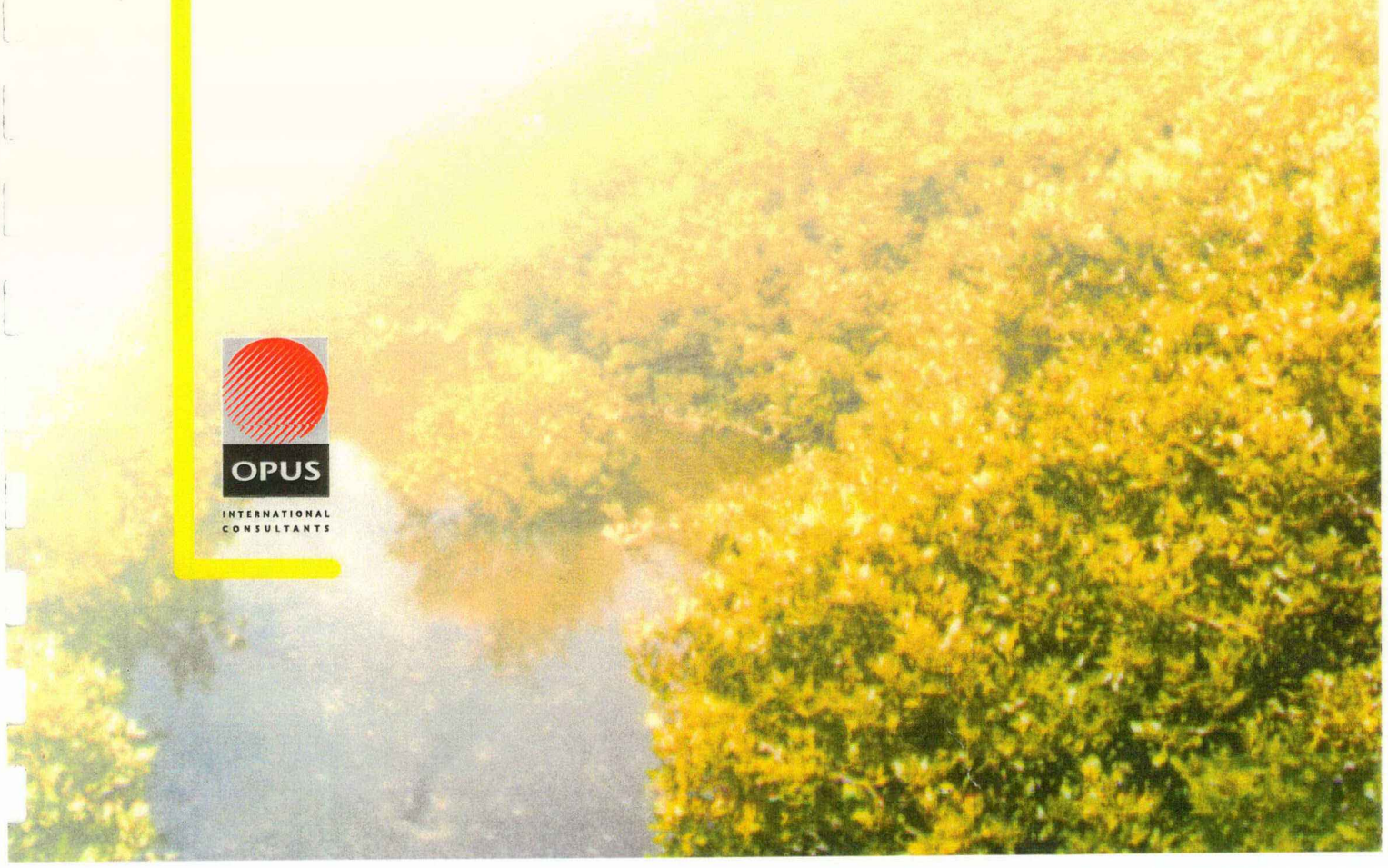
WESTERN
BAY OF PLENTY
DISTRICT COUNCIL

Athenree

Stormwater Plan



OPUS
INTERNATIONAL
CONSULTANTS

Western Bay of Plenty District Council

Athenree Stormwater Plan

Project 1508 - Contract 55/417

Prepared By ..... Keith Caldwell

Reviewed By ..... John Crawford, Janine Fallwell, Richard Coles

Approved By ..... Ian Carlisle

Opus International Consultants Limited
Office
Opus House
PO Box 3057
Hamilton

Telephone: Telephone
Facsimile: Facsimile

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Contents

APPENDICES

EXECUTIVE SUMMARY

The Athenree peninsula is a coastal Harbour settlement in the north of the Western Bay of Plenty District. The central "spine" of the Athenree peninsula extends 1.0km northeast from the Steele/Athenree Road intersection and then sweeps 1.5km north to the promontory at the end of Koutunui Road. The peninsula is approximately 700m wide and there are few defined stream channels.

The Athenree Stormwater Management Plan has been prepared for the Western Bay of Plenty District Council (WBOPDC) as a component of the Athenree Structure Plan, which is yet to be completed. WBOPDC staff considered that the Stormwater Management Plan should be the first step in preparing a comprehensive structure plan for the area, as this would ultimately refine the Athenree Urban Growth Area boundaries.

The purpose of the Athenree Stormwater Plan was to assess the feasibility for providing stormwater reticulating to the Athenree urban growth area. This included assessing constraints and making collection, disposal and treatment recommendations for existing urban and 'Greenfield' catchments.

Options were evaluated against assessment criteria and ranked. Through the ranking process it was identified that some options identified intangible costs to the community that needed additional community consultation. For reasons of practicality, and to minimise the length and cost of the consultation, it was considered that this consultation should be undertaken when the Athenree Structure Plan is presented to the community.

The Stormwater Management Plan recommends the following collection and treatment options:

1. Kerb and channel be used for new roads followed by piped reticulation;
2. Wet ponds will be used to treat stormwater prior to discharge into Tauranga Harbour;
3. In existing urban areas where wet ponds cannot be retrofitted or upgraded it is recommended that in-sump filters be used to treat the stormwater;
4. Open drains can be used to direct stormwater to pond areas where a natural appearance is considered important to maintain coastal landscape features.

The capital cost of the possible future works is $3.2 million. These works are to be funded by Development Impact Fees or other cost recovery methods. Annual maintenance costs of the $75,000 or $356/ha of urban development have been identified and these would have to be funded by Council via rates from the urban areas. Investigation, consent

processing and management costs have been estimated at $75,000 to achieve a comprehensive consent and $15,000 per annum monitoring cost thereafter, based on population growth matching Council's 'average' estimate of the low/low and low/high scenarios.

The study brief required annual expenditure for the expansion and upgrade of infrastructure. The project team have concluded that it is extremely difficult to estimate where development will occur if large tracts of land are to be rezoned residential with few planning controls to restrict leapfrog development. The latter is considered highly probable as parts of the catchment have water views and are likely to be considered more marketable by developers and more desirable by the housing market.

Further, population projections currently used by Council indicate that the annual growth at Athenree over the next 20 years will be small, on average around 12 additional households per year. This low level of growth renders loan funding large tracts of trunk infrastructure expensive, as recoupment of capital cost would take a considerable number of years. This is not considered to be sustainable and is likely to place a significant burden on future generations to service the debt. It is therefore recommended that Council rezone part of the study area at a time. The new zoning should be immediately adjacent to the existing infrastructure to ensure systematic growth. Development can then progressively expand into the newly zoned urban area. This will reduce loan-funding costs and minimise debt while providing opportunity for the Athenree community to expand.

This Plan provides a framework within which developers are able to design future Harbour outlets and stormwater assets that address local water quality issues in accordance with any Comprehensive Discharge Consent, and provide supporting data for resource consent applications to Western Bay of Plenty District Council and Environment Bay of Plenty. Obtaining a Comprehensive Discharge Consent will avoid the need for Council or developers to apply for individual consents for stormwater works in future.

This plan should be implemented by its inclusion in the Athenree Structure Plan, which assesses all infrastructure requirements and planning controls necessary to allow urban development over the whole study area. Further studies are required to complete the structure plan. These may identify additional management issues that can impact on recommendations in this Stormwater Plan. It is therefore recommended that following completion of the further works identified in Section 5.2 of this report, that the stormwater management solutions are assessed against any new information.

1 INTRODUCTION

1.1 Why is a Stormwater Plan needed?

A key objective of the Athenree Stormwater Plan is to support a comprehensive resource consent application from Western Bay of Plenty District Council to Environment Bay of Plenty for Council's existing and future stormwater assets. To achieve this aim the Plan includes a stormwater treatment concept for each catchment on the peninsula. These concepts provide a framework within which developers are able to:

- design harbour outlets for new reticulation;
- design stormwater assets that address local environmental issues.

A second key objective is to assist Council with future stormwater management policy for Athenree. In particular, whether or not the imposition of Development Impact Fees or other cost recovery is required for stormwater 'headworks' assets, reserve land and treatment devices. To achieve this aim the Plan includes cost estimates for those assets and Council activities associated with future development eg – stormwater system operating and maintenance, resource consent investigation, processing and monitoring.

1.2 Scope of the Athenree Stormwater Plan

The Athenree Stormwater Plan is intended:

- to promote treatment at source stormwater concepts for the existing and future urban developments;
- to identify stormwater reserves that will connect future subdivisions with the Harbour shoreline for stormwater treatment devices, pipelines and overland flow routes and capitalise on opportunities for restoration of natural habitats and passive and active recreation;
- to support an application for a Comprehensive Discharge Consent;
- to ensure concepts are "future proofed" to allow for future urban development.

The project involves several key elements:

- desk study of the relevant legislation and other information, eg Regional plans, District Plan, GIS stormwater records, see Appendix 1;
- technical study of Athenree catchments to support Stormwater Structure Plans, see Appendix 2;

- preparation of a Stormwater Structure Plan and the associated costs of environmental impact assessment, resource consent application, land purchase, construction, operation and maintenance.

1.3 Stormwater Management Responsibilities

Local and territorial authorities have a mandate to manage proposed and existing stormwater services under several pieces of legislation. These include:

- the Local Government Act (1974) gives jurisdiction to local authorities to manage stormwater infrastructure via the Resource Management Act (1991) process of subdivision consent and to maintain stormwater within Council land including road reserves;
- the Building Act (1991) incorporates standards that require protection of buildings from flooding during a 50 year Average Recurrence Interval event;
- the purpose of the RMA is to promote the sustainable management of natural and physical resources. The Act sets out the functions of both local and regional councils for the purposes of giving effect to the Act. These include controlling the effects of development on the environment, including avoidance or mitigation of natural hazards. Local authorities generally achieve these functions through their district plans and engineering codes of practice for development, whilst regional councils do so through regional plans. Regional councils have jurisdiction over the Coastal Marine Area, including the discharge of water and contaminants into or onto land or water. The jurisdiction of local authorities over land, include the responsibility to manage any stormwater discharges from development;
- the Soil Conservation and Rivers Control Act 1941 provides Regional Councils with soil conservation functions, which in a wider context includes control of discharges and the protection of water quality.

