KING + CAMPBELL

with

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Water Management Plan
Seascape Grove Estate
South West Rocks
Part 3A
DGEAR REPORT

14777 July 2006

Water Management Plan
Seascape Grove Estate, South West Rocks
Part 3A - DGEAR's Report

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Table of Contents

List of Appendices

Appendix A – Sheet 14 & 15 of the Engineering plans by King and Campbell Ref 14777

Appendix B - Sheet 16 & 17 of the Engineering plans by King and Campbell Ref 14777.

Appendix C – Hard copy printout of “Drains” software Stormwater Results

Section 1
Introduction

This report is to be read in conjunction with the Part 3A application prepared by ERM. Issues relating to the locality and details of development are set out in their submission.

1.1 Development Proposal

The proposal is to develop the parcel for residential development in a number of stages. This report sets out the strategies for the management of stormwater on the site and for design of stormwater control measures that address issues relating to stormwater quantity and stormwater quality. The creation of additional residential lots increases the water runoff volumes and increases the discharges of pollutants from the site. To ameliorate these factors the development proposes to implement a number of water quality control factors and devices to ensure that the development has no net increase in pollutant loads or peak discharges into the receiving waterways.

1.2 Background

The proposal is part of an approved Master Plan (Ref: MP39-9-2004) that was notified on 31 March 2006. As part of the Master Plan submission a Concept Stormwater Management Plan was prepared by ERM in September 2004. Studies relating to the receiving waterway Saltwater Creek and Lagoon were undertaken by Kempsey Council a short time after the submission of the masterplan. These studies include:

- Saltwater Creek Preliminary Draft Estuary Management Plan (WBM Oceanics, January 2005);
- Saltwater Creek Estuary Process Study (MHL2002); and
- Draft Flood Study for Saltwater Lagoon (Kempsey Shire Council 2004).
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In the period since early 2005 these studies have been reviewed and have been subject to public consultation. The proponent participated in Kempsey Council's final public consultation regarding the Saltwater Creek and Lagoon Estuary Management Plan on held 11 May 2006. At the time of writing, this plan is incorporating amendments relating to the public consultation and we have been advised that it is scheduled to be adopted in

the very near future.

1.3 Applicable Planning Controls and Policy Documents

The DGEAR requirements issued by the Department of Planning on 2nd May 2006 list the following items as requiring assessment with the project application:

- Assess Groundwater Impacts;
- Demonstrate Compliance with the 1:100 Year ARI Storm Event for the Site;
- Address Water Sensitive Urban Design Measures and Compliance with BASIX Requirements;
- Water Management Plan to be prepared to assess compliance with Saltwater Creek and Lagoon Estuary Management Plan; and
- Identify Site Specific Stormwater Principles.
-

The associated stormwater design has been formulated using Kempsey Council's DCP 36 and Development Design Specification D5.

The Saltwater Creek and Lagoon Estuary Management Plan and Study (SCLMP) in final draft Feb 2006 (WBM Oceanics) also sets out objectives with regard to runoff volume and quality.

Given that Kempsey Council does not have runoff water quality guidelines, the water quality objectives have been adopted from Australian Runoff Quality Chapter 6. These objectives are consistent with adjoining localities that have similar coastal environments.

Other documents applicable to the design include:

Managing Urban Stormwater: Treatment Techniques (NSW EPA,1997)

Managing Urban Stormwater: Council Handbook (NSW EPA 1997)

National Water Quality Management Strategy. Australian Guidelines for Urban Stormwater Management (ANZECC, 2000)

Water Sensitive Urban Design (WSUD)

Managing Urban Stormwater Treatment Techniques/ NSW EAP 1997

Managing Urban Stormwater: Scource Control (DEC 1998)

Managing Urban Stormwter: Soils & Construction (NSW Landcom, March 2004) – "The Blue Book"

Australian Water Quality Guidelines for Fresh and Marine Waters (Australian and New Zealand Environment and Conservation Council, 1992 & 2000).

Water Sensitive Urban Design (WSUD)

The objectives of this approach have been reviewed and incorporated into the design philosophies of the development. WSUD is the integration of various Best Management Practices (BMP) for the sustainable management of the urban water cycle.

Key principles of WSUD include:

- Protect natural systems (creeks, rivers and wetlands) within urban catchments.
- Protect water quality by improving the quality of stormwater runoff draining from urban developments.
- Integrate stormwater treatment into the landscape.
- Add long term value while minimising development costs.
- Reduce potable water demand by using stormwater as a resource.

