients, heavy metals, Ec and pH will be required to determine long term recycled water irrigation sustainability.

The implementation of the Recycled Water Management Plan for the site and its continual review and improvements provide a mechanism for managing and minimising risk over the site. In particular, the minimisation of over irrigation and ensuring that application rates are sustainable in the short and long term.

APPENDIX A

GROUNDWATER QUALITY MONITORING WELL LOCATIONS, INSTALLATION AND BORE LOGS

SITE

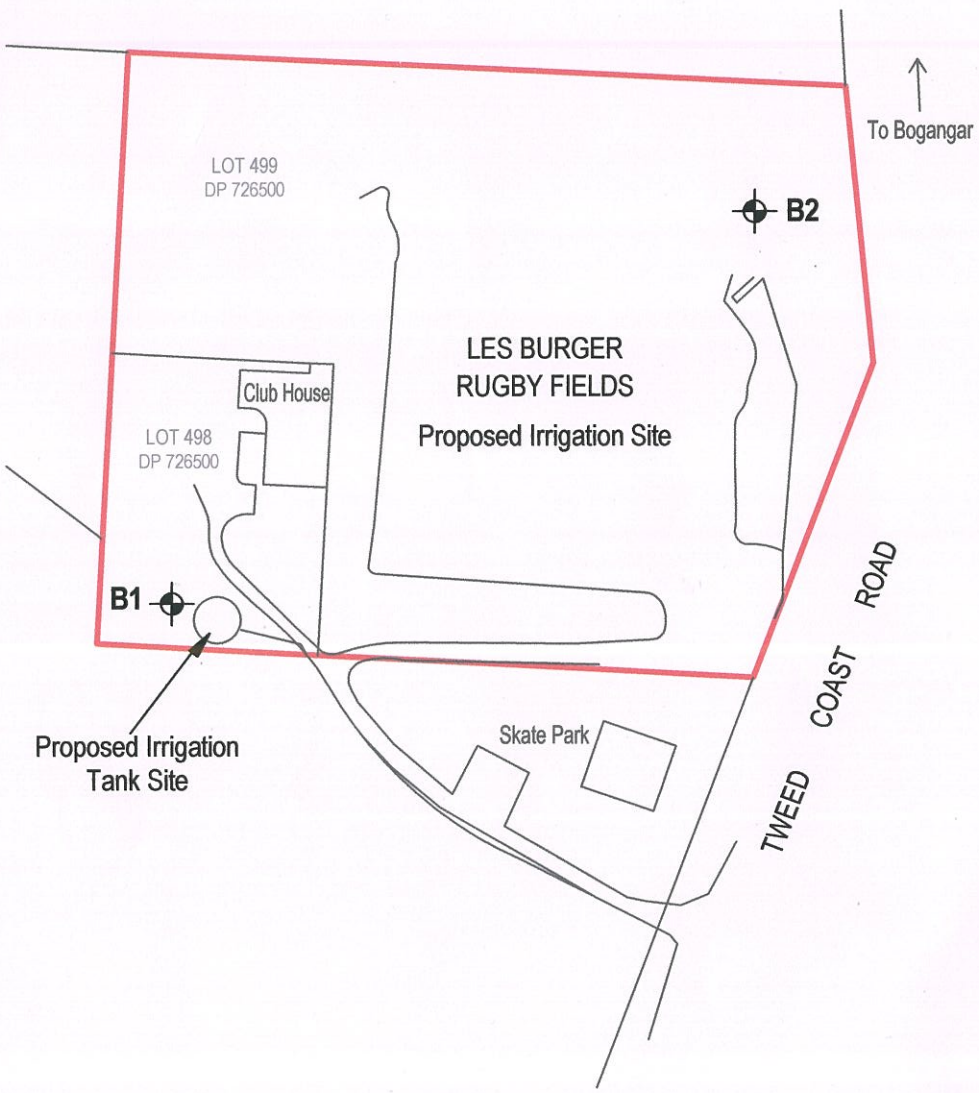


Reproduced with Permission, Copyright Universal Press Pty Ltd
UBD Reference: Map O Ref F11 (51st Edition) N.T.S.

LEGEND

GW1 Groundwater Well

Site Boundary



Reference: MWH's 'Project Site Plan', Drawing No.WT06031/03, dated 20.01.07

ACEA

CLIENT:

MWH AUSTRALIA PTY LTD

BUTLER PARTNERS

79 Doggett Street, Newstead
Queensland 4006 Australia
Telephone 61 7 3852 3800
Facsimilie 61 7 3852 3808

LES BURGER RUGBY FIELDS

TWEED COAST ROAD, BOGANGAR

LOCALITY PLAN AND TEST LOCATIONS

NORTH

0 50 100m

SCALE: 1:2500 (A4)

DATE: SEPTEMBER 2007

DRAWN BY: FD

APPROVED:

PROJECT No: 07182

DRAWING No: 1 REV: A

BORE REPORT

BUTLER PARTNERS

Client: MWH Australia Pty Ltd
Project: Well Monitoring Installation
Location: Les Burger Rugby League Fields, Bogangar
Project No: 07182

BORE 2 - Groundwater

Page No: 1 of 1
Date: 27 August 2007
Ground Surface Level:

Depth (m)	Description	RL (m)	Lithology	Sample Type	Sample Depth (m)	Sample ID	Test Results	Groundwater Bore Details
0	***SAND (SW)*** - dark grey-black, fine grained, dry	0.0						Lock Cover, Concrete, Sand
1	- light-grey, fine grained, moist	-1.0						Blank
2		-2.0						Bentonite
3	- dark brown, fine grained, moist	-3.0						
4		-4.0						Sand
5	- white with black mottling, fine grained, wet	-5.0						
6	***SANDY CLAY (SC)*** - dark brown, fine to medium grained (indurated sand), dry	-6.0						
7	***SANDY CLAY (SC)*** - dark brown, fine grained, moist	-7.0						Slotted 50mm PVC screen
8		-8.0						
9	End of Bore at 9 m	-9.0						End Cap
10		-10.0						

D	Disturbed Sample	E	Environmental Sample	C	NMLC Coring
B	Bulk Sample	S	Standard Penetrometer Test (SPT)	Is(50)	Point Load Test Result (MPa)
U	Undisturbed Tube (50mm diameter)	HB	SPT Hammer Bouncing	(d)	Diametral Point Load Strength Test
pp	Pocket Penetrometer Test (kPa)	( )	No Sample Recovery	(a)	Axial Point Load Strength Test