2 CATCHMENT DESCRIPTION & URBAN DEVELOPMENT

2.1 The Athenree Landscape

The Athenree - Tanners Point landscape unit is located on the northern extreme of the Tauranga Harbour and extends inland to the foothills of the northern Kaimai Ranges. To the east is the coastal spit between Island View and Bowentown and to the north are the coastal lowlands of Waihi Beach. The stormwater study area is a discrete area within this unit known locally as the Athenree peninsula, see Figure 1.

Within the landscape specific to the stormwater study area there are a number of landscape character areas that have a major influence on the future land use assumptions and stormwater management concept recommended in this Plan. The landscape character areas are delineated in Figure 2 as follows:

Estuarine
These areas are tidal being located below High Water along the harbour edge. The intact parts of the tidal wetland feature mangroves as the dominant or climax plant species.

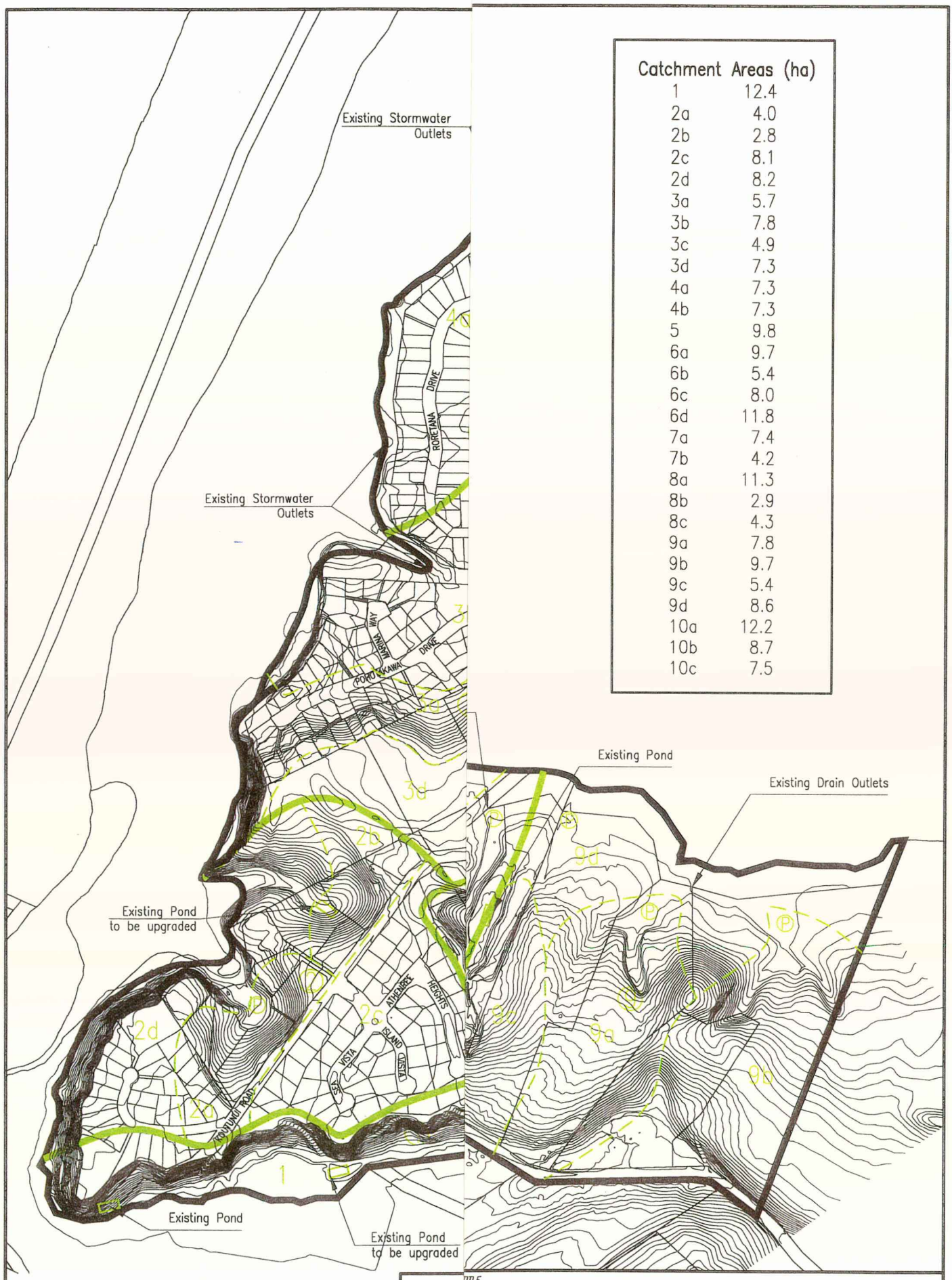
At low tide, the shallow estuarine waters and mudflats are visible with some areas of seagrass and mats of succulent species. These grade into the mangrove and saltmarsh rush association towards the high tide mark. The height and density of the mangrove increases towards the land and where wave action or other disturbance is least. Above this in a number of places are areas of raupo and flax swamp where the salt influence is less.

Flats
The low-lying land that extends inland from the harbour and estuarine areas. In the past these areas were often poorly drained pasture. The majority of this land is now occupied by the eastern extent of the existing residential housing of Athenree township.

Slopes
The western extent of the study area is comprised of a gently undulating south-facing slope rising from the harbour to Athenree Road and that road's intersection with Steele Road. The land use is pasture with open pine shelterbelts in the western portion and horticulture with trimmed shelterbelts in the eastern portion. On the north-west aspect of the study area there is a further area of gently sloping pasture. This area traverses from Steele Road above the Waihi refuse tip to a small valley immediately west of the defunct water reservoir off Koutunui Road.

Escarpment

An almost continuous, 20m high escarpment runs from the small valley west of Koutunui Road around the northern margin of the study area and then traverses across the peninsula above the flats to above the harbour edge in the south.



Catchment	Areas (ha)
1	12.4
2a	4.0
2b	2.8
2c	8.1
2d	8.2
3a	5.7
3b	7.8
3c	4.9
3d	7.3
4a	7.3
4b	7.3
5	9.8
6a	9.7
6b	5.4
6c	8.0
6d	11.8
7a	7.4
7b	4.2
8a	11.3
8b	2.9
8c	4.3
9a	7.8
9b	9.7
9c	5.4
9d	8.6
10a	12.2
10b	8.7
10c	7.5

0 10mm 50 100 200 300mm

GRAPHIC SCALES

TITLE

ATHENREE STORMWATER PLAN

Figure 1: Catchment Plan

STATUS		FILE 5/62395			
SCALE 1:8000 (A3)	PLOT DATE June 2001	JOB 362395.00	CODE	SHEET 1	REVISION

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Landscape Character Areas

Key:
- Estuarine
- Flats
- Slopes
- Escarpment
- Terrace

ROBERTSON DRIVE
ATHENREE ROAD
POPLAR WAY
MAGNOLIA DRIVE
ALDELA STEWART DRIVE WEST
KOUTUNUI ROAD
ATHENREE ROAD
STEEL ROAD
SEA VISTA
ISLAND VISTA
ATHENREE HEIGHTS
KOUTUNUI ROAD

GRAPHIC SCALES

AMENDMENT	APP'D	DATE

	BY	CHECKED	DATE
DESIGN			
DRAWN	MJB	KJC	08/00
APPROVED			

Western Bay of Plenty District Council

OPUS INTERNATIONAL CONSULTANTS
Tauranga Office
PO Box 646
Tauranga, New Zealand
Tel: +64 7 578 2089
Fax: +64 7 578 2086

TITLE: ATHENREE STORMWATER PLAN

Figure 2: Landscape Character Areas

STATUS		FILE			
		5/62395			
SCALE	PLOT DATE	JOB	CODE	SHEET	REVISION
1:8000 (A3)	August 2000	362395.00		2	

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The northern and western escarpments contain numerous large pohutukawa trees along with several karaka trees at the northern most point.

The middle section of the escarpment contains residential development and scrubby vegetation. There are mature eucalypts, pine, poplar and sheoak (Latin name *casuarinas*, non-native shelterbelt tree common in coastal BOP). Intermixed with trees on the southern area are groups of willow, thorn tree, privet, treefern and broadleaf native species along with some houses and small areas of horticulture.

Terrace

The central "spine' of the Athenree peninsula extends from the Athenree Road/ Steele road intersection and sweeps round to the northern promontory that is the Koutunui Pa site. This area is elevated above the steep to more gently sloping escarpment and is gently sloping or flat. The vegetation is characterised by numerous horticultural shelterbelts and orchards of avocado and citrus.

The 5 landscape types (estuarine, flats, slopes, escarpment, terrace) were taken from a visual landscape evaluation of the Western Bay of Plenty District (Boffa Miskell Ltd, Auckland 1993). That report delineates the landscape of the district into five landscape types as a basis for understanding the different landscape components and characteristics of the district. Within each landscape type a further delineation was made into landscape units based on a more detailed analysis of landform, landcover and land use.

The study area has been split into 10 catchments as shown in Figure 1. Each catchment has its own unique blend of current land use and landscape character (flats/escarpments/terrace). Detailed descriptions of each catchment are included in the technical report in Appendix 2.

2.2 Current Land Use

Athenree settlement is located at the end of a peninsula in the northern part of the Western Bay of Plenty District. The settlement is generally a low density residential area bounded by the Tauranga Harbour.

The land use is characterised by established residential areas, intermingled with numerous neighbourhood recreation reserves and fringed by reserve land around much of the foreshore. A newer residential area exists on the northern part of the peninsula, with rural-residential subdivisions also currently under development in this area.

2.3 Urban Development

Athenree currently has no formal Structure Plan but for the purposes of this study urban development is expected to eventually cover the whole study area (210 ha). For this study it is assumed that urban development will comprise of greenfields development plus infill housing for 56% of the lots over 800m^2 in a residential zone, see Table 2.3. The 56% infill assumption was provided with population projection data by Western Bay of Plenty District Council, see Appendix 2.

Greenfields development is assumed to occupy the 210ha study area less 40ha of existing urban development in 1999. This area is further reduced by severe topographical constrictions in parts of five sub-catchments. The areas are sub-catchments 1, 2d, 3a, 6b and 7b where the escarpment ground slope exceeds 2.5H:1V, see Figure 1. The total area of these sub-catchments is 45ha, Table 2.3. Therefore the total land area available for greenfields development is assumed to be 125ha. Based on average 'mode' population growth, 2.55 people per dwelling and an infill/greenfields development split of 33%/67%; greenfields development of approximately 152 dwellings will occur in Athenree by 2012, see population data Appendix 2.