Relevant WSUD documents referred to in the development of this Stormwater Management Plan include:

- CRC for Catchment Hydrology (Report 00/1 Aug 2000), Water Sensitive Road Design – Design options for improving stormwater quality of road runoff.
- CRC for Catchment Hydrology (Report 02/10 Sept. 2002), Water Sensitive Urban Design – A Stormwater Management Perspective.

- Upper Parramatta River Catchment Trust (May, 2004), Water Sensitive Urban Design – Technical Guidelines for Western Sydney.
- Urban Water Resource Centre (November, 2004), Water Sensitive Urban Design: Basic Procedures for 'Source Control' of stormwater.
- Melbourne Water (June, 2004), WSUD Engineering procedures.

Section 2
Site Characteristics

2.1 Existing Land Use

The existing land use of the property is for Agricultural pursuits and grazing. In recent years the property mainly stock cattle and undertook pasture improvements to supplement feed for the livestock.

The property also comprises a main residence and associated farm workshops and managers quarters.

2.2 Topography

The property is located on the north and north eastern side of a ridge line that reaches a height of approximately RL 50.0m AHD. This slope grades to the north eastern corner to a low point level of approximately RL 3.8m AHD.

2.3 Geology

Two geological groups are identified at the subject site from the Dorrigo - Coffs Harbour 1:250 000 Geological Series Sheet. The southern section of the site is underlain by Upper Permian Smokey Cape Adamellite. The remainder of the site is underlain by Quaternary alluvial, paludal and estuarine deposits, mainly sands, silts and gravels.

2.4 Typical Soil Profile

An analysis of the soil profile was undertaken by Chandler Geotechnical Pty Ltd in May 2003. The report divides the site into 3 distinct soil profiles with the typical subsurface conditions listed below:

Subsurface Conditions
The site can be divided into three general areas according to the typical subsurface conditions as reported in the test pits.

North-Eastern Corner (Pits 4, 5 & 6)
This section of the site is generally below about RL5.0 and is low lying wetland. Subsurface conditions in this area comprise slopewash in the form of silty clay underlain by sands and clayey sands. The surface water in this location is perched on the silty clay immediately below the topsoil. The sands encountered in the vicinity of test pit 5, below the silty clay slopewash, are permeable and removal of this material during construction

of the detention basin should improve the drainage properties of the low lying areas of the site.

South-Eastern Corner (Pits 14 to 16 and Pit 18)
This area generally comprises an organic topsoil layer of around 200mm to 300mm thickness overlying residual silty clay. The silty clay is of weathered mudstone original and the plasticity ranges from medium to high. Slopewash of varying thickness was encountered between the topsoil layer and the residual silty clay layer in test pits 15, 16 and 18.

Remainder of Site (Pits 1 to 3, 7 to 13)
This area is associated with the higher and better drained parts of the site. Subsurface conditions comprise topsoil to depths of around 200mm to 300mm thickness overlying orange/brown residual sandy clay. Slopewash material of up to 0.4m thickness was encountered between these two layers in some of the test pits. The orange/brown sandy clay layer tends to be underlain by extremely to highly weathered siltstone/mudstone at varying depths.

2.5 Catchment Characteristics

The upper reaches of the catchment comprise a ridgeline protected by 7(d) Environmental Protection zoning and Low Density Rural Residential zonings. This ridge occupies a prominent position in the South West Rocks skyline and it is unlikely that the current use and level of vegetation will undergo any significant changes. The lower reaches of the catchment comprise the subject property and are proposed to be used a residential development. Stormwater flows from outside the development are proposed to be separated from the urban runoff via a separate stormwater line running through the Bushfire APZ located on the eastern edge of the development.

Immediately downstream of the site is an open drain in a low lying area that discharges to Saltwater Creek Lagoon. The relationship of the site to Saltwater Creek is discussed in detail in later sections of this report.

The relationship of the site to the key features is also shown in the aerial photo below.

The land use categories are as shown in sheet 14 of the engineering plans. A reduced copy of this plan is enclosed as Appendix A.

Aerial Location

Photo showing the relationship of the site to key infrastructure.

Section 3
Stormwater Management Plan

3.1 Stormwater Run-Off and Flooding

The piped stormwater system for the development has been modelled for the entire catchment. Generally all of the stormwater flows to the low point in the north eastern corner of the site.

The stormwater pipe layout and catchment details are as shown in Sheets 14 and 15 of the enclosed engineering plans enclosed as Appendix A. The stormwater system has been designed in accordance with Kempsey Council's development specification D5. The pipe capacity has been designed for a 1:5 year storm with overland flow routes to cater for the 1:100 year storm in accordance with the established major/minor approach to urban stormwater design. The stormwater modelling was carried out in "Drains" simulation software. Drains is a simulation program that converts rainfall patterns to stormwater runoff hydrographs and routes these through networks of pipes, channels and streams.