Rig: EZE-CAT Track Mounted
Drilling Method: 100mm solid flight auger, 200mm hollow flight auger
Groundwater: Groundwater encountered at 2.6m in sand to 5.2m.
Remarks:

BORE REPORT

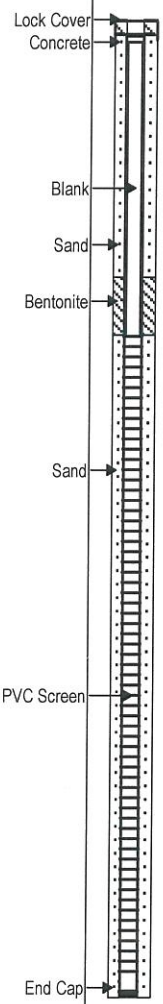
BUTLER PARTNERS

Client: MWH Australia Pty Ltd
Project: Monitoring Well Installation
Location: Les Burger Rugby League Fields, Bogangar.
Project No: 07182

BORE 1 - Groundwater

Page No: 1 of 1
Date: 27 & 28 August 2007
Ground Surface Level:

Depth (m)	Description	RL (m)	Lithology	Sample Type	Sample Depth (m)	Sample ID	Test Results	Groundwater Bore Details
0		0.0						
	SAND (SW) - white, fine grained, dry to moist							
1		-1.0						
2		-2.0						
						2.3		
						2.8		
3		-3.0						
	- white, fine grained, moist							
4		-4.0						
5		-5.0						
	SANDY CLAY (SC) - dark brown, fine to medium grained							
	- weathered coffey rock (indurated sand)							
6		-6.0						
7		-7.0						
8		-8.0						
9		-9.0						
	End of Bore at 9 m							
10		-10.0						



D	Disturbed Sample	E	Environmental Sample	C	NMLC Coring
B	Bulk Sample	S	Standard Penetrometer Test (SPT)	Is(50)	Point Load Test Result (MPa)
U	Undisturbed Tube (50mm diameter)	HB	SPT Hammer Bouncing	(d)	Diametral Point Load Strength Test
pp	Pocket Penetrometer Test (kPa)	( )	No Sample Recovery	(a)	Axial Point Load Strength Test

Rig: EZE-CAT Track Mounted
Drilling Method: 100 mmm soild flight auger, 200 mm hollow flight auger
Groundwater: Groundwater encountered at 3.0m in sand to 5.6m.
Remarks:

Department of Water and Energy

North Coast Region
Locked Bag 10

Grafton NSW 2460
Phone: (02) 66416500

BORE LICENSE CERTIFICATE
UNDER SECTION 115 OF THE WATER ACT, 1912

30BL184759

New South Wales Government

Tweed Shire Council
P O Box 816
Murwillumbah NSW 2484

LICENSE NUMBER
30BL184759
DATE LICENSE VALID FROM
02-Aug-2007
DATE LICENSE VALID TO
PERPETUITY
FEE
$0.00

ABN 27380445450 GST NIL

LOCATION OF WORKS

Portion(s) or Lot/Section/DP	PARISH	COUNTY
498//726500	Cudgen	Rous

TYPE OF WORKS	PURPOSE(S) FOR WHICH WATER MAY BE USED
Bore	Monitoring Bore

CONDITIONS APPLYING TO THIS LICENSE ARE

As shown on the attached Condition Statement

ORIGINAL

Department of Water and Energy

North Coast Region
Locked Bag 10

Grafton NSW 2460
Phone: (02) 66416500

BORE LICENSE CERTIFICATE
UNDER SECTION 115 OF THE WATER ACT, 1912

30BL184758

New South Wales Government

Tweed Shire Council
P O Box 816
Murwillumbah NSW 2484

LICENSE NUMBER
30BL184758
DATE LICENSE VALID FROM
02-Aug-2007
DATE LICENSE VALID TO
PERPETUITY
FEE
$0.00

ABN 27380445450 GST NIL

LOCATION OF WORKS

Portion(s) or Lot/Section/DP	PARISH	COUNTY
499//726500	Cudgen	Rous

TYPE OF WORKS	PURPOSE(S) FOR WHICH WATER MAY BE USED
Bore	Monitoring Bore

CONDITIONS APPLYING TO THIS LICENSE ARE

As shown on the attached Condition Statement

ORIGINAL

APPENDIX B

LABORATORY RESULTS

TWEED LABORATORY CENTRE
A COMMERCIAL UNIT OF THE TWEED SHIRE COUNCIL ABN 90 178 732 496

46 Enterprise Avenue,
Tweed Heads South NSW 2486.
Phone (07) 5569 3100
Fax (07) 5524 2676

All correspondence:
Tweed Shire Council
PO Box 816
Murwillumbah NSW 2484

LABORATORY REPORT

Lab No: 9890-sw
LIMs No: 07/0771

Client: MWH Australia Pty Ltd
Address: Suite 4
60 Nerang Street
NERANG
Q'LD 4211

Attention: Brigita Arrowsmith
Fax No: 07 5578 4295
Email: Brigita.arrowsmith@mwhglobal.com
Job No: D3550.4626.30000

Sample Description: Hastings Point Recycled Water Study.

Taken By: Client
Date Taken: 04/09/2007
Date Received: 04/09/2007
Date Testing Commenced: 04/09/2007
Date Testing Completed: 05/09/2007

			Results	
Test	**Units**	**Method**	**BH-1**	**BH-2**
Faecal coliforms (membrane presumptive)	**cfu/100mL**	**B1**	<10	<10

Results refer to samples as received at the Laboratory.
All pages of this Report have been checked and approved.

NATA ACCREDITED FOR TECHNICAL COMPETENCE

This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025.
Accreditation No: 13538

Dr PJ Wright
(Senior Technical Officer)

Date of Report: 11 September 2007

TWEED LABORATORY CENTRE
A COMMERCIAL UNIT OF THE TWEED SHIRE COUNCIL ABN 90 178 732 496

46 Enterprise Avenue,
Tweed Heads South NSW 2486.
Phone (07) 5569 3100
Fax (07) 5524 2676

All correspondence:
Tweed Shire Council
PO Box 816
Murwillumbah NSW 2484

LABORATORY REPORT

Lab No: 9890-sw
LIMs No: 07/0771

Client: MWH Australia Pty Ltd
Address: Suite 4
60 Nerang Street
NERANG
Q'LD 4211

Attention: Brigita Arrowsmith
Fax No: 07 5578 4295
Email: Brigita.arrowsmith@mwhglobal.com
Job No: D3550.4626.30000

Sample Description: Hastings Point Recycled Water Study.