Infill development may occur in any part of the existing urban area (40ha) not designated in the District Plan as potentially unstable. Using the same assumptions as above the total land available for infill development is 56% of the lots over 800m^2 in a residential zone and infill development of approximately 50 dwellings will occur in Athenree by 2012.

Based on average mode population growth sufficient land for greenfields and infill development is available until well beyond the year 2021, see population data Appendix 2 (Attachment 6).

Delineation of escarpment areas into land vulnerable to long-term slip risk or possibly subject to instability is outside the scope of this study and may be undertaken as future land capability studies timed to precede future development.

Table 2.3 – Urban Development

Catchment Data (from Figure 1)		Landscape Characters (from Figure 2)	Future Land Use	Future Lot Size* (m^2)
No.	Area (ha)			
1	12.4	Escarpment (Steep) & Terrace	Existing Rural & Infill Res	Existing/350
2a	4.0	Escarpment & Terrace	Infill Res/Residential	350 min
2b	2.8	Escarpment & Terrace	Infill Res/Residential	350 min
2c	8.1	Terrace	Infill Res/Residential	350 min
2d	8.2	Escarpment (Steep) & Terrace	Existing Rural & Infill Res	Existing/350
3a	5.7	Escarpment (Steep)	Existing Rural & Infill Res	Existing/350
3b	7.8	Flats	Infill Res/Residential	350 min
3c	4.9	Terrace	Infill Res/Residential	350 min
3d	7.3	Terrace	Infill Res/Residential	350 min
4a	7.3	Flats	Infill Res/Residential	350 min
4b	7.3	Flats	Infill Res/Residential	350 min
5	9.8	Flats	Infill Res/Residential	350 min
6a	9.7	Flats	Residential	350 min
6b	5.4	Escarpment (Steep) & Terrace	Existing Rural & Infill Res	Existing/350
6c	8.0	Escarpment	Residential	350 min
6d	11.8	Terrace	Residential	350 min
7a	7.4	Terrace	Residential	350 min
7b	4.2	Escarpment (steep)	Existing Rural	Existing
8a	11.3	Slopes	Residential	350 min
8b	2.9	Slopes	Residential	350 min
8c	4.3	Slopes	Residential	350 min
9a	7.8	Slopes	Residential	350 min
9b	9.7	Slopes	Residential	350 min
9c	5.4	Slopes	Residential	350 min
9d	8.6	Slopes & Estuarine	Residential	350 min
10a	12.2	Slopes	Residential	350 min
10b	8.7	Slopes	Residential	350 min
10c	7.5	Slopes	Residential	350 min

Notes:

1. * Existing = Lot size assumed to remain as existing due to severe topographical restrictions.
2. **Existing Urban Areas:** Assumed (from Council data) 56% infill of existing lots to a minimum size of $350m^2$ for sewered lots.
3. **Greenfields Development:** minimum size of $350m^2$ for sewered lots.

3 STORMWATER RETICULATION & TREATMENT OPTIONS

3.1 Statutory Requirements

A desk study of Regional plans and the District Plan yielded a significant set of statutory requirements for stormwater management. The requirements are both general and specific to the Athenree peninsula. That information has been summarised in Appendix 1.

3.2 Stormwater Issues & Possible Solutions

The stormwater treatment options recommended in this Plan were developed in a technical report, see Appendix 2. The concepts were developed as follows:

- catchment descriptions
- Western Bay of Plenty District Council stormwater design standards
- stormwater issues & possible solutions
- local hydrology
- stormwater quantity calculations
- stormwater quality treatment calculations
- land, capital, maintenance and operating costs
- investigation, resource consents and monitoring costs

Local environmental issues are discussed in the technical report and form the basis of the treatment options presented. That discussion of issues is summarised below.

Table 3.2 – Key Issues

No.	Stormwater Management Issue	Possible Solution
1	Development of steep areas resulting in erosion where intensified runoff from the new roads, house roofs and driveways concentrates in valley floors.	Drainage reserves with buried low flow pipelines providing a non-erodible conduit and planting for restoration of natural habitat.
2	Development of areas 'above' shoreline cliffs resulting in erosion by intensified runoff.	Cliff top Building Line restrictions and buried low flow pipelines.
3	Development and installation of shoreline discharges resulting shore erosion by tidal action.	Embankment immediately landward of high tide level with non-erosive floodgated outlet.
4	Development and increased sediment and contaminant loads impact on sensitive seagrass, mangrove & other ecosystems of the Harbour.	At-source and/or end-of-pipe stormwater management concepts.

Stormwater design for Athenree is similar to other areas of New Zealand in that there are site specific features that impact on the design. The key site features are:

- catchments in the Athenree peninsula discharge direct to the Harbour;

- catchments on the Athenree peninsula are relatively small (Area = 4 to 35 hectares) and have no permanent natural watercourses apart from farm drains.

These features negate a stormwater management issue normally associated with urban development. The issue is that intensified runoff (eg 5 to 100year Average Recurrence Interval, critical duration events) from the new roads, house roofs and driveways may flood properties further down a catchment. In Athenree the increase in water quantity as a result of urban development is a minor issue as all catchments have an adequate slope to the Harbour. Therefore developers source document for stormwater quantity issues will primarily be the Western Bay of Plenty District Council's Code of Practice Section 3.2.2.

Runoff from all the catchments in the study area is sourced from within the study area apart from a small area (less than 10 ha) to the south-east of catchment 9a. The land use and runoff from this area will have an insignificant influence on the Plan recommendations.

3.3 Stormwater Reticulation Options

There are two principal stormwater collection options considered worthy of consideration, open swales and kerb and channel. The following table assesses the two options in terms of financial implications and a general assessment. The general assessment relates to non-financial benefits and costs such as urban amenity.

Table 3.3: Assessment of Collection Options

Assessment of Collection Options				
	General Assessment		Financial Assessment	
Collection Options	Benefit	Costs	Maintenance Cost	Capital Cost
Kerb & Channel	Year round tidy appearance	No Treatment Capacity.	Low maintenance costs	High construction costs.
Swale	Can perform some level of storm-water treatment.	Expensive to retrofit K & C to roads designed for swales.	High maintenance costs.	Low construction costs.

Assessment of Reticulation Options				
	General Assessment		Financial Assessment	
Reticulation Options	**Benefit**	**Costs**	**Maintenance Cost**	**Capital Cost**
Piped System	Suitable in all terrain and provides erosion protection.	Secondary flow paths required.	Low	High
Open Channel System	Limited treatment capacity in flat terrain	Not suitable for Steep Grades	High	Low

Taking into account the sub-catchments that are determined by the topography of the Athenree area, it is recommended that kerb and channel be used as the collection system for new roads followed by piped reticulation. Open Drains can be used where there is a need to maintain a natural appearance e.g. where a pond area and surrounding reserve also functions as an active recreation reserve, or where the visual impacts of a concrete channel will detract from the natural appearance of the edge of Tauranga Harbour. In catchments with steep cliffs stormwater should be piped to ponds or specially designed outfall structures.

3.4 Stormwater Treatment Options

3.4.1 Evaluation of Treatment Options

Future urban developments will increase pollutant loads discharging to Tauranga Harbour unless appropriate treatment concepts are installed to cater for this development. In Athenree increasing pollutant loads have the potential to have a detrimental effect on sensitive seagrass, mangroves and other ecosystems of the Harbour.

In this report ponds are 'key treatment methods'. In-Sump Filters, soakpits and grassed swales are not considered to be 'key treatment' devices but are suitable in some instances where the key devices are not practicable. However, as the Council Code of Practice precludes the use of soak pits these have not been included in the evaluation. Table 3.4 contains an evaluation of treatment methods.

Table 3.4: Comparison of Treatment Methods

ASSESSMENT CRITERIA	TREATMENT METHODS					
	DO NOTHING			GRASSED SWALES		
	BENEFITS	COSTS	RANK	BENEFITS	COSTS	RANK
Stormwater Quality	Nil.	Will not be improved, will continue to be degraded.	5	Enhancement of quality of Stormwater, watercourses/harbour.	Partial treatment - dependent on maintenance regime	2
Stormwater Quantity	Nil.	As intensity of development increases, isolated ponding issues may arise.	5	Managed/attenuated run-off to watercourses.	Partial control - dependent on maintenance regime	2
Social/Community Acceptance		Potential for criticism due to increasing community awareness of environmental issues.	S	Some may recognise environmental benefits.	High potential for negative reaction – disruption; need? Adjacent private landowners may have to maintain.	S
Cultural		Unlikely to be acceptable to tangata whenua as intensity of development increases.	S	Enhancement of watercourses/Tauranga Harbour.	Earthworks – potential for effects on archaeological sites.	S
Visual	No change.	Nil.	3	Softening of urban landscape.	Disruption to existing streetscape during construction. Potential unkempt appearance	3
Financial Capital Cost O + M Cost	No short term financial cost to Council or ratepayers.	May result in financial implications in long term should quality of watercourses/harbour be degraded and require remedying.	 1 1	Provides a level of treatment and may reduce the size of ponds (dependant on low grade and length of swale)	Capital cost and maintenance costs med. - high as individual driveways must have crossings over or be sagged through swale. Swales require regular maintenance.	 5 3

*** Ranking: 1 = Excellent, 5 = Poor, S = Subject to consultation**

Table 3.4 Continued

ASSESSMENT CRITERIA	TREATMENT METHODS					
	PONDS			IN SUMP FILTERS		
	BENEFITS	COSTS	RANK	BENEFITS	COSTS	RANK
Stormwater Quality	Key Treatment Device improved quality of Stormwater, watercourses and harbour.	Nil.	1	Partial treatment device – removal of litter and coarse particles.	Unproven performance record.	3
Stormwater Quantity	Key treatment device reduced/managed run-off.	Nil.	1	No change.	No change.	5
Social/Community Acceptance	Enhanced landscape and added value to recreational areas.	Probable loss of public open space. Minor loss of usable reserve area in Greenfield.	S	Environmental benefits recognised. Avoids use of open space otherwise required for ponds/grass swales.		S
Cultural	Enhancement of quality of receiving environment.	Earthworks – potential for effects on archaeological sites.	S	Enhancement of watercourses/Tauranga harbour.	Nil.	S
Visual	Potential for creating landscape feature through planting/walkways.	Adverse visual effects during construction only. Existing urban – less scope for visual enhancement. Greenfield: plan as part of subdivision.	3	No permanent visual impact.		1
Financial Capital Cost O + M Cost	Low maintenance budget for road berms not reliant on ratepayers mowing berm.	Capital costs med-high as reserve land required for ponds.	 5 3	Capital costs less as only sump is changed from traditional subdivision design.	O&M costs potentially high dependant on chosen maintenance regime.	 3 3

*** Ranking: 1 = Excellent, 5 = Poor, S = Subject to consultation**

3.4.2 Options for Greenfields Development

For greenfields development, developers could be given the choice of which key treatment method they wish to employ as long as the performance will be equal or better than ponds. This allows approval of techniques devised and applied in the future that are unknown or unproven at present. However, this would make it difficult to size the appropriate treatment device and therefore determination of DIF will be difficult. It is recommended that the preferred option (wet ponds) be adopted and included in the structure plan for Athenree. Should the developer wish to deviate from the structure plan then a resource consent would be required. This is achieved by new district plan rules that are recommended in Appendix 4.