The model uses time-area calculations and Horton infiltration procedures to calculate flow hydrographs from sub-catchments. The various sub-catchment flows are combined and routed through a pipe and channel system. Calculations are performed at specified times after the start of each storm. At each time step, a hydraulic grade line analysis is performed throughout a drainage network, and flow rates and water levels are determined.

3.1.1 On Site Detention

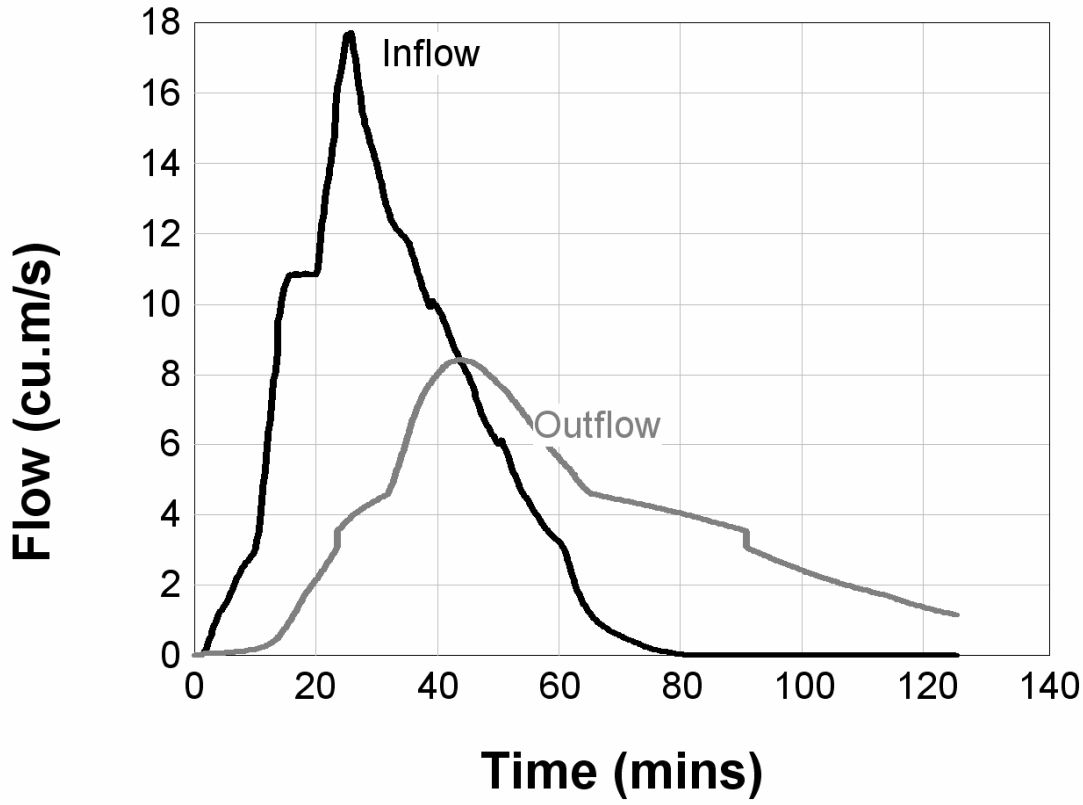
As part of the overall stormwater runoff model a wet detention basin was included immediately upstream of the existing discharge point at the north eastern corner of the site. The pond will have a permanent water level of RL 3.5 with a maximum height of RL 5.02 in a 1:100 year event. The pond has a low level outlet comprising four 750 diameter pipes and a high level overflow weir for major storm events. Details of the stormwater detentions basin controls are as shown on sheet 16 of the engineering plans

An objective of the design is to satisfy the DGEAR requirement that the proposal demonstrates compliance with the 1:100 year flood. This requirement is also set out in Objective 14 of the SWCEMP (Section 5.1 Quality Objectives). The results of the detention calculations are shown below:

3.1.2 Modelling Results

Following the calculation of the model it can be demonstrated that the basin design limits the stormwater discharge to pre existing flows. A table of the pre and post development flows is shown below and the outflow hydrograph showing the attenuation that is achieved by the basin.

Storm Frequency ARI	Pre Development Flow	Post Development Flow
5 year	4.5	3.66
100 year	11.59	8.41



3.2 Stormwater Quality Measures

As previously discussed a Concept Stormwater Management Plan was prepared to accompany the Master Plan submission (ERM Sept 2004). The plan set out a number of measures to be incorporated into the subdivision design to allow the water quality objectives to be met. Since that time the Stage 1 lots (23 lots) have been developed and a number of meetings were held with Kempsey Council as the future asset owners and the stormwater quality control measures have been refined and detailed with an approach that takes into account Council's resources and technical experience.