Taken By: Client
Date Taken: 04/09/2007
Date Received: 04/09/2007
Date Testing Commenced: 04/09/2007
Date Testing Completed: 11/09/2007

		Results	
Test	**Method**	**BH-1**	**BH-2**
pH (pH units)	**P1**	5.4	5.4
BOD_5 mg/L	**C1**	2.4	1.0
Conductivity @ 25°C μScm^{-1}	**P2**	82	178
Sodium Absorption Ratio	**--**	1.2	1.0
Sodium mg/L	**M8**	12	15
Calcium mg/L	**M8**	3.8	9.5
Magnesium mg/L	**M8**	2.1	4.6
Potassium mg/L	**M8**	<5	<5
Nitrite – N mg/L	**C4**	<0.05	<0.05
Nitrate – N mg/L	**C4**	0.09	1.93
Sulphate mg/L	**M8**	5.9	32.3
Chloride mg/L	**C24**	14.7	25.9
Fluoride mg/L	**C36**	<0.1	<0.1
Total Phosphorus – P mg/L	**C17**	0.79	0.08

NATA ACCREDITED FOR TECHNICAL COMPETENCE

This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025.
Accreditation No: 12754

Edward Dickson
(Laboratory Coordinator)

Date of Report: 14 September 2007

LABORATORY REPORT

		Results	
Test	**Method**	**BH-1**	**BH-2**
Bromide mg/L	**M8**	0.05	0.04
Alkalinity mg/L as $CaCO_3$	**C10**	13	11
Iron (total) mg/L	**M8**	3.40	1.31
Aluminium (soluble) mg/L	**M8**	1.79	1.43
Arsenic (soluble) mg/L	**M8**	<0.005	<0.005
Cadmium (soluble) mg/L	**M7**	<0.001	<0.001
Chromium (soluble) mg/L	**M8**	<0.01	<0.01
Copper (soluble) mg/L	**M7**	0.002	<0.001
Lead (soluble) mg/L	**M7**	<0.001	<0.001
Manganese (soluble) mg/L	**M8**	0.02	0.02
Nickel (soluble) mg/L	**M8**	<0.01	0.01
Zinc (soluble) mg/L	**M8**	0.09	0.03
Ammonia – N mg/L	**C3**	0.08	0.28
Total – N mg/L	**C55**	3.99	3.07
Nitrogen – oxidised mg/L	**C4**	0.086	1.929

Results refer to samples as received at the Laboratory.
All pages of this Report have been checked and approved.

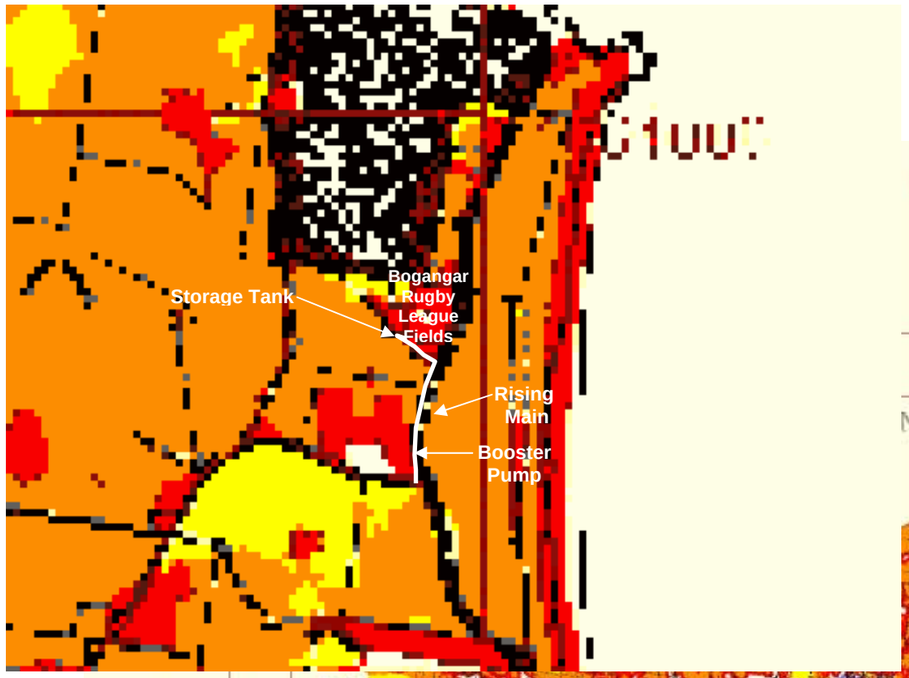
This Report replaces the Report issued 11 September 2007 (pH results now included).

Edward Dickson
(Laboratory Coordinator)

Date of Report: 14 September 2007

APPENDIX I

TWEED SHIRE BUSH FIRE PRONE LAND MAP



Map 1 of 2

Tweed Shire Bush Fire Prone Land

February 2004

Click for high definition version

KYOGLE SHIRE

BYRON SHIRE

LISMORE CITY

2 0 2 4 6 8 Kilometres

Bush Fire Prone Land Map -Legend

- Bush Fire Prone Land - Vegetation Category 1
- Bush Fire Prone Land - Vegetation Category 2
- Bush Fire Prone Land - Buffer Zones - 100m and 30m
- Major Roads
- Tweed Shire Boundary
- Property Boundaries

Ecograph

APPENDIX J

HASTINGS POINT STP ENVIRONMENTAL PROTECTION LICENCE

Section 55 Protection of the Environment Operations Act 1997

Environment Protection Licence

Licence - 3618

Department of **Environment & Climate Change** NSW

Licence Details	
Number:	3618
Anniversary Date:	19-February
Review Due Date:	04-Mar-2010

Licensee

TWEED SHIRE COUNCIL
PO BOX 816
MURWILLUMBAH NSW 2484

Licence Type

Premises

Premises

HASTINGS POINT SEWAGE TREATMENT PLANT
ROUND MOUNTAIN ROAD
HASTINGS POINT NSW 2489

Scheduled Activity

Sewage Treatment Systems

Fee Based Activity	**Scale**
Sewage Treatment - processing by small plants (< 10000 ML per year) (71[a])	> 219 - 1000 ML discharged

Region

North East - North Coast
NSW Govt Offices, 49 Victoria Street
GRAFTON NSW 2460
Phone: 02 6640 2500
Fax: 02 6642 7743

PO Box 498 GRAFTON
NSW 2460

Environment Protection Licence

Licence - 3618

Department of Environment & Climate Change NSW

Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 ("the Act") and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 - 132 of the Act); and
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).