The overall conclusion is that collection by kerb and channel with reticulartion by either pipe or open channel systems to the wet ponds is the best option for green fields developments because ponds have a higher treatment efficiency than the other methods.

3.4.3 Options for Infill Development

Where infill development of existing urban areas is not intensive then treatment elements are not essential and environmental effects may be minimised by a combination of 'on-site controls' as listed in section 3.6 (third bullet point). The term 'intensive' infill development is defined by the overall percentage impervious area in each sub-catchment. The impervious area could be measured from the latest aerial photographs or some other method determined by Council at the time. It is recommended that infill development be termed intensive if future impervious percentages in a sub-catchment would exceed 33% and the increase over existing levels exceeds 5%. (Note: 33% impervious is the current average for urban areas similar to Athenree.)
Due to lack of available area for wet ponds, in-sump filters are recommended as the best practicable treatment element for some existing urbanised areas where significant infill is predicted. It is recognised that retrofitting in-sump filters is not a 'key treatment' but that they will be an improvement over the existing situation in cases where there is no existing treatment device.

The overall conclusion is that reduced-size wet ponds and in sump filters are the best options for infill development because they optimise treatment efficiency and space benefits.

A more detailed description of the treatment methods is set out below.

3.4.4 Ponds

The technical report advanced the initial treatment solutions detention ponds and/or wet ponds for developable catchments, see Appendices 2 & 3.1. The wet pond concepts are based on Auckland Regional Council Technical Publication Number 10 in accordance with WBOPDC Subdivision and Development Code of Practice. Wet ponds operate by retention of inflow for sufficient time to allow sediment particles to settle to the bed of the pond. Sedimentation is an important mechanism for stormwater treatment because studies show that over half the pollutants in stormwater are attached to particles. Wet ponds also treat stormwater by biological uptake and other treatment mechanisms.

Ponds in a reduced form can also be considered as a 'non-key' treatment elements. For instance, a pond at 25% of full design volume would provide 50% of design sediment removal and at 5% of full design volume would provide 30% of design sediment removal. Obviously the sediments removed would tend toward the larger particle sizes with progressively more silt and clay size particles passing as the pond size decreases. This type of element may be able to be used with other options or where a discharge is not so critical.

Ponds may be used as a comprehensive treatment device in conjunction with a conventional urban development with kerb and channel (ie no source treatment) or in conjunction with swales and other permeable surfaces to minimise stormwater impacts and provide some at-source treatment.

3.4.5 In-Sump Filters

In-Sump filters such as the proprietary product "Enviropod" on the New Zealand market, consist of a filter device that can be retro-fitted to existing roadside sumps. The filters can vary in size dependent on the targeted material to be removed. Additional absorption pads can be added where necessary for oil or grease removal.

The filters rely on a well managed maintenance regime and the frequency of maintenance is site-specific as well as filter-specific. As a result of this stringent maintenance requirement they are not recommended for use on greenfields projects where Council will inherit the ongoing maintenance requirements, but are seen as potential mitigating devices in areas where the 'key treatment devices' are not able to be installed.

At this point usage of these devices is still at the trial stage in New Zealand and therefore there is limited performance data available.

3.4.6 Grassed Swales

Grassed swales are another treatment device effective in the stormwater treatment train typically used in conjunction with downstream ponds. Although retention time in grassed swales is much shorter than ponds, physical filtering of low flows and biological uptake mechanisms do operate. The advantage of grassed swales are that they achieve stormwater treatment closer to the source than end of pipe solutions like ponds. Grass swales are considered part of an overall treatment system and do not replace the need for treatment ponds or equivalent but may reduce the volume of ponds required. Data relating to the performance of grass swales in improving stormwater quality is inconclusive.

3.5 Treatment Options for Athenree Catchments

3.5.1 Evaluation Summary

Table 3.4.1, Catchment Treatment Summary indicates which treatment option is to be used for each catchment. No wet ponds are listed for sub-catchments 1, 2d and 7b because the majority of the catchments are steep escarpment and the existing 10 to 15 lots are better served by 'non-key treatment' methods eg in-sump filters.

Two existing catchments (4a and 4b) have an 'at this stage' rider attached to the stormwater management recommendations. The final recommendation on these catchments will be determined following a consultation process with both the community and the Western Bay of Plenty District Council.

Table 3.5: Catchment Treatment

Cat.	Future Urban Development?	Possible Treatment Options			
		Wet Ponds (App 3.1)	Grassed Swales (App 3.2)	In-sump Filters (App 3.3)	Other Mgmt. Options (S. 3.5)
1	Partly existing urban. Infill possible.			✓	✓
2a	Existing urban. Infill possible.	✓			✓
2b	Existing urban. Infill possible.	✓			✓
2c	Existing urban. Infill possible.	✓			✓
2d	Partly existing urban. Infill possible.			✓	✓
3a*	Existing urban. Infill possible.			✓	✓
3b	Existing urban. Infill possible.			✓	✓
3c	Existing urban. Infill possible.	✓			✓
3d*	New urban possible.			✓	✓
4a	Existing urban. Infill possible.			✓	✓
4b	Existing urban. Infill possible.			✓	✓
5	New urban possible.	✓			✓
6a	New urban possible.	✓			✓
6b	Existing urban. Infill possible.	✓			✓
6c	New urban possible.	✓			✓
6d	New urban possible.	✓			✓
7a	New urban possible.	✓			✓
7b	No. Too steep for new urban.			✓	✓
8-10	New urban possible.	✓			✓

* In-sump Filters recommended at this stage as there is insufficient room for full pond solution.

3.5.2 Catchment 1

This catchment is predominantly a west-facing escarpment except for a small area of terrace at the north end. The terrace is elevated approximately 25m above mean sea level. From that level the escarpment slopes down at approximately 3.0 Horizontal to 1.0 Vertical (3H:1V) to 2H:1V.

Whilst infill residential is possible for the 6 to 7 lots in the terrace areas the remainder of the catchment mostly slopes are greater than 2.5H:1V and key treatment options are unnecessary. In this case the list of stormwater treatment options includes:

- in-sump filters in road sumps, see Appendix 3.3 (intermediate location);
- other techniques, see Section 3.6.

3.5.3 Catchment 2

This catchment features terrace surrounding two east-facing escarpment valleys. The escarpment vegetation is a mixture of ancient pohutukawa trees at the north end and rural residential elsewhere.

Infill residential is possible in all areas of this catchment except catchment 2d as the escarpment slopes are less than 2.5H:1V. The treatment options for catchment 2a include:

- wet pond, see Appendix 3.1 (end of pipe location);
- other techniques, see Section 3.6.

Catchment 2b & 2c have existing wet ponds therefore grassed swales and in-sump filters are not necessary but other techniques are possible to further improve stormwater quality.

Catchment 2d treatment options are as per Catchment 1.

- in-sump filters in road sumps, see Appendix 3.3 (intermediate location);
- other techniques, see Section 3.6.

3.5.4 Sub-catchments 3a & 3d

The topography of Catchment 3 includes terrace land in the west, an east facing escarpment and flat land in the east. The terrace land has urban development along Koutunui Road and a mixture of cropping and rural residential in the remaining area. The escarpment is also farmed but includes an urban area along Pohutukawa Drive with a shoreline reserve to the east.

The coastal park between Roretana Avenue and Pohutukawa Drive has a sufficient area of gently sloping area for a retrofitted wet pond for all of Catchment 3.

However the park is a significant recreational asset and it is unlikely that a retrofitted wet pond would receive support.

A further restriction is the private, arable land in sub-catchments 3a and 3d. This land discharges a significant sediment load particularly in autumn, during intense rainfall, after the crop has been removed and the soil cultivated. The sediment load is similar to the acute problems caused by urban development but longer lasting than the urban development case. The result is that large amounts of soil wash into the urban area and are transferred by the stormwater system to the estuary. If robust runoff prevention measures were implemented for the arable land, then the list of stormwater management options for sub-catchments 3a & 3d include:

- in-sump filters and other techniques, such as vegetated buffer strips.

When/if catchment 3d is developed it is recommended that:

- ponds be installed to treat stormwater.

Given the lack of available space ponds may need to be located at the top of the terrace thereby requiring special engineering considerations. Stormwater treatment will be provided by the developer on site meeting standards identified in the Council Code of Practice for Development.

3.5.5 Sub-catchment 3b & 3c

The east portion of Catchment 3b has a separate drain network to the remainder of Catchments 3 and is unaffected by the large sediment load. The coastal park has a sufficient area for a retrofitted wet pond for Catchment 3b but a retrofitted wet pond sufficient for Catchment 3 as a whole is unlikely to receive support. This prediction is based on the fact that the two reserves in Athenree identified for possible wet ponds are the also the best two reserves for active recreation. In this case the list of stormwater treatment options includes:

- in-sump filters and other techniques.

Grassed swales are omitted from the list because Catchment 3b is made up of three moderately sloping well-defined catchments. The challenge here is that the overland flow runs along the valleys at right angles to road berms. Whereas grassed swales need to be able to 'catch' and convey stormwater along road berms to be effective at removal of sediment and associated contaminants. Sub-catchment 3c has a site for a large wet pond and treatment options are:

- wet pond, see Appendix 3.1 (end of pipe location);
- other techniques, see Section 3.6.

3.5.6 Catchment 4

Catchment 4 topography consists of coastal flats with a maximum ground level of RL5.0m. Urban development is the predominant land use. Exceptions are the hot springs motor camp in the centre of the catchment and reserve land along the entire foreshore.

The houses to the north of Athenree Road are drained to soakage holes via road sumps. The remaining area all drains to stormwater outlets spaced along the Roretana Avenue and Waione Avenue. The terrain is too flat for reticulation of these existing outlets to one central wet pond and there is insufficient space in the existing coastal reserve (20m width) to retrofit a wet pond for each of the outlets. The existing discharge pipe on Roretana Drive transverses a lot owned by Western Bay of Plenty District Council. This land could be utilised for construction of a pond which would be less than desirable in size but provide partial treatment. Stormwater treatment options for Catchment 4 include:

- partial ponds and in-sump filters.