The stormwater quality approach relies on five (5) broad treatment techniques being:

- Buffers Strips
- Median Swales
- Gross Pollutant trap
- Infiltration Structures
- Sediment pond
-

Each of these measures is discussed below and shown in details on Sheets 14 to 18 on the attached engineering plans.

3.2.1 Buffer Strips

The use of buffer strips along the conventional footpath with plantings between the concrete footway and road pavement is shown in the photograph below. The footpath edges will be landscaped and the other partsof the footpath reservation will be turfed. The arrangement is as shown in the photo below.

Example of Planted Edges – Stage 1 Seascape Grove Estate

3.2.2 Median Swales

The provision of a centre draining separated carriageway on the road that is located over the existing gully (Road No 2). The pavement runoff is directed to the centre strip that is vegetated with native grasses and trees species to strip pollutants from the runoff. The typical arrangement is shown in the photo below.

The layout of the centre draining median is shown on the engineering plans and the Landscape Principles plan. Planting species are also shown on the Landscape Principles Plan

3.2.3 Gross Pollutant Trap

In accordance with the previous Stormwater Concept Management Plan, that was approved as part of the Master Plan 05-0018, it is proposed to insert a Gross Pollutant Trap (GPT) into the stormwater discharge pipeline immediately prior to discharge into the infiltration basin. The GPT proposed is an Ecosol RSF4000 or equivalent. The independently tested results of this type of device are as set out below.

The device will be sized to accept the 1 : 1 year flows from the catchment. The flows will then be diverted to the infiltration basin to assist with the removal of dissolved pollutants such as Nitrogen and Phosphorus.

POLLUTANTS	POLLUTANT REMOVAL EFFICIENCY	DESCRIPTION
Litter	VH	Anthropogenic material such as cans, bottles, plastic bags and packing materials (generally > 5mm in diameter)
Vegetation	VH	Organic material, such as leaves and grass clippings
Coarse Sediment	VH	Solid material of varying size (generally > 0.5mm), both mineral and organic
Fine Sediment	H	Fine sand (generally < 0.1mm median diameter), both mineral and organic
Free Oils and Grease	M	Free floating oils that do not emulsify in aqueous solution, such as cooking and motor oil
Nutrients (N & P)	L	Total phosphorous and total nitrogen
Attached Pollutants	L	Generally attached to fine sediments and include nutrients, heavy metals, toxicants, and hydrocarbons
Dissolved Pollutants	L	Nutrients, metals, and salts, etc

N = negligible, L = low, M = medium, H = high, VH = very high

3.2.4 Filtration Structure

The filtration structures are proposed at the end of the discharge pipes to strip dissolved pollutants from the runoff. These basins are set at a height slightly above the pond height and are designed to accept the volume equivalent to the 1 :1 year flows. The location and layout of the basins is as Sheet 16 and 17 of the engineering plans and enclosed as – Appendix B.

3.3 Stormwater Quality Modelling

The modelling of the stormwater quality was undertaken in the Model for Urban Stormwater Improvement Conceptualisation (MUSIC, Version 3.0) developed by the CRC for Catchment Hydrology and was utilised to evaluate pre- and post-development pollutant loads and concentrations from the site. Whilst this model is not in itself a precise engineering design tool, it provides a useful mechanism through which the performance of a

stormwater management scheme can be investigated and refined in order that best management practices are achieved for a given site. Two modelling scenarios were considered:

- Pre-development model including existing rural , rural-residential and vegetated and forest land.
- Post-development treated including the maximum likely development scenario with stormwater treatment measures.

A number of options were modelled for the second scenario and the final results are as shown on sheets 14 to 18 of the engineering plans. This arrangement also allows community use of the drainage reserve and the incoprporation of a water body that will become an important open space node for the development.

The quality modelling was done on the basis of the existing catchment (pre development) and the catchment after the urban development. Both scenarios are shown in the table below. The layout of the treatment diagram is also as shown below. The land use types are as shown on Sheet 14 of the engineering plans (Appendix A).