The EPA publication "A Guide to Licensing" contains information about how to calculate your licence fees.

The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

TWEED SHIRE COUNCIL
PO BOX 816
MURWILLUMBAH NSW 2484

subject to the conditions which follow.

1 Administrative conditions

A1 What the licence authorises and regulates

A1.1 Not applicable.

A1.2 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity
Sewage Treatment Systems

Fee Based Activity	Scale
Sewage Treatment - processing by small plants (< 10000 ML per year) (71[a])	> 219 - 1000 ML discharged

A1.3 Not applicable.

A2 Premises to which this licence applies

A2.1 The licence applies to the following premises:

Premises Details
HASTINGS POINT SEWAGE TREATMENT PLANT
ROUND MOUNTAIN ROAD
HASTINGS POINT
NSW
2489
LOT 3 DP 601993; LOT 1 DP 808376

A2.2 The premises also includes the reticulation system owned and operated by the licensee that is associated with the sewage treatment plant(s) identified in condition A2.1.

A2.3 The premises also includes the infiltration dune disposal area LOT 1 DP 808736 labelled “Effluent Dune Disposal Area” marked with red crosses on map titled “Fig 2” submitted to the EPA with Licence Information Form dated 20/12/99.

A3 Other activities

A3.1 This licence applies to all other activities carried on at the premises, including:

Grease Trap Waste Treatment Facility

A4 Information supplied to the EPA

A4.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:

(a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
(b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

A5 Objectives of this licence

A5.1 The objectives of this licence are to:

(a) prevent as far as practicable sewage overflows and sewage treatment plant bypasses;
(b) require proper and efficient management of the system to minimise harm to the environment and public health; and
(c) require practical measures to be taken to protect the environment and public health from sewage overflows and sewage treatment plant effluent.

A5.2 This licence is to be construed in a manner that will promote the objectives referred to in A5.1.

2 Discharges to air and water and applications to land

P1 Location of monitoring/discharge points and areas

P1.1 Not applicable.

P1.2 The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.

P1.3 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.

Water and land

EPA identi-fication no.	Type of monitoring point	Type of discharge point	Description of location
1		Discharge to waters - dry weather	Exfiltration dune disposal area approximately 100 metres east of the junction of Coast and Round Mountain Roads as shown on locality plan submitted with Licence Information Form dated 20/12/99
2	Wet weather discharge and volume monitoring	Wet weather discharge and volume monitoring	Effluent disposal line to Christies Creek as shown on locality map submitted with Licence Information Form dated 20/12/99. Monitoring by calculation.
3	Effluent quality monitoring		Effluent pumping station
4	Total volume moitoring		Inlet to works
5	Effluent quality monitoring		The first effluent distribution box located at exfiltration dune disposal area approximately 100 metres east of the junction of Coast and Round Mountain Roads as shown on "Fig 2" submitted to the EPA with the Licence Information Form dated 20/12/99.

3 Limit conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L1.2 The licensee may only discharge untreated or partially treated sewage from the sewage treatment plant and/or the reticulation system subject to the conditions of this licence, including O1 and O2.

L2 Load limits

L2.1 The actual load of an assessable pollutant discharged from the premises during the reporting period must not exceed the load limit specified for the assessable pollutant in the table below.

Note: An assessable pollutant is a pollutant which affects the licence fee payable for the licence.

L2.2 The actual load of an assessable pollutant must be calculated in accordance with the relevant load calculation protocol.

Assessable Pollutant	Load limit (kg)
BOD (Enclosed Waters)	5000
Nitrogen (total) (Enclosed Waters)	9645

Assessable Pollutant	Load limit (kg)
Oil and Grease (Enclosed Waters)	4823
Phosphorus (total) (Enclosed Waters)	5000
Total suspended solids (Enclosed Waters)	9645

Note: The load limits referred to in condition L2.1 do not apply to discharges from the reticulation system.

Load Reduction Agreement

L2.3 When a Load Reduction Agreement expires or is terminated the EPA will, after consultation with the licensee, apply a new load limit having regard to the agreed load in the table below or the load that may be achievable if the agreement is terminated early.

Assessable Pollutant	Agreed Load (kg)
Total Phosphorus	665

Note: For the purposes of calculating fees payable by the licensee on termination or expiration of the Load Reduction Agreement under clause 28B of the Protection of the Environment Operations (General) Regulation, the maximum load for each assessable pollutant is taken to be the lowest reported actual load over the agreement period minus one percent.

L2.4 If the licence is transferred during the reporting period immediately preceding the termination or expiration of the Load Reduction Agreement, a reference in condition L2.3 to the actual load reported in the Annual Return for that period is taken to be a reference to the total of the actual loads reported in the Annual Returns prepared by the transferring licensee and the new licensee.

Note: Condition R1.3 requires an Annual Return to be prepared by both the transferring licensee and the new licensee.

L3 Concentration limits

L3.1 For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.

L3.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.

L3.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.

Water and Land

POINT 1

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile Concentration Limit
Oil and Grease	milligrams per litre	-	-	-	10
Total suspended solids	milligrams per litre	20	25	-	40
Biochemical oxygen demand	milligrams per litre	20	25	-	40

L3.4 For the purpose of determining compliance with the specified Total Suspended Solids (TSS) licence limit, the concentration of TSS in samples collected, must be determined using the following equation:

TSS(a) (milligrams per litre) = TSS (b) (milligrams per litre) minus 0.1 times chlorophyll "a" (micrograms per litre).

TSS(a) = TSS concentration calculated for compliance.
TSS(b) = Measured concentration of TSS (including algae).

The chlorophyll "a" analysis must be carried out on a subsample of the sample collected for the determination of the measured TSS. The sample must be well mixed when subsampling.

L4 Volume and mass limits

L4.1 For each discharge point or utilisation area specified below (by a point number), the volume/mass of:

(a) liquids discharged to water; or;

(b) solids or liquids applied to the area;

must not exceed the volume/mass limit specified for that discharge point or area.

Point	Unit of measure	Volume/Mass Limit
1	kilolitres per day	2500

L5 Waste

L5.1 The licensee must not cause, permit or allow any waste generated outside the premises to be received at the premises for storage, treatment, processing, reprocessing or disposal or any waste generated at the premises to be disposed of at the premises, except as expressly permitted by the licence.

L5.2 This condition only applies to the storage, treatment, processing, reprocessing or disposal of waste at the premises if those activities require an environment protection licence.