3.5.7 Catchment 5

This catchment is also coastal flats with a maximum ground level of RL15.0m. The harbour bounds the area to the south and there is a slight rise on the other three sides that act as catchment boundaries. Catchment 5 has a site for a large wet pond and treatment options are:

- wet pond, see Appendix 3.1 (end of pipe location);
- other techniques, see Section 3.6.

3.5.8 Catchment 6

The topography in this part of the peninsula features terrace land in the west (Sub-catchment 6d), a south facing escarpment (6b & 6c) and flat land in the east (6a). The terrace land has a mixture of horticulture (kiwifruit) and rural residential urban development. The escarpment is also a mix of horticulture and rural residential (with shoreline reserve) but includes an urban area north of Athenree Road.

Sub-catchments 6c & 6d are drained via farm drain that exits to the Harbour. The existing pond may be upgraded but only for sub-catchment 6b. The problem is that

the pond has been built at the tidal edge and disruption to this ecosystem should be minimised, if possible. The treatment options for sub-catchment 6b are as for sub-catchment 2b.

- other techniques, see Section 3.6.

Sub-catchments 6a, 6c & 6d each have sites for large wet ponds and the treatment options are.

- wet pond, see Appendix 3.1 (end of pipe location);
- other techniques, see Section 3.6.

3.5.9 Catchment 7

This catchment features terrace land in the north and a south facing escarpment along the shoreline. The terrace land has a mixture of horticulture (kiwifruit) and rural residential urban development. The remainder escarpment is a mixture of pasture and scrub with a shoreline reserve running for half it's length.

Sub-catchment 7a has a site for a large wet pond and treatment options are:
- wet pond, see Appendix 3.1 (end of pipe location);
- other techniques, see Section 3.6.

Catchment 7b treatment options are in-sump filters and "other Stormwater Management Options" in Section 3.6.

3.5.10 Catchments 8 & 9

The dominant landform in this catchment is the south facing slopes that form into two distinct basins. The landform is similar to Catchment 2 but on larger scale. The land use is a mixture of horticulture (kiwifruit) and rural residential urban development (with shoreline reserve).

The sub-catchments that form catchments 8 & 9 have sites for large wet ponds and treatment options are:

- wet pond, see Appendix 3.1 (end of pipe location);
- other techniques, see Section 3.6.

3.5.11 Catchment 10

The dominant landform in this catchment is the north facing slopes. The land use is a mixture of horticulture (kiwifruit) and rural residential urban development (with shoreline reserve).

The sub-catchments that form catchment 10 have sites suitable for large wet ponds. The treatment options are:

- wet pond, see Appendix 3.1 (end of pipe location);
- other techniques, see Section 3.6..

3.6 Other Stormwater Management Options

Table 3.5 above refers to other management options. Examples of these permanent techniques for stormwater management in urban areas include:

- road narrowing, permeable paving
- soakage chambers, although Athenree soils lessen their effectiveness;
- on-site controls eg upgrading septic tanks to reticulated sewerage plus treatment plant (programmed for completion in 2002), buffer planting between grassed areas and roads, sand filters for vehicle parking areas, diversion of contaminated stormwater to sewer;
- solid waste measures eg mechanical street sweeping, litter pick-up and road sump cleaning;
- erosion controls (permanent) eg vegetation of bare areas, riparian planting;
- public education eg information packs and seminars for schools, door knocking of commercial and industrial landowners to determine their on-site controls and suggest enhancements;
- planning controls eg enforcement of code of subdivision development, stormwater plans, subdivision resource consents that include the above measures, minimisation of impermeable surfaces, minimum average lot size.

In addition there will be techniques devised and applied in the future that are unknown at present.

4 STORMWATER STRUCTURE PLAN

4.1 Constraints on Treatment Option Sites

Prior to the formulation of an overall Stormwater Structure Plan consideration needs to be made of local constraints on urban development and associated stormwater infrastructure that are shown on the Constraints Plan, see Figure 3. The constraints are as follows:

- Archaeological sites
- Existing recreation, historic and esplanade reserves
- Maori land
- Significant Ecological sites
- Land vulnerable to long term slippage and subject to instability
- Significant Heritage Features
- Land subject to inundation.

In Athenree the above constraints do not prohibit urban development on a large scale. Rather, they tend to combine with constraints like land instability to limit development of portions of catchments. Works within any of the above constraint areas may require other resource consents as appropriate.

4.2 Location of Future Treatment Options

The layout of the recommended stormwater reserves that encompass the post-development floodable areas and trunk stormwater infrastructure are shown in the Management Plan, see Figure 4. The reserves will provide secondary flow paths for flows in excess of the capacity of the primary piped system from urban areas overland to the Harbour. Ponds may be located in these reserves.

Inspection of the site shows that wave action is actively eroding the south coast of Athenree due to the long fetch (several kilometres) up Tauranga Harbour from the south east. The District Plan maps recommend two coastal reserves, see Figure 3. If these reserves are implemented as urban development occurs there will be a coastal reserve created along the entire Athenree south coast. The north coast of Athenree is also eroding but only to the 'main' Harbour shoreline to the east of Pohutukawa Drive. To the west of this point the estuary, at high tide, has very little fetch (less than 500m) from the north.

4.3 Cost of Future Stormwater Management

Attachment 3 summarises the cost estimates associated with existing and future Council stormwater assets.

Legend

- Archeological Site
- 83 Site Number
- Other Archeological Site
- Recreational Reserve
- Historic Reserve
- Esplanade
- Proposed Esplanade
- Maori Land
- Designated Area
- U13/23 Significant Ecological Site
- Vunerable to Long Term Land Slip Risk
- Possibly Subject to Instability
- 109 Significant Heritage Feature

Site No.	Site Type:	First Recorded:	Sewer Plan Reference:
U13/44*	Pa	1980	R1
U13/46*	Pa	1980	R1
U13/50*	Pa	1980	W2
U13/76*	Midden/Findspot	1980	V1, W1
U13/77*	Midden	1980	R1, V1
U13/79*	Pit/Meeting House	1980	W1
U13/80*	Midden/Pit	1980	W2
U13/81	Midden/Findspot	1980	Y2
U13/84*	Midden/Findspot	1980	Z1
U13/87	Midden	1980	AA1
U13/89*	Midden/Pits	1980	Y3, Z3
U13/90	Midden/Findspot	1980	Y2
U13/103	Midden	1980	Z1
U13/1249*	Midden	2000	Z1
U13/1250*	Midden	2000	AA1

*Visible Evidence

GRAPHIC SCALES

AMENDMENT	APP'D	DATE

	BY	CHECKED	DATE
DESIGN			
DRAWN	MJB		08/00
APPROVED			

Western Bay of Plenty District Council

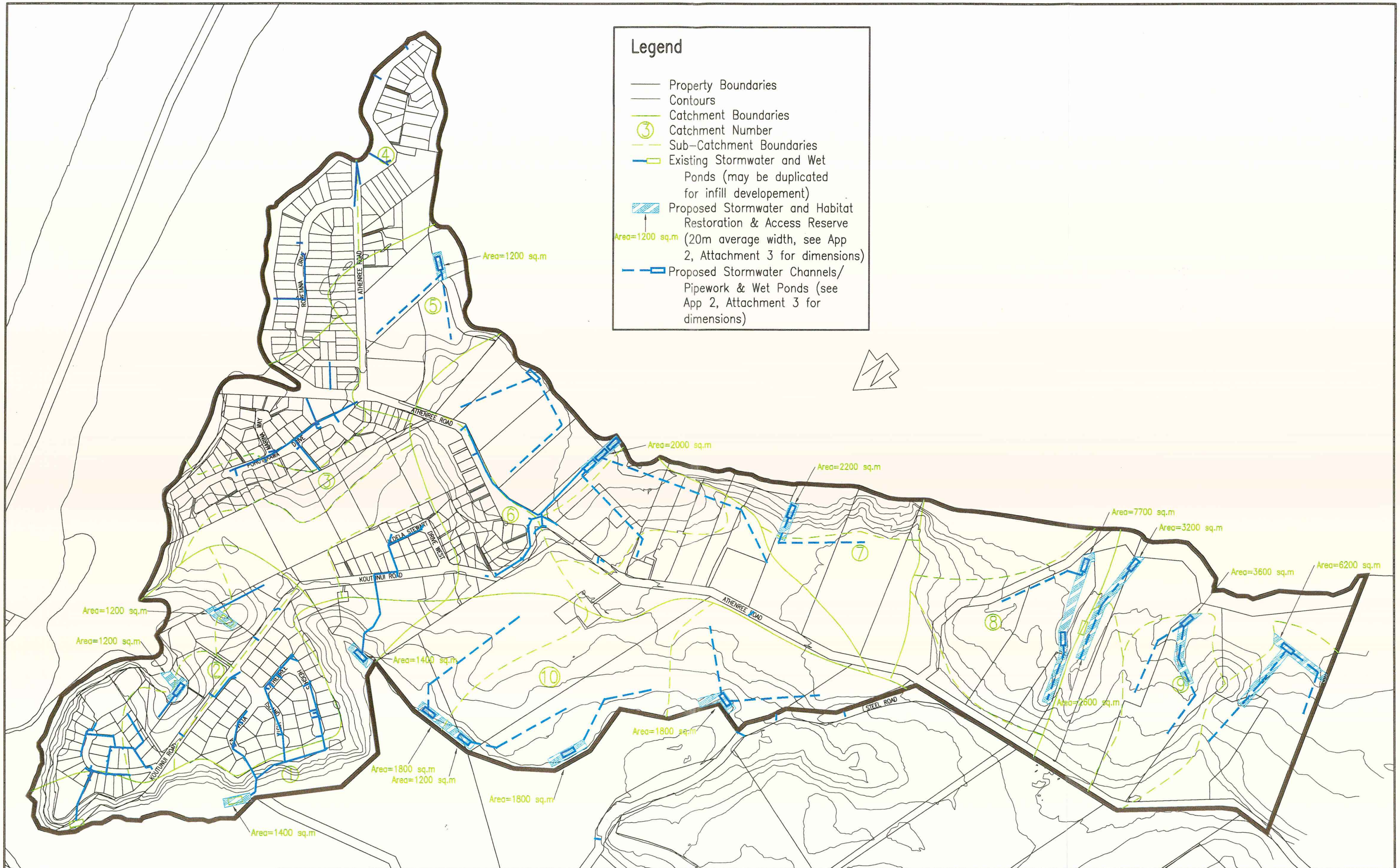
OPUS INTERNATIONAL CONSULTANTS
Tauranga Office
PO Box 648
Tauranga, New Zealand
Tel +64 7 578 2099
Fax +64 7 578 2098

TITLE: ATHENREE STORMWATER PLAN

Figure 3: Constraints Plan

STATUS		FILE			
		5/62395			
SCALE	PLOT DATE	JOB	CODE	SHEET	REVISION
1:8000 (A3)	August 2000	362395.00		3	

g:\waihi\29c012\acad\acad r14 files\plans\athenree_presentation.dwg ORIGINAL SHEET SIZE A1 [840x594]



			BY	CHECKED	DATE
		DESIGN			
		DRAWN	MJB	KJC	08/00
		APPROVED			
AMENDMENT	APP'D	DATE			

Western Bay of Plenty District Council

OPUS International Consultants
Tauranga Office
PO Box 646
Tauranga, New Zealand
Tel: +64 7 578 2089
Fax: +64 7 578 2086

TITLE
ATHENREE STORMWATER PLAN

Figure 4: Stormwater Management Plan

STATUS		FILE 5/62395			
SCALE 1:8000 (A3)	PLOT DATE August 2000	JOB 362395.00	CODE	SHEET 4	REVISION

GRAPHIC SCALES

g:\waihi\29c012\acad\acad r14 files\plans\athenree_presentation.dwg ORIGINAL SHEET SIZE A1 [840x594]

5 RECOMMENDATIONS

5.1 Implementation

Athenree currently has no formal Structure Plan but for the purposes of this study urban development is expected to cover the whole study area (210 ha). For this study it is assumed that urban development will comprise greenfields development plus infill housing for 56% of the lots over 800m^2 in a residential zone.