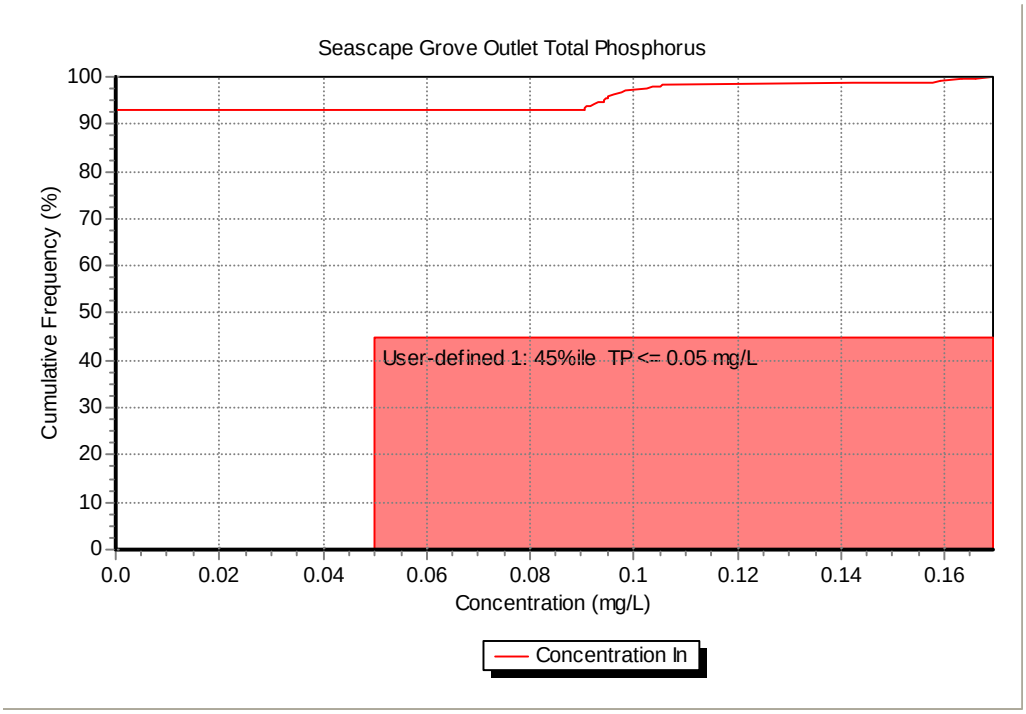
The results of the Music Modelling are set out below. The following table shows the reduction in Mean annual Pollutant loads at the drainage outlet that are acheived by the measures proposed.

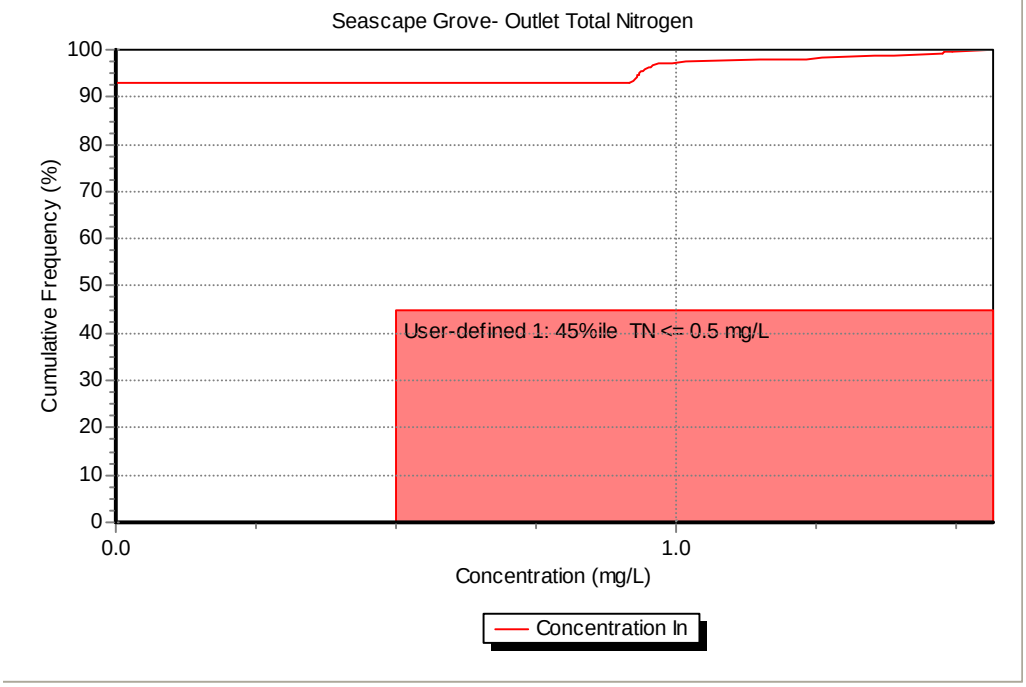
	Pre Development	**Post Development**
Total Suspended Solids (kg/yr)	20600	4480
Total Phosphorus (kg/yr)	58	16
Total Nitrogen (kg/yr)	419	144
Gross Pollutants (kg/yr)	570	0