L5.3 The licensee may receive and/or transfer sewage and Group C waste generated outside the premises for treatment, processing or reprocessing at the premises. The licensee must take reasonable steps to ensure that sewage received at the premises has been lawfully discharged in accordance with a trade waste agreement or customer contract (as applicable) in force between the licensee and the generator of the waste. The licensee must treat, process or reprocess the sewage and Group C waste in accordance with this licence prior to discharge from the premises.

L5.4 The licensee may receive, store, treat, process or reprocess and/or transfer at the premises sewage products generated or stored outside the premises by the licensee's other sewage treatment systems. Sewage products must be received, treated, processed or reprocessed in accordance with this licence.

L6 Noise Limits

L6.1 Not applicable.

L7 Frequency limits

L7.1 Discharges through point 2 are only permitted when the STP inflow exceeds 6920 kL/day.

L8 Potentially offensive odour

L8.1 No condition in this licence identifies a potentially offensive odour for the purposes of section 129 of the Protection of the Environment Operations Act 1997.

Note: Section 129 of the Protection of the Environment Operations Act 1997 provides that the licensee must not cause or permit the emission of any offensive odour from the premises but provides a defence if the emission is identified in the relevant environment protection licence as a potentially

offensive odour and the odour was emitted in accordance with the conditions of a licence directed at minimising odour.

4 Operating conditions

O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.

This includes:
(a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
(b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

Note: The requirements of O1.1 apply to the whole of the premises, including the reticulation system.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:
(a) must be maintained in a proper and efficient condition; and
(b) must be operated in a proper and efficient manner.

Note: The requirements of O2.1 apply to the whole of the premises, including the reticulation system.

O3 Appropriate treatment processes

O3.1 Sewage or effluent must not be discharged from Point(s) 1 unless it has been treated in accordance with the requirements of the table below.

Required treatment process	Flow range
Screening and oxidation ponding	All sewage inflows

The flows noted in the table above are the inflows to the premises' sewage treatment plant(s).

O3.2 However the licensee is not taken to have breached this condition if the licensee can demonstrate:

(a) the failure to treat the liquid waste as required was solely as a result of a failure of the power supply to the premises, or a failure of essential equipment;
(b) the failure of power supply or equipment could not reasonably have been prevented; and
(c) normal operating conditions were restored as soon as possible after the power supply failure or the failure of essential equipment.

O4 Prohibition on acceptance of pesticides

O4.1 The licensee must not consent to the receipt of organochlorine pesticides (including dieldrin, heptachlor and chlordane) into the sewage treatment system after October 2003.

O5 Biosolids management

O5.1 Biosolids at the premises must be stored, treated, processed, classified, transported and disposed in accordance with the Biosolids Guidelines, or as otherwise approved in writing by the EPA.

Note: This condition does not apply to the reuse or disposal of biosolids by the licensee at locations other than the premises.

O6 Effluent application to land

O6.1 The quantity of effluent applied to the utilisation area(s) must not exceed the capacity of the utilisation area(s) to effectively utilise the effluent.

For the purpose of this condition, “effectively utilise” includes the ability of the soil to absorb the nutrient, salt and hydraulic loads and the applied organic material without causing harm to the environment.

O6.2 Effluent application to the utilisation area(s) must not occur in a manner that causes surface run-off from the utilisation area(s).

O6.3 Spray from effluent application to the utilisation area(s) must not drift beyond the boundary of the utilisation area(s) to which it has been applied.

O7 New sewage pumping stations

O7.1 Dry weather overflows resulting in pollution of waters from any sewage pumping station(s) installed within the sewage treatment system after January 2004 are not permitted.

O8 Extensions to the reticulation system

O8.1 The licensee must ensure that any extensions to the reticulation system after January 2004 are planned, designed, constructed and installed to prevent as far as practicable overflows from the premises.

Note: “The premises” includes both the new and the previously existing parts of the sewage treatment system.

5 Monitoring and recording conditions

M1 Monitoring records

M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.

M1.2 All records required to be kept by this licence must be:
(a) in a legible form, or in a form that can readily be reduced to a legible form;
(b) kept for at least 4 years after the monitoring or event to which they relate took place; and
(c) produced in a legible form to any authorised officer of the EPA who asks to see them.

M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:
(a) the date(s) on which the sample was taken;
(b) the time(s) at which the sample was collected;
(c) the point at which the sample was taken; and
(d) the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:

Water and Land

POINT 3

Pollutant	Units of measure	Frequency	Sampling Method
Biochemical oxygen demand	milligrams per litre	Special Frequency 1	Representative sample
Nitrogen (total)	milligrams per litre	Special Frequency 1	Representative sample
Oil and Grease	milligrams per litre	Special Frequency 1	Representative sample
Phosphorus (total)	milligrams per litre	Special Frequency 1	Representative sample
Total suspended solids	milligrams per litre	Special Frequency 1	Representative sample

POINT 5

Pollutant	Units of measure	Frequency	Sampling Method
Faecal Coliforms	colony forming units per 100 millilitres	Special Frequency 1	Representative sample

For the purpose of the table above Special Frequency 1 means the collection of samples at least once every fortnight and at a minimum of 10 day intervals.

M3 Testing methods - concentration limits

M3.1 Not applicable.

M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

Note: Testing methods - load limit

Note: Clause 18 (1) and (2) of the Protection of the Environment Operations (General) Regulation 1998 requires that monitoring of actual loads of assessable pollutants listed in L2.1 must be carried out in accordance with the testing method set out in the relevant load calculation protocol for the fee-based activity classification listed in condition A1.2.

M4 Recording of pollution complaints

M4.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.

M4.2 The record must include details of the following:
(a) the date and time of the complaint;
(b) the method by which the complaint was made;
(c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
(d) the nature of the complaint;
(e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
(f) if no action was taken by the licensee, the reasons why no action was taken.

M4.3 The record of a complaint must be kept for at least 4 years after the complaint was made.

M4.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M5 Telephone complaints line

M5.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.

M5.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.

M5.3 Conditions M5.1 and M5.2 do not apply until 3 months after:
(a) the date of the issue of this licence or
(b) if this licence is a replacement licence within the meaning of the Protection of the Environment Operations (Savings and Transitional) Regulation 1998, the date on which a copy of the licence was served on the licensee under clause 10 of that regulation.

M5.4 For the purpose of condition M5.1, operating hours are defined as twenty-four hours a day, seven days a week.