Future urban developments will increase pollutant loads discharging to Tauranga Harbour unless appropriate treatment concepts are installed prior to development. In Athenree increasing pollutant loads will have a detrimental effect on sensitive seagrass and mangroves ecosystems of the Harbour. The 'Do Nothing' stormwater management option is not an option in any of the study area.

The following table identifies the key stormwater management issues and identifies management controls and actions for implementation. Detailed stormwater management recommendations for subcatchments are detailed in Table 3.5 and described and reasoned in Sections 3.5.2 to 3.5.11. Evaluation of collection options is identified in Section 3.4.

Table 5: Stormwater Management Recommendations

No.	Stormwater Management Controls	Stormwater Management Implementation
1	**Planning phase** - No buildings in flood plains or overland flow paths.	Overland flow paths to be finalised during detailed stormwater design at time of subdivision. Buildings should have freeboard as specified by the Code of Practice and Section 15.3.5.3(c)(vi) of the district plan (Note: The latter will require alignment with the COP if there is a difference in standard when the draft Code is finalised).
2	100 year ARI critical duration event runoff conveyed to outlet safely via pipelines and stormwater reserve assets.	No action except comply with Code of Practice.
3	Installation of stormwater reserves and floodgate outlets to assist recommendation 2 above, limit erosion and realise opportunities to restore habitats by native planting.	Include in Structure Plan for Athenree and as condition in Comprehensive Stormwater Discharge Consent – refer (S3.3). The structure plan will be referenced in section 15 of the district plan.
4	Wet ponds are the best option for greenfields development to maximise treatment efficiency. Stormwater to be passed through a wet pond – ARC	Include in Structure Plan for Athenree and as condition in Comprehensive Stormwater Discharge Consent – refer (S3.3). The

No.	Stormwater Management Controls	Stormwater Management Implementation
	TP10 and on-site controls where required prior to Harbour discharge. .	structure plan will be referenced in section 15 of the district plan.
5	Reduced-size wet ponds and in-sump filters are the best option for infill development to optimise treatment efficiency and space benefits. Treatment device required if percentage impervious area has exceeded 33% and increased by 5% between measurements. Initial method selected to be applied over full catchment and approved alternative possible.	Include in Structure Plan for Athenree and as condition in Comprehensive Stormwater Discharge Consent – refer (S3.4.3). Impervious surface rule to be included in Section 15 (Stormwater & Development) of the District Plan.
6	Infill development may occur in any part of the existing urban area, except the area where land is designated vulnerable to long-term slip risk or possibly subject to instability in existing DP or in future.	Include in Structure Plan for Athenree and as condition in Comprehensive Stormwater Discharge Consent – refer (S3.2). A suitable building line restriction or special zoning could be imposed in the district plan. This would require further geotechnical work.
7	Clifftop discharges connected together and discharged via a treatment device and approved pipeline to shore level.	Include in Structure Plan for Athenree and as condition in Comprehensive Stormwater Discharge Consent – refer (S3.2).
8	All stormwater treatment designs must include a maintenance methodology statement for approval.	Catchment discharge consent application and subsequent Stormwater Discharge Consent to cover this.
9	**Construction Phase** – Prior to urban development stormwater management measures must be installed.	Comprehensive Stormwater Discharge Consent.
10	**Operation Phase** – Promote on-site controls and public education as the keys to ongoing stormwater quality improvement.	Include as item for Council education strategy and Comprehensive Stormwater Discharge Consent – refer (S3.5).
11	**Other Stormwater Management Options** – Promote use of options as appropriate.	To be implemented through Councils Environmental Education Programme.

The Athenree Stormwater plan will form the basis for the stormwater component of the Athenree Structure Plan, which is yet to be completed. The structure plan will be empowered by its inclusion by reference in rules within Section 15 of the District Plan. Section 5.2 identifies a list of future work which is required to form part of the structure plan which may also impact on future development in the Athenree area. This may have implications in terms of the recommendations of this report. It is therefore recommended that the 'future work' identified in Section 5.2 be undertaken and then the findings of this report reviewed in terms of any critical changes, especially as it relates to assumptions.

5.2 Future Investigation

The following 'future work' is recommended to be undertaken:

- The development of a structure plan for the area. This will include taking into account the findings of this report and further work as identified below.
- Where reserve areas are considered to have multiple purposes (ie stormwater management and recreational functions) then further work will be required to identify the reserve areas to accurately show them on the structure plan.
- Geotechnical investigations in terms of the impact of urban development adjacent to Athenree cliff tops including the identification of suitable building line restrictions.
- Monitoring of the quality of the receiving environment is likely to be required as a condition of any Comprehensive Discharge Consent granted. We recommend that Western Bay of Plenty District Council undertakes the first water sampling and analysis as soon as possible. Such data can then form part of the monitoring provisions of the application for discharge consent, and will also provide a vital basis for future monitoring.
- Assessment of Building Floor Levels in Athenree taking into account sea level rise and wave run-up during storm events. This may result in a minimum floor level greater than that identified in the COP and/or district plan (currently 2.8 Motoriki Datum).
- A visual ecological assessment of the entire Athenree foreshore may provide useful additional monitoring data.
- Determine the existing average imperviousness for the existing residential area and therefore identify the likely development potential prior to reaching the threshold for additional treatment devices and design of any capacity improvements.

6 ASSESSMENT OF ENVIRONMENTAL EFFECTS

6.1 Introduction

This Plan supports an application for comprehensive discharge consent under the Resource Management Act for both existing and proposed Council stormwater assets located within the boundaries shown in Figure 1. In addition, the Plan provides a framework within which developers are able to design future Harbour outlets and stormwater assets that address local water quality issues. The Plan will also provide supporting data for resource consent applications to Western Bay of Plenty District Council and Environment Bay of Plenty for any works developers propose that are not covered by the Comprehensive Discharge Consent.

The assessment remains general at this stage. A more detailed assessment of effects will need to be completed following Council's adoption of the recommended Stormwater Management Controls, and also following the necessary community consultation.

6.2 Stormwater Description

Site descriptions of the individual catchments and stormwater systems are described in Appendix 2, Section 2.

6.3 Description of the Physical Environment

The physical environment is described in Section 2.

6.4 Description of the Social Environment

The social environment is described in Appendix 2, Section 2.

6.5 Statutory Controls

Statutory controls are described in detail in Appendix 1.

The following resource consents are required for the recommended stormwater management controls (with the exception of the "other management options").

- Comprehensive Discharge Consent (Environment Bay of Plenty)
- Large scale earthworks, including within the "Riparian Management Zone" (Environment Bay of Plenty)

- Any stormwater works within "*Identified Significant Features*" including the "*Tauranga Harbour Landward Edge*" (Western Bay of Plenty District Council)
- Stormwater ponds on land not vested as Drainage Reserve (Western Bay of Plenty District Council).

Environment Bay of Plenty is currently finalising the non-statutory draft version of the Water and Land Plan. This Plan will address discharges of stormwater onto land. The requirements of this Plan will need to be considered if it has been publicly notified as a statutory draft by the time Council is ready to lodge an application for Comprehensive Discharge Consent.

6.6 Tangata Whenua Consultation

Public consultation is outside the scope of this plan. However initial consultation with tangata whenua has been undertaken for the proposal in conjunction with the current Waihi Beach Sewerage Scheme - Reticulation project.

Opus contacted the nine tangata whenua groups listed in Appendix 1 and asked them whether or not they have an interest in the area covered by the Athenree Stormwater Management Plan. Their replies are summarised in Appendix 1.

All nine groups listed in Appendix 1 were invited to a meeting at the Waihi Beach Community Centre on 26 June 2000 to discuss both the Athenree Stormwater Management Plan and the Waihi Beach Sewerage Reticulation Scheme. Three groups attended, namely, Te Whanau o Tauwhao ki Otawhiwhi Marae, Te Runanga a Iwi o Ngati Tamatera and Te Kupenga o Ngati Hako. At the meeting each of these groups agreed to prepare a report that assessed the effects of the Athenree Stormwater Management Plan on their interests.

6.7 Effects of Stormwater Discharge

6.7.1 Issues and Stormwater Management Controls

The environmental effects of the stormwater discharges are described in general in Section 3.

Table 6: Stormwater Management Issues and Management Controls

No.	Issues	Stormwater Management Controls
1	Intense runoff from new roads, roofs and driveways causing erosion and flood potential.	• install stormwater systems and stormwater reserves.
2	Stormwater outlets causing shore erosion.	• install embankments with floodgated outlet to halt tidal action in stormwater reserves.
3	Intense runoff from new roads, roofs and driveways causing sedimentation of Harbour and damage of seagrass beds and mangroves.	• install key treatment devices (ponds and/or grassed swales) and in-sump filters and promote on site controls and education to improve stormwater quality.
4	Intense runoff from new roads, roofs and driveways carrying contaminants to Harbour.	• install key treatment devices (wet ponds and/or grassed swales) and in-sump filters and promote on site controls and education to improve stormwater quality. • litter control by sump cleaning and pick-up.

6.7.2 Effects of Works and Proposed Mitigation Measures

Sediment run-off and erosion are the main potential effects associated with the construction of the stormwater management controls. The landscape effects of any works within the Tauranga Harbour Landward Edge will also need to be carefully addressed.