The mean annual values of the daily pollutant loads are shown in the table below. The design objectives are also shown for comparison. A graphic representation of the reduction in pollutant loads is also shown below

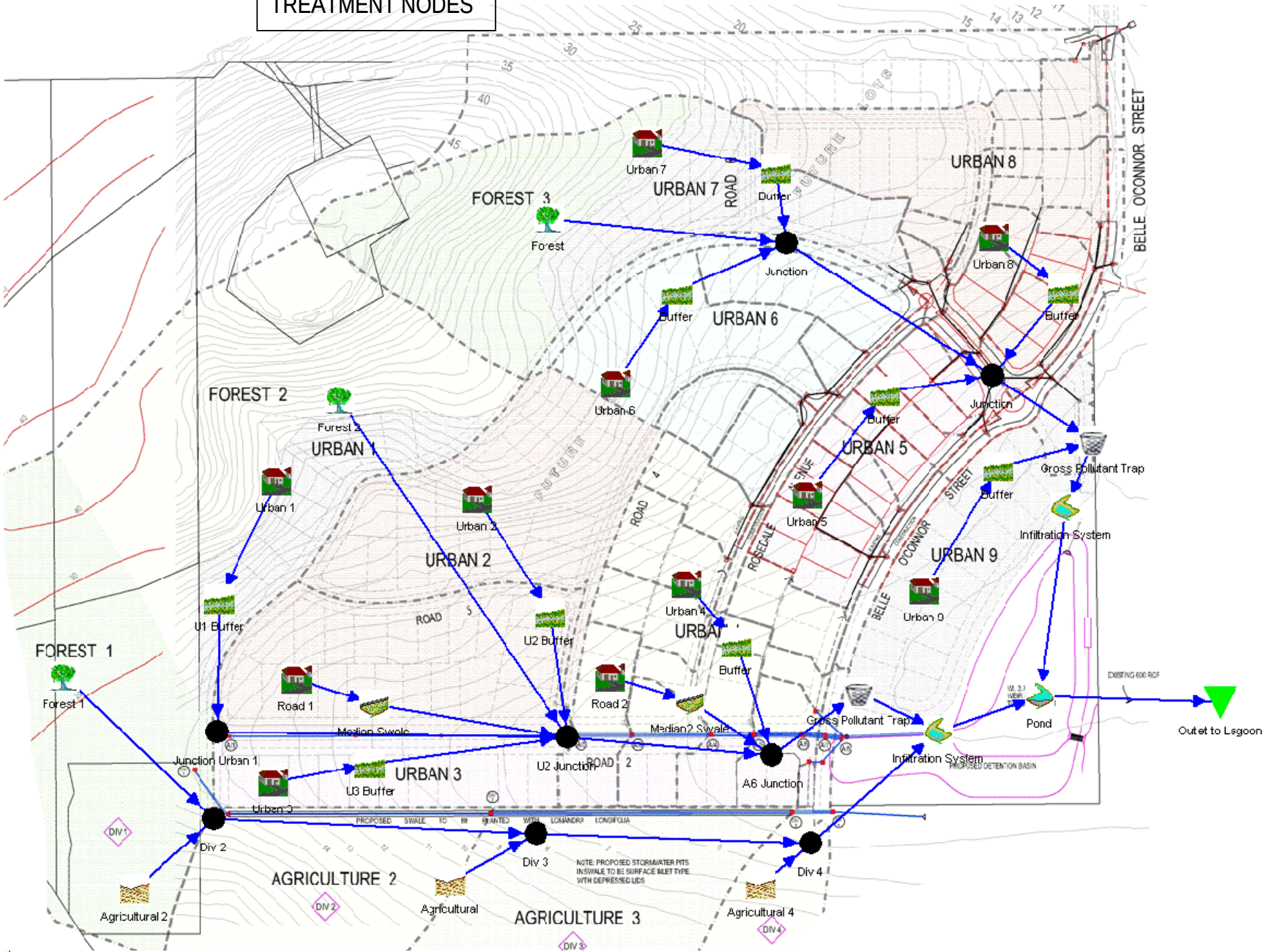
	Flow Weighted Daily Mean Pre Development	**Flow Weighted Daily Mean Post Development**	**Design Objectives**
TSS Concentration (mg/L)	51.600	1.510	50
TP Concentration (mg/L)	0.189	0.008	0.05
TN Concentration (mg/L)	1.530	0.078	0.5

These results demonstrate the effectiveness of the treatment train and the compliance with the Anzecc guidelines regarding water quality.Implementation of the measures proposed will satisfy the design objectives for Water quality.