M5.5 The public notification referred to in condition M5.2 must include specific reference to the fact that the complaints line may be used by the community for the reporting of overflows.

M6 Requirement to monitor volume or mass

M6.1 For each discharge point or utilisation area specified below, the licensee must monitor:

(a) the volume of liquids discharged to water or applied to the area;
(b) the mass of solids applied to the area;
(c) the mass of pollutants emitted to the air;

at the frequency and using the method and units of measure, specified below.

POINT 2

Frequency	Unit Of Measure	Sampling Method
Daily during any discharge	kilolitres	Special Method 1

POINT 4

Frequency	Unit Of Measure	Sampling Method
Daily	kilolitres	Special Method 2

For the purpose of the table above:

(a) Special Method 1 means by calculation; and

(b) Special Method 2 means ultrasonic level sensor and continuous recorder.

M6.2 In the event that the licensee cannot comply with a volume monitoring method as required by this licence solely due to the failure or malfunction of essential monitoring equipment, volume may be estimated using another agreed method approved in writing by the EPA. This provision only applies for the duration of the failure or malfunction. The licensee is to rectify the failure or malfunction as soon as practicable.

M6.3 The licensee must:

(a) submit in writing to the EPA a proposal for a method of volume estimation; or

(b) use a method of volume estimation already approved in writing by the EPA,

to be used in the event that essential monitoring equipment referred to in the previous condition has failed or malfunctioned.

M7 Requirement to record sewage treatment plant bypasses

M7.1 The licensee must record the following details in respect of each bypass of any of the appropriate treatment processes required by condition O3 which may be reasonably expected to adversely affect the quality of the final discharge:

(a) the EPA point identification number through which the bypass discharged;
(b) the date, estimated start time and estimated duration of the bypass;
(c) the estimated volume of the bypass;
(d) the level of treatment of the sewage at the STP prior to discharge;
(e) the probable cause of the bypass;
(f) any actions taken to stop the bypass happening; and
(g) any actions taken to prevent the bypass happening again.

M8 Biosolids monitoring

M8.1 Biosolids at the premises must be recorded, monitored and classified in accordance with the Biosolids Guidelines, to the extent that those Guidelines are applicable, or as otherwise approved in writing by the EPA.

Note: This condition does not apply to the reuse or disposal of biosolids by the licensee at locations other than the premises.

M9 Requirement to record overflows

M9.1 From October 2003 the licensee must record the following details in relation to each observed or reported overflow from the reticulation system and from the sewage treatment plant:

(a) the location of the overflow;
(b) the date, estimated start time and estimated duration of the overflow;
(c) the estimated volume of the overflow;
(d) a description of the receiving environment of the overflow;
(e) classification as a dry or wet weather overflow;
(f) the probable cause of the overflow;
(g) any actions taken to stop the overflow happening;
(h) any actions taken to clean up the overflow; and
(i) any actions taken to prevent the overflow happening again.

M10 Environmental monitoring

M10.1 Not applicable.

6 Reporting conditions

R1 Annual return documents

What documents must an Annual Return contain?

R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:
(a) a Statement of Compliance; and
(b) a Monitoring and Complaints Summary.
A copy of the form in which the Annual Return must be supplied to the EPA accompanies this licence. Before the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.

Period covered by Annual Return

R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided below.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

R1.3 Where this licence is transferred from the licensee to a new licensee:
(a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
(b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:
(a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or
(b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.

Deadline for Annual Return

R1.5 The Annual Return for the reporting period must be supplied to the EPA by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later

than 60 days after the date the transfer was granted (the 'due date').

Notification where actual load can not be calculated

R1.6 Where the licensee is unable to complete a part of the Annual Return by the due date because the licensee was unable to calculate the actual load of a pollutant due to circumstances beyond the licensee's control, the licensee must notify the EPA in writing as soon as practicable, and in any event not later than the due date. The notification must specify:

(a) the assessable pollutants for which the actual load could not be calculated; and
(b) the relevant circumstances that were beyond the control of the licensee.

Licensee must retain copy of Annual Return

R1.7 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.

Certifying of Statement of Compliance and signing of Monitoring and Complaints Summary

R1.8 Within the Annual Return, the Statement of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:
(a) the licence holder; or
(b) by a person approved in writing by the EPA to sign on behalf of the licence holder.

R1.9 A person who has been given written approval to certify a certificate of compliance under a licence issued under the Pollution Control Act 1970 is taken to be approved for the purpose of this condition until the date of first review of this licence.

R2 Notification of environmental harm

Note: The licensee or its employees must notify the EPA of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.

R2.1 Notifications must be made by telephoning the EPA's Pollution Line service on 131 555.

R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.

R3 Written report

R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:
(a) where this licence applies to premises, an event has occurred at the premises; or
(b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence,

and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.

R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.

R3.3 The request may require a report which includes any or all of the following information:
(a) the cause, time and duration of the event;
(b) the type, volume and concentration of every pollutant discharged as a result of the event;
(c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
(d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
(e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
(f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
(g) any other relevant matters.

R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

R4 Notification of bypass or overflow incidents

R4.1 Where either:

(a) sewage or partially treated sewage is discharged from the premises as a result of a bypass of the sewage treatment plant, or:
(b) an observed or reported overflow has occurred from the reticulation system, and overflow or bypass may pose a risk to public health, the licensee is to promptly give appropriate notification to any parties that are likely to be affected, including:
    (i) the potentially affected community;
    (ii) the Department of Health;
    (iii) <Specify other contact points eg Safe Food NSW Shellfish Quality Assurance Program if discharge could affect shellfish production, Sydney Catchments where STS is in Sydney Catchment, or other parties as appropriate>.

R4.2 When the licensee notifies the Department of Health or Safe Food NSW Shellfish Quality Assurance Program of a bypass or overflow incident, the licensee must also notify the EPA by telephoning its Pollution Line service on 131 555. Notifications are to be given as soon as practicable after the licensee or one of the licensee's employees or agents becomes aware of the incident, and must include all relevant information including the information required under condition M9.1 or M7.1.

R5 Annual System Performance Report

R5.1 The licensee must supply to the EPA an Annual System Performance Report not later than 60 days after the end of each reporting period.