As part of any application for both discharge consent and associated earthworks consent, an Erosion Sediment Control Plan will need to be formulated and adhered to during the construction phase.

Any permanent effects on the landscape of the Tauranga Harbour Landward Edge, or on any other identified Significant Features, should be avoided. The scale and duration of any construction within the Harbour Landward Edge should be minimised to reduce any adverse effects on the landscape.

6.8 Receiving Environment

The existing and proposed stormwater outfalls from the Athenree peninsula will flow into the same receiving environment, the Tauranga Harbour. As Steel Road denotes the north-western extent of the area covered by the Stormwater Management Plan, the Waiau River will not receive stormwater from the subject area.

The stormwater works proposed in the Stormwater Management Plan are aimed to avoid, remedy or mitigate the potential adverse effects of stormwater run-off into

the harbour. Measures proposed in the existing urban area are intended to enhance the quality of the harbour, by managing stormwater quantity and improving quality.

6.9 Statutory Assessment

6.9.1 Regional Plans

The following Environment BOP Plans provide the framework for assessing the effects of the proposed stormwater management works:

- Proposed Bay of Plenty Regional Coastal Environment Plan (Version 9, 29 June 1999).
- Proposed Bay of Plenty Regional Land Management Plan (Version 8, March 1998).

The relevant rules are incorporated in Appendix 1 of the Stormwater Management Plan. Any consents required under the Proposed Regional Land Management Plan, such as earthworks, will be sought and obtained separately from the discharge consent.

The **Proposed Regional Land Management Plan** applies to the construction phase of the stormwater management works. The Proposed Land Management Plan aims to promote soil conservation practices and avoid the adverse effects of erosion and sedimentation on the water quality of our streams, rivers, lakes and marine environments.

Section 6.5 of the Regional Land Management Plan incorporates the following objectives and policies for the management of erosion and discharge of sediment:

Objective 6.5.2(a). *"A further decrease in the discharge of sediment resulting from unsustainable land uses".*

Policy 6.5.3(a). *"To actively promote sustainable land management and use through soil conservation and erosion control practices".*

The mitigation measures to be implemented during both the construction phase and through the operation of the stormwater works themselves, will ensure that the relevant objectives and policies of the Proposed Regional Land Management Plan are met.

The **Proposed Regional Coastal Environment Plan** recognises the coastal environment is integrated with some activities on the land. The Coastal Plan further recognises that the *"maintenance of good coastal water quality is essential to the social , recreational, economic, cultural and spiritual needs of the community, as well as for protecting the overall health of the environment"*. (Section 9.1 Coastal Discharge).

The following objectives and policies for coastal discharges are relevant to the Athenree Stormwater Management Plan and associated proposed works:

Objective 9.2.2. *"Maintenance and enhancement of the water quality of the Bay of Plenty Coastal Marine Area".*

Policy 9.2.3(a). *"To integrate the management of water quality in the coastal marine area with the management of land use and fresh water".*

Policy 9.2.3(d). *"Urban land use will be managed to ensure that stormwater does not cause estuarine and harbour water quality to fail the standards set in policies 9.2.3(b) and (c) or cause accumulation of contaminants in harbour or estuary sediment at levels which have adverse effects on marine life. The following techniques should be considered:*

- *source control;*
- *integrated management of whole stormwater catchments;*
- *minimising the total area of impermeable catchment surfaces;*
- *maximising disposal of stormwater to ground, except where this would cause flooding, instability or groundwater contamination;*
- *minimising the possibility of cross contamination of stormwater systems with sewage;*
- *the installation of stormwater treatment devices in new or upgraded stormwater systems; and*
- *ensuring that the layout of subdivision and services facilities the retention of riparian margins and wetlands".*

Policy 9.2.3(h). *"To continue to monitor and report on the water quality of the Bay of Plenty coastal marine area".*

The Stormwater Management Plan has been formulated with the above objectives and policies as the basis for the outcomes sought. Construction of the proposed stormwater works will be undertaken in accordance with an appropriate Erosion and Sediment Control Plan. Implementation of the stormwater management works will ensure that the quality of the coastal environment is protected and, as far as possible, actually enhanced.

6.10 Options to Reduce Effects

Description of options to reduce environmental effects of the stormwater discharges is described in Section 5.

6.11 Monitoring

Monitoring is described in Appendix 2, Section 5.4.

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Appendix 1

Statutory Requirements

1 Statutory Requirements

1.1 Regional Plans

1.1.1 Proposed BOP Regional Land Management Plan (Version 8 March 1998)

Purpose
Environment Bay of Plenty's (Environment BOP) Proposed Regional Land Management Plan is designed to achieve integrated management of both landuse and water reserves.

The Proposed Land Management Plan focuses on:

- the maintenance of catchments to provide high quality water resources for downstream users;
- the encouragement of land management activities which reduce the discharge of elevated levels of sediment to water bodies;
- the encouragement of sustainable land management systems.

Objectives and policies cover sustainable land management, soil conservation, riparian management, protection of wetlands, and integration of land and water management. To achieve these objectives and policies, the plan contains rules relating to earthworks; vegetation clearance; stream crossings; and wetland modification.

Overview of Rules
The scale and nature of earthworks are controlled in order to avoid erosion and also sediment run-off to watercourses, including the harbour. The Plan incorporates the following zones within which special controls apply:

- Riparian Management Zone which is defined as a specified horizontal distance from a wetland, or from the bed of a river or lake, or from the coastal marine area.
- Erosion Hazard Zone incorporates land that has limitations due to severe to extreme erosion hazards. This land is defined by slope, location to watercourses, soil type and altitude.

Resource consent is required for small scale earthworks within the Erosion Hazard Zone or Riparian Management Zone. The definition of small scale earthworks includes:

- *an exposed area of land less than I hectare; or*
- *the disturbance of less than 2,000m³ of land, soil, sand, rock, pumice, earth or overburden; or*

- *the placement or deposition of less than 2,000m³ of cleanfill material.*

Resource consent is also required for large scale earthworks, which are by definition:

- *the disturbance of a discrete area of land of 1 hectare or more; or*
- *the disturbance of 2,000m³ or more of land, soil, sand, sand, rock, pumice, earth or overburden; or*
- *the placement or deposition of 2,000m³ or more of cleanfill material."*

Erosion and sediment controls are required to be implemented for all earthworks. Environment BOP's *"Erosion and Sediment Control Guidelines for Earthworks"* provide the principles and practice for erosion and sediment control. These guidelines are intended to be used by persons proposing activities that require resource consent, as well as any permitted activities.

Vegetation Disturbance

Vegetation clearance is controlled to avoid erosion and to minimise any sediment run-off into water courses. As for earthworks, the extent of vegetation clearance permitted depends on slope of the land, location in relation to any water course and the ability to meet the general conditions of the Plan relating to protection of water quality and free flow of water courses.

Stream Crossings

The Plan allows certain small scale stream crossings to be installed and maintained as a permitted activity, subject to compliance with specific conditions. These conditions include location outside the Erosion Hazard Zone and avoidance of any alteration to the natural course of a stream.

Culverts, single span bridges and fords over the permitted activity threshold, or that do not comply with the specific general conditions, require resource consent.

Wetland Modification

The Plan recognises that wetlands support a natural ecosystem of plants and animals that are adapted to wet conditions.

By definition, wetland modification includes *"enhancement, adjustment of the watertable, drainage, excavation or infilling of the wetland or burning or destruction of the wetland vegetation".*

Wetland modification provided for as a permitted activity is limited to weed removal and other vegetation clearance necessary for the maintenance of water

bodies created for hydro-electric generation. All other wetland modification requires resource consent.

1.1.2 Transitional Regional Coastal Plan (October 1991)

Environment BOP's Transitional Regional Coastal Plan (Appendix 3) contains general authorisations for Councils to discharge stormwater. Such authorisations will expire when the Proposed Coastal Environment Plan becomes operative.

The Proposed Plan is anticipated to become operative within the next 2 years following resolution of outstanding references to the Environment Court.

General Authorisations No 7 and 8 are relevant to any stormwater management methods in the Bay of Plenty Region.

General Authorisation No. 7
This authorisation provides for the damming of any river or stream by an "inconsequential dam" provided that the following criteria are met:

- the spillway does not exceed 1.5 metres in height
- Environment BOP is notified of any dam constructed after 1 October 1990
- there are no detrimental effects on any other person's land, nor on the use or supply of water downstream
- fisheries, wildlife and aquatic life are not adversely affected
- erosion control measures are implemented.

General Authorisation No. 8
The discharge of clean stormwater into natural water is provided for by this authorisation, subject to:

- the maximum discharge not exceeding the flow from a 300mm pipe on a flat grade or equivalent of 80 litres per second
- the suspended solids concentration of the water discharge not exceeding 150 g/m^3
- the water discharged being substantially free of grease and oil
- erosion and flooding to be avoided during and after construction and any adverse effects on any other person's land avoided.

1.1.3 Proposed BOP Regional Coastal Environment Plan (Version 9, 29 June 1999)

1.1.3.1 Purpose

The Proposed Regional Coastal Environment Plan recognises the coastal environment is integrated with some activities on the land. The plan therefore addresses both the coastal marine area and the wider coastal environment.

1.1.3.2 Proposed Stormwater Discharges to Coastal Marine Area

Rule 9.2.4 (a)(i) states that *"the discharge of stormwater to the coastal marine area is a permitted activity provided that:*

- *the suspended solids concentration of the water discharged does not exceed 150 g/m^3; and*
- *the water discharged is substantially free of grease, oil, scums and foam; and*
- *the maximum discharge does not exceed 80 litres per second for a 20% AEP storm event (5 year return period storm)".*

Any other discharge constitutes a descretionary activity, unless it is specifically classified as a prohibited activity. Resource consent cannot be granted for a prohibited activity

1.1.3.3 Existing Stormwater Outfalls to the Coastal Marine Area

It is important to note that any existing stormwater outfalls that are not currently subject to consent, and that do not meet the criteria of Rule 9.2.4 (a)(i), will require resource consent if the Proposed Plan, once operative, does not provide for such outfalls as a permitted activity. This situation is specified in Section 20(2) of the Resource Management Act 1991 which outlines the provisions for *"certain existing lawful activities".*

1.1.3.4 Status of the Harbour, Foreshore and Environs

Coastal Habitat Preservation Zone

The northern portion of the harbour that encompasses the Athenree peninsula, is classed as Coastal Habitat Protection Zone.

The description in the seventh schedule of the Plan describes this part of the harbour as:

"a large wetland, much of which is relatively unmodified, comprising a representative example of the estuarine vegetation of Tauranga Harbour. Much of this site is in the Athenree Wildlife Management Reserve".