Seascape Grove Outlet Total Phosphorus
Cumulative Frequency (%)
100
90
80
70
60
50
40
30
20
10
0
0.0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
Concentration (mg/L)
User-defined 1: 45%ile TP <= 0.05 mg/L
Concentration In


Seascape Grove- Outlet Total Nitrogen
Cumulative Frequency (%)
100
90
80
70
60
50
40
30
20
10
0
0.0
1.0
Concentration (mg/L)
User-defined 1: 45%ile TN <= 0.5 mg/L
Concentration In

TREATMENT NODES



3.4 Effluent Reuse Scheme.

The proposed lots are a key element of the implementation of the Integrated Water Cycle Management Strategy (IWCMS) that has been adopted by Kempsey Council. The first 23 lots have implemented the dual use scheme and the potable and reuse water mains are in place. The development will also accommodate the reuse distribution mains that will transport treated effluent to the smaller of the two existing reservoirs on the ridge to the south of the lots. The utilisation of this reservoir opens up the use of the effluent as it allows reticulation to other parts of South West Rocks including the existing playing fields and sporting grounds in accordance with the objectives of the IWCMS.

The scheme has been accepted by the Department of Plannnig and has been registered on the BASIX compliance tool

The benefits of the effluent reuse scheme are :

- Reduced deposits of nutrient laden runoff from the Sewer Treatment Works. The effluent is currently disposed of, into the sandhills along the coastal fringe.
- Reduced requirement for additonal water supplies by making better use of existing potable water supply.
- Reduced pressure on groundwater sources and rivers. Reduction of occurrence of algal blooms.
- Whilst not stricly included in the modelling of the water quality measures on the site it is important to highlight the benefits of this aspect of the water cycle.
-

3.5 Estate Based Waterwise Education

An important facet of the Water Management Strategy is to utilise the opportunity to influence community attitudes and behaviours with regard to water use.

The development proposes to include a brochure outlining Water Saving Tips and strategies to reduce the opportunities for water based pollutants such as nitrogen and phosphorus to enter the receieing waters of the Saltwater Lagoon.

Home based activities that will be covered by the educational material include:

- Washing of cars on grassed areas;

- Recognising that the stormwater system connects to the Saltwater Creek Lagoon.
- Proper disposal of oils, detergents, herbicides,insecticides, paints and solvents;
- Minimising use of garden chemicals and fertilisers;
- Siltation and erosion on site;
- Removal of leaves or grass clippings and organic materials before they enter the stormwater system;
- Reduction of water usage in line with BASIX objectives;
- Lead, oil and type rubber from roads;
- Bacteria and micro-organisms from animal dropping;
- Litter items such as plastic bags, drink containers, food wrappers and cigarette butts;
- Information that effluent reuse should not be “over used” and is also a valuable resource;
- Water wise hose fittings and adherence to any water restrictions.

Information on the benefits of reducing pollutants and adopting waterwise practices will be:

- Included on the estate web site;
- Included with the promotional material handed out to potential purchasers;
- Be appropriately displayed at the sales office;
- Taught to Sales staff and included in discussions with potential purchasers.

All of the material will be consistent with the management strategies set out in the Saltwater Creek and Lagoon Environmental Management Plan.

Section 4
Saltwater Creek and Lagoon Estuary Management Plan

4.1 Saltwater Creek and Lagoon Estuary Management Plan

As previously discussed the Saltwater Creek and Lagoon Estuary Management Plan is currently being finalised. The final draft of February 2006 sets out a number of issues and then puts in place a number of management options/ strategies to improve the water quality in the downstream estuary.

Of a total of 14 individual management objectives the key matters relevant to this proposal are listed below. We have also set out the measures proposed to satisfy these objectives.

Objective (5) Prevent the generation of acidic runoff resulting from activities carried out on potentially acid sulfate soils surrounding Saltwater Creek and Lagoon:

The geotechnical testing for the site does not indicate the existence of any potential Acid Sulfate soils. In addition, the work method statements for the civil construction would include measures to identify any suspect material if found and to undertake the appropriate management techniques in accordance with the Acid Sulfate Soils Manual.

Objective (7) Ensure fire and weeds are managed appropriately on private properties surrounding Saltwater Creek and Lagoon.

The drainage structures and surrounding areas will be appropriately maintained as a buffer fire buffer zone. Fire fighting water hydrants will be installed. These measures will protect the vegetation in the Saltwater Creek and Lagoon.

The use of indigenous species in the landscaping principals and the implementation of the weed management measures will protect / control weed migration and infestation of the interface.

Objective (13) Ensure that all future development does not place any additional stress on the existing natural environment of Saltwater Creek and Lagoon.