R5.2 The report is to supplement the Annual Return and must include but need not be limited to:

(a) the 50 percentile, 90 percentile, 100 percentile and 3DGM values calculated from the monitoring data required by this licence for the reporting period for each pollutant which has corresponding concentration limits specified in this licence;
(b) the total amounts of biosolids, as classified in the Biosolids Guideline, disposed of on-site, off-site and to landfill during the reporting period;
(c) a diagram showing the major process elements, discharge points and monitoring points at the premises' sewage treatment plant(s),where there has been any significant change since the previous reporting period or this information has not been provided previously to the EPA;
(d) the number of dry and wet weather bypasses recorded over the reporting period (recorded in accordance with condition M7);
(e) a breakdown of the total number of complaints received by the licensee during the reporting period in relation to the premises into categories of "odours – sewage treatment plant", "odours – reticulation system", "water pollution – sewage treatment plant", "water pollution – reticulation system" and any other category indicated by the complaints;
(f) a summary of observed, reported or recorded wet weather overflows and observed, reported or recorded dry weather overflows and sewage treatment plant bypasses. These data are to be for the current reporting period and for the four previous twelve-month periods, for which data has been collected. Any significant actions taken to address bypasses or overflows are to be noted;
(g) the amount of rainfall measured at a rain gauge at the STP, or at the rain gauge closest to the centre of the catchment of the sewage treatment system, for each month of the reporting period; and
(h) a brief progress report on the implementation over the reporting period of actions specified in PRP100.

R5.3 The Annual System Performance Report must be presented in a format approved in writing by the EPA.

R5.4 The requirements of R5.2 (d), (e), (f) and (g) apply to the part of the reporting period beginning three months after the date the licence is varied to include this condition.

General conditions

G1 Copy of licence kept at the premises

G1.1 A copy of this licence must be kept at the premises to which the licence applies.

G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.

G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

Note: For the purposes of this condition, "the premises" refers to each Sewage Treatment Plant(s) described in condition A2.1.

G2 Signage

G2.1 The location of EPA point number(s) 1, 2, 3 and 4 must be clearly marked by signs that indicate the point identification number used in this licence and be located as close as practical to the point.

G3 Contact number for incidents and responsible employees

G3.1 The licensee must operate 24-hour telephone contact lines for the purpose of enabling the EPA to directly contact one or more representatives of the licensee who can:
(a) respond at all times to incidents relating to the premises; and
(b) contact the licensee's senior employees or agents authorised at all times to:
(i) speak on behalf of the licensee; and
(ii) provide any information or document required under this licence.

G3.2 The licensee is to inform the EPA in writing of the appointment of any subsequent contact persons, or changes to the person's contact details as soon as practicable and in any event within fourteen days of the appointment or change.

G4 Clean-up

G4.1 In the event of an overflow or bypass that harms or is likely to harm the environment, the licensee must use all practicable measures to minimise the impact of the overflow or bypass on the environment and public health. These measures are to be implemented as soon as practical after the licensee or one of the licensee's employees or agents becomes aware of the overflow or bypass.

Pollution studies and reduction programs

PRP100 Sewer Overflow Investigations Report

100.1 The objective of this PRP is to identify overflows from the sewage reticulation system that pose a significant risk of harm to the environment or public health, and to identify management priorities and actions required to reduce this risk.

100.2 The licensee must prepare a Sewer Overflow Investigations Report for the premises' reticulation system. The report must include but need not be limited to:

(a) identification of the location of all designed overflow points and other frequent overflow points within the reticulation system and an assessment of the likelihood of overflows from these points;
(b) assessment of the significance of impacts on the environment and public health resulting from these overflows;
(c) evaluation and ranking of the resultant risk to the environment and public health from these overflows; and
(d) identification of management priorities and actions to reduce the risk of harm to the environment and public health.

100.3 With regard to the identification of actions to reduce the risk of harm to the environment and public health, as required by condition 100.2(d), the licensee must consider the effects of any actions that improve the performance of the reticulation system with respect to the performance of the sewage treatment plant, for example with respect to the frequency and volume of bypasses or overflows from the sewage treatment plant, to ensure that the actions minimise the potential environmental and public health impact of discharges from the whole of the premises.

100.4 The report must also include the identification of any sewage pumping stations within the premises that are not capable of meeting a condition prohibiting dry weather overflows, including reasons why any sewage pumping station is not capable of meeting such a condition and whether it should be upgraded.

100.5 This report is to be submitted to the EPA in writing by July 2007.

Notes:

(1) If this requirement is included on a number of sewage treatment system licences held by the licensee, a single report may be submitted to the EPA provided that it meets the requirements relating to all of the licences.
(2) The requirement to prepare this report does not affect the requirement to comply with any other condition of this licence.
(3) It is the EPA's intention to include, at some point in the future, a licence condition prohibiting dry weather overflows from those sewage pumping stations that have been identified as being capable of meeting such a condition. This would be consistent with the requirement for proper and efficient maintenance and operation of the system.
(4) Progress reports on the implementation over the reporting period of actions specified in PRP100 are required in the Annual System Performance Report under condition R5 of this licence.

Special conditions

E1.1 Not applicable.

Special Dictionary

ug/L	Means micrograms per litre.

access chamber	a structure constructed to provide physical access to sewer pipes. Also known as a manhole.
approved	Means approved in writing by the EPA. The EPA's approval may be given unconditionally, or subject to conditions.
Biosolids	Has the same meaning as in Schedule 1, Part 3 of the *Protection of the Environment Operations Act 1997.*
Biosolids Guidelines	Means the "Environmental Guidelines: Use and disposal of biosolids products" published by the EPA in October 1997, or any subsequently updated guidelines which replace this publication.
bypass	Means circumstances where sewage has been received at the sewage treatment plant but is discharged from the plant without it being treated, processed or reprocessed by means of any or all of the designed treatment processes of the plant. A new bypass event is defined as a bypass that commences at least 24 hours after the end of the previous bypass.
cfu	Means colony forming units
condition	Means a condition of this licence.
designed overflow structure	Means a designed structure (excluding access chambers) in the reticulation system which operates as a relief to allow sewage to discharge at a planned location or a sewage pumping station, but does not include a bypass from a sewage treatment plant.
designed overflow	Means an overflow from a designed overflow structure.
dry weather bypass	Means a bypass that occurs when the flow rate of sewage at the inflow point of the STP does not exceed the flow rate specified in M7.2.
dry weather overflow	Means an overflow that is not a wet weather overflow.
dry weather sewage treatment plant discharge	Means a discharge of sewage or effluent from the STP that occurs when the flow rate of sewage at the inflow point of the STP does not exceed the flow rate specified in M7.2
effluent	Means sewage that has received all of the designed treatment processes at the sewage treatment plant.
fc	Means faecal coliforms expressed in colony forming units per 100mL.
Group C waste	Has the same meaning as in Part 3 of Schedule 1 of the *Protection of the Environment Operations Act 1997*.
ISO	Means International Standards Organisation.
kL	Means kilolitre.
L/s	Means litres per second.
metal-A	Means the following metals: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver and zinc.
mL	Means millilitres.
ML	Means megalitres.
offensive odour	Has the same meaning as in the *Protection of the Environment Operations Act 1997*.
overflow	Is a discharge of untreated or partially treated sewage from the sewage treatment system.
reticulation system	Means that part of the sewage treatment system owned and operated by the licensee which collects and transports sewage to the sewage treatment plant and includes all sewer pipes (whether greater or less than 300mm diameter), sewer rising mains, access chambers, vent shafts, designed overflow structures, sewage ejection units and sewage pumping stations, but does not include the sewage treatment plant.