This objective aims to ensure that future development has no net detrimental impact on the existing condition of the estuary.

The stormwater quality modelling indicates a reduction of pollutant loadings and the stormwater detention basin demonstrates that peak discharges will not exceed pre development conditions. Loadings to the estuary are therefore maintained to at or below existing conditions.

The proposed estate community education program is a sub set of objectives 1, 2, 6 and 7.

The objectives seek to educate the community to such matters as:

- Weeds and pests;
- Good environmental behaviour;
- Bushland friendly plants;
- Garden maintenance; and
- Bush "beyond the backyard".

The proposed infrastructure will enable these objectives to be met and therefore the development is consistent with the Saltwater Creek and Lagoon Estuary Management Plan.

Section 5
Dgear Requirements

5.1 Assess Groundwater Impacts

Groundwater

The implications of the proposal in terms of Principle 4 of the NSW Groundwater Quality Protection Policy (DLWC 1998), are discussed below:

Threat Factor:

The proposed development is low density residential with reticulated sewerage and therefore poses limited inherent risk of groundwater quality impacts. Additional measures taken in this development to protect water quality include on-site stormwater management measures use of native low-water use landscaping in public areas and community education materials relating to water use. No significant drains or pumping are proposed, therefore groundwater levels would not be lowered, avoiding any issues of acid leachate from potential acid sulphate soils present downstream.

Vulnerability of the Groundwater System:

There is no known groundwater use for drinking water supplies downstream of the site. The groundwater system is primarily vulnerable to acidic leachate due to lowering the groundwater table and to groundwater quality effects of contaminating activities.

Beneficial Use of the Groundwater:

Groundwater flowing into the Saltwater Creek and Lagoon wetlands would provide a role in the environmental health of the wetland system. Near the mouth of the creek it may provide beneficial use for human recreation (swimming and fishing).

It is proposed to maintain stormwater quality from the site through the integrated on-site stormwater management system as discussed in Section 3 This system provides treatment prior to discharge to the adjacent property to the north. The Geotechnical assessment (Chandler Geotechnical Pty Ltd) undertaken for the proposal indicated there are no acid sulfate soils present on-site.

Natural infiltration of rainwater over the site will be reduced due to an

increase in area of hard surfaces due to development. This is likely to be somewhat offset by watering of private gardens in the allotments and use of the treated effluent dual water supply on-site. Community education materials relating to water use will encourage use of waterwise gardens and proper use of stormwater drains to minimise the potential for contaminates in the stormwater system.

5.2 Demonstrate Compliance with the 1:100 Year ARI Storm Event for the Site

The report above demonstrates that the proposed measures provide protection for the 1:100 year storm event from the site and also the 1:100 year flood level from Saltwater Creek.

The proposed detention basin limits discharges from the site to pre-development flows for a range of storm up to and including the 1:100 year event.

5.3 Address Water Sensitive Urban Design Measures and Compliance with BASIX Requirements

Water sensitive urban design measures addressed include:

- Removal of water borne pollutants through an effective treatment train;
- Siltation and erosion controls;
- Effluent reuse to reduce sewer treatment plant discharges to the coastal sand dunes and to reduce the demand for potable water supplies;
- Orientation of lots to maximise solar access;
- Use of indigenous plant species and rehabilitation of public areas.
-

5.4 Water Management Plan to be Prepared to Assess Compliance with Saltwater Creek / Lagoon Estuary Management Plan

The matters concerning compliance with the Saltwater Creek and Lagoon Estuary Management Plan are covered in detail in Section 4 of this report.

To summarise they relates to:

- Elimination of Acid Sulfate runoff;
- Measures to reduce pollutant loads and stormwater discharges to pre-development flows; and
- Participation in the public eduction campaign through information sharing at the land purchase and house building stage.

5.5 Identify Site Specific Stormwater Principles

Site specific stormwater principles are as set out in the Stormwater Management Plan requirements.

The principles of Water Quality Control, stormwater runoff attenuation and public education are specific principles that are to be incorporated into the development.

5.6 Conclusion

The measures proposed will satisfy the requirements for water quality and water runoff quantity. The estate will include a higher standard of stormwater management that will also include higher awareness on the part of the residents. It is envisaged that each of the new residents will have some level of ownership of these measures which ensures they are sustainable.

References

Stormwater

Managing Urban Stormwater: Soils & Construction (NSW Landcom, March 2005) – "The Blue Book"

Stormwater Outlet Structures to Streams (for pipes, culverts, drains and spillways – Version 1) (DIPNR)

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Sustainable Water: Best Practices (to be used in conjunction with the sustainable Water Development Control Plan) (Hornsby Shire Council, Amended 12/8/97)

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