sewage	Means untreated liquid waste received in the reticulation system.
sewage ejection unit	Is a pump intended to control the transport of sewage from premises normally occupied by no more than 10 persons, or of an average daily flow of sewage not exceeding 2,000 litres through the sewer pipes, where steep hills and other variations in the land topography can prevent or limit the gravity flow of sewage to the sewage treatment plant.
sewage products	Means any by-product of the treatment processes and includes biosolids, raw sludge, liquid sludge, thickened sludge, digested sludge, screenings and grit.
sewage pumping station (SPS)	Is a structure which controls the transport of sewage through the sewer pipes, where steep hills and other variations in the land topography can prevent or limit the gravity flow of sewage to the sewage treatment plant, but does not include a sewage ejection unit.
sewage treatment plant (STP)	Is a facility at which sewage is stored and treated following delivery from the reticulation system prior to discharge, and includes discharge structures and STP bypass points.
sewage treatment system	Means the reticulation system and the sewage treatment plant used for the transport, treatment and discharge of effluent and sewage.
Trade waste agreements	Means agreements reached between the licensee and industrial and commercial customers to restrict the amount of toxic and other potentially harmful substances discharged to the reticulation system.
TRC	Means total residual chlorine.
waters	Has the same meaning as in the *Protection of the Environment Operations Act 1997*.
wet weather bypass	Means a bypass that occurs when the flow rate of sewage at the inflow point of the STP equals or exceeds the rate specified in condition M7.2.
wet weather overflow	A wet weather overflow is an overflow where the probable cause is rainfall.

Dictionary

General Dictionary

In this licence, unless the contrary is indicated, the terms below have the following meanings:

3DGM [in relation to a concentration limit]	Means the three day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples
Act	Means the Protection of the Environment Operations Act 1997
activity	Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment Operations Act 1997
actual load	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 1998
AM	Together with a number, means an ambient air monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
AMG	Australian Map Grid

Environment Protection Licence

anniversary date	The anniversary date is the anniversary each year of the date of issue of the licence. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
annual return	Is defined in R1.1
Approved Methods Publication	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 1998
assessable pollutants	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 1998
BOD	Means biochemical oxygen demand
CEM	Together with a number, means a continuous emission monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
COD	Means chemical oxygen demand
composite sample	Unless otherwise specifically approved in writing by the EPA, a sample consisting of 24 individual samples collected at hourly intervals and each having an equivalent volume.
cond.	Means conductivity
environment	Has the same meaning as in the Protection of the Environment Operations Act 1997
environment protection legislation	Has the same meaning as in the Protection of the Environment Administration Act 1991
EPA	Means Environment Protection Authority of New South Wales.
fee-based activity classification	Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations (General) Regulation 1998.
flow weighted composite sample	Means a sample whose composites are sized in proportion to the flow at each composites time of collection.
grab sample	Means a single sample taken at a point at a single time
hazardous waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
industrial waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
inert waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
licensee	Means the licence holder described at the front of this licence
load calculation protocol	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 1998
local authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
material harm	Has the same meaning as in section 147 Protection of the Environment Operations Act 1997
MBAS	Means methylene blue active substances
Minister	Means the Minister administering the Protection of the Environment Operations Act 1997
mobile plant	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997

	1997
motor vehicle	Has the same meaning as in the Protection of the Environment Operations Act 1997
O&G	Means oil and grease
percentile [in relation to a concentration limit of a sample]	Means that percentage [eg.50%] of the number of samples taken that must meet the concentration limit specified in the licence for that pollutant over a specified period of time. In this licence, the specified period of time is the Reporting Period unless otherwise stated in this licence.
plant	Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.
pollution of waters [or water pollution]	Has the same meaning as in the Protection of the Environment Operations Act 1997
premises	Means the premises described in condition A2.1
public authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
regional office	Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence
reporting period	For the purposes of this licence, the reporting period means the period of 12 months after the issue of the licence, and each subsequent period of 12 months. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
reprocessing of waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
scheduled activity	Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997
solid waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
TM	Together with a number, means a test method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
treatment of waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
TSP	Means total suspended particles
TSS	Means total suspended solids
Type 1 substance	Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements
Type 2 substance	Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements
utilisation area	Means any area shown as a utilisation area on a map submitted with the application for this licence
waste	Has the same meaning as in the Protection of the Environment Operations Act 1997
waste code	Means the waste codes listed in Appendix 5 of the EPA document A Guide to Licensing Part B.
waste type	Means Group A, Group B, Group C, inert, solid, industrial or hazardous waste

Environment Protection Licence

Licence - 3618

Department of Environment & Climate Change NSW

Ms Nadia Kanhoush

Environment Protection Authority

(By Delegation)

Date of this edition - 11-Sep-2007

End Notes

1	Licence varied by notice 1011078, issued on 31-Aug-2001, which came into effect on 25-Sep-2001.
2	Licence varied by notice 1012905, issued on 27-Mar-2002, which came into effect on 21-Apr-2002.
3	Licence varied by notice 1018070, issued on 12-Jun-2002, which came into effect on 07-Jul-2002.
4	Licence varied by notice 1026887, issued on 11-Aug-2003, which came into effect on 05-Sep-2003.
5	EPA Condition ID S40934 amended 13-08-04
6	Licence varied by notice 1044663, issued on 07-Mar-2005, which came into effect on 01-Apr-2005.
7	Licence varied by notice 1070669, issued on 14-Mar-2007, which came into effect on 14-Mar-2007.
8	Licence varied by correction to DECC catchment record, issued on 22-May-2007, which came into effect on 22-May-2007.
9	Licence varied by notice 1076747, issued on 11-Sep-2007, which came into effect on 11-Sep-2007.