Significant and Outstanding Values

The Tauranga Harbour, including in the vicinity of Athenree, is identified in the Proposed Regional Coastal Environment Plan as being an area of:

Open drains, channels and necessary incidental equipment are provided for as a permitted activity, with the exception of reserves and land Identified as a Significant Ecological, Landscape or Heritage Feature. Such structures are classified as a non-complying activity where they are proposed within Identified Significant Features, and they constitute a discretionary activity within public reserves.

No mention is made of stormwater ponds within the Works and Utilities Section or the zoning provisions of the Proposed Plan.

1.2.3 Significant Ecological, Landscape and Heritage Features

The Athenree peninsula and its environs incorporate numerous natural features identified in the Proposed Plan as Significant for their ecological, landscape or heritage values. These are listed below and are illustrated on the Constraints Plan (Figure 3).

Protected and Identified Significant Ecological Features

U13/1 Estuarine margin and wetland - around the northern portion of the Athenree peninsula. An area designated for proposed Government Purposes Reserve (Wildlife Purposes) forms part of this identified feature.

U13/8 Estuarine Margin Vegetation - along a portion of the foreshore immediately north west of Pohutukawa Drive, and also south west of Athenree settlement. This land is shown as *"Proposed Esplanade Reserve"*.

U13/9 Estuarine Vegetation - along the foreshore south west of Athenree settlement.

U13/10 Estuarine Vegetation - along the southern foreshore of the peninsula, west of Waione Avenue.

U13/18 Forest - this incorporates mature Pohutukawa trees along the foreshore north west of Roretana Drive.

Identified Significant Landscape Features

S7 - Tauranga Harbour - The Proposed Plan explains that the harbour is Identified as an Outstanding Natural Feature and Landscape in the Bay of Plenty Coastal Environment Assessment. This identification incorporates the whole harbour and its estuarine fringe.

S8 - Tauranga Harbour Landward Edge - The area identified as visually significant includes all the land 40 metres inland from Mean High Water Springs.

Identified Significant Heritage Feature

- Significant Conservation or Cultural Value; and
- Outstanding Natural Feature and Landscape.

The Plan identifies the Tauranga Harbour as comprising the following four distinctive components of Conservation Value:

(i) wetland along its margins
(ii) estuaries where the many rivers and streams enter the harbour
(iii) extensive inter-tidal flats
(iv) the sub-tidal area.

This status given to the Tauranga Harbour recognises that the extensive range of habitats supports a wide range of birds.

The "outstanding" status given to the harbour's natural features and landscape values, applies to the entire harbour, its estuarine fringe and unmodified islands.

The above values, and the associated objectives and policies, must be taken into account in the assessment of any proposal. Any activities, including associated stormwater discharges, must be managed in a way that does not comprise these values:

District or Local Significance
The plan further identifies the following sites of district or local significance at Athenree:

- Significant Indigenous Vegetation Areas - two areas west of Athenree settlement are identified as comprising *"a relatively large example of the freshwater wetland vegetation, characteristic of Tauranga ecological district"*.
- Significant Marshbird Habitat Areas - the estuarine fringe along the southern side of the Athenree peninsula is a habitat for banded rail, north island fernbird and pukeko.

1.1.4 Draft Water and Land Plan

The proposed Coastal Environment Plan covers any discharges into the Coastal Marine Area. None of Environment BOP's plans currently cover any discharge of stormwater onto land. Such discharges will however be addressed in the "Water and Land Plan", due to be released as a non-statutory draft in the second half of 2000. Once this document gains statutory weight, any stormwater discharges onto land will need to be in accordance with this plan.

1.2 Proposed Western Bay of Plenty District Plan

1.2.1 Natural Environment and Natural Hazards

The Natural Environment Section (9) of the Proposed Plan has as its primary objective:
" to promote the sustainable management of the remaining natural environment resources of the District (plants, animals, habitats and ecosystems)."

This Section states that "priorities generally focus on the four major habitat types with the most substantial remaining areas of native habitat: native forest, wetlands, stream/ river margins (riparian), the coast."

Policy 9.2.4 recognises "the off site contributions of riparian areas to the health of adjoining habitats (wetlands, rivers, the sea, estuaries, and other associated land/ water interfaces)."

The above objectives and principles must be reflected in management of stormwater disposal in Athenree. The area is characterised by its natural landscape features of the harbour, foreshore, wetlands and established trees, including pohutukawas.

The Natural Hazards Section (12) aims to minimise "the threat of natural hazards to human life and the natural and physical environment" (Objective 12.2.1).

The main natural hazards recognised are coastal erosion and inundation, flooding, and land instability. Council exercises its discretion over the establishment of activities within areas identified as subject to these natural hazards.

1.2.2 Works and Network Utilities

Section 17 provides for works and network utilities.

Underground pipelines conveying stormwater, and associated pump stations (with aboveground dimensions less than 50m^2 gross floor area), are provided for as a permitted activity in all zones and reserves, with the exception of land Identified as a Significant Ecological, Landscape or Heritage Feature. Where these works are proposed within areas identified as Significant Features, they constitute a discretionary activity.

The Koutunui Pa site at the extreme northern portion of the peninsula is identified as a Significant Heritage Feature (reference 109). This is a former pa site of Ngati Ranginui Iwi.

APPENDIX 1

TANGATA WHENUA GROUPS CONTACTED ABOUT THE ATHENREE STORMWATER MANAGEMENT PLAN

No	Group	Interested in the Area Covered by the Athenree Stormwater Management Plan?	Source of Information
1	Ngaiterangi Iwi Society	The Society usually leaves it to the local Marae to respond to the consultation, but maintains a watching brief.	Telephone conversations with Brian Dickson.
2	Ngati Ranginui Iwi Society	The Society usually leaves it to the local hapu to respond to the consultation, and only becomes involved if it is an iwi wide issue. Did not want to receive the documents on the project.	Telephone conversations with Colin Bidois on 23 June 200.
3	Hauraki Maori Trust Board		
4	Te Whanau o Tauwhao ki Otawhiwhi Marae	Yes.	Meeting at Otawhiwhi Marae on 18 June 2000.
5	Te Ruunanga a Iwi o Ngati Tamatera	Yes.	
6	Te Kupenga o Ngati Hako	Yes.	
7	Ngati Tara Tokanui	Yes, letter confirmed interest in Athenree.	Letter dated 11 July 2000 from George Williams.
8	Ngati Wai – Tuapiro Marae, Surtees Road, Katikati	Yes.	Meeting at Tuapiro Marae on 27 July 2000.
9	Te Runanga o Ngai Tamawhariua – Te Rereahutukahia Pa		

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Appendix 2

Technical Report

Western Bay of Plenty District Council

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Athenree Stormwater Plan

Technical Report

Opus: *an accomplished work, a creation, an achievement*

Western Bay of Plenty District Council

Athenree Stormwater Plan

Technical Report

Prepared By
KJ Caldwell

Reviewed By
JM Crawford

Opus International Consultants Limited
Office
Opus House
PO Box 3057
Hamilton

Telephone: Telephone
Facsimile: Facsimile

Date: June 2001
Reference: g:\5project\362395\techrep4.doc
Status: Final

Contents

1 INTRODUCTION

This report contains details of the stormwater calculations and cost estimates that are summarised in the Athenree Stormwater Plan.

The calculation methodology is to firstly provide a description of each catchment, WBOPDC design standards and hydrology prior to undertaking stormwater quantity and stormwater quality treatment calculations. This information 'sets the scene' for the design and costing of stormwater management concepts (grassed swales, wet ponds, in-sump filters, litter and sediment traps and other options) for each catchment described in the Plan.

This technical report assumes that:

- any future developments will be built in accordance with the Western Bay of Plenty Subdivision and Development Code of Practice (effective at that time);
- catchments in the Athenree peninsular discharge direct to the Harbour;
- catchments on the Athenree peninsular range in area from 4 to 35 hectares and have no permanent natural watercourses apart from farm drains.

These assumptions restrict the type and location of future stormwater management measures. Large catchment solutions like retention of natural watercourses and retrofitted dry detention basins for reserves may not be required. The list of stormwater management concepts includes:

- to promote treatment at source stormwater concepts for the existing and future urban developments;
- to identify stormwater reserves that will connect future subdivisions with the Harbour shoreline for stormwater treatment devices, pipelines and overland flow routes and capitalise on opportunities for restoration of natural habitats and passive and active recreation;
- to ensure concepts are "future proofed" to allow for future urban development.

2 CATCHMENT DESCRIPTION

2.1 Catchment Layout

The study area has been split into 10 catchments or watersheds that discharge to similar areas of the Harbour as shown in Figure 1. Each catchment contains 1 to 5 sub-catchments that are based on their landscape character (estuarine/flats/slopes/escarpments/terrace).

2.2 Catchment Descriptions

Catchment 1 – Koutunui West Escarpment
This catchment is predominantly a west-facing escarpment except for a small area of terrace at the north end. The terrace is elevated approximately 25m above mean sea level. From that level the escarpment slopes down at approximately 3.0 Horizontal to 1.0 Vertical (3H:1V) to 2H:1V.

The terrace at the north end that features 6 or 7 housing lots, a reserve with ancient pohutukawa trees and a pa site. The remainder of the escarpment is a mixture of pasture and scrub.

Catchment 2 – Koutunui East Escarpment
This catchment features terrace surrounding two east-facing escarpment valleys. The escarpment vegetation is a mixture of ancient pohutukawa trees at the north end and rural residential elsewhere.

The terrace land features new urban development in the north and west. The smaller areas of terrace are rural residential and the escarpment valleys are currently undeveloped due to the steepness of the slopes and poor drainage in the restricted valley floor areas. One of the two escarpment valleys has a shoreline reserve.

The stormwater system for the two subdivisions consists of a dry sediment trap for the north subdivision and a construction phase wet sedimentation pond for the south subdivision that has been retained as a permanent stormwater treatment device. The dry sediment trap is located immediately west of the north subdivision and the wet sediment pond is located immediately north of the north subdivision. Both treatment devices are located in Catchment 1, see Figure 1.

Catchment 3 – Pohutukawa Drive Escarpment

This catchment features terrace land in the west, an east facing escarpment and flat land in the east. The terrace land has urban development along Koutonui Road and a mixture of cropping and rural residential in the remaining area. The escarpment is also farmed but includes an urban area along Pohutukawa Drive with a shoreline reserve to the east.

The urban areas alongside Koutonui Road are drained via a pipeline in an orchard and to the west facing escarpment in Catchment 1. The Pohutukawa Drive area all drains to the estuary via a pipe network that ends in a reserve beside the estuary.

Catchment 4 – Roretana Drive Flats

This catchment's topography is coastal flats with a maximum ground level of RL5.0m. The harbour bounds the area on three sides and there is a slight rise that acts as a catchment boundary to the west. Urban development is the predominant land use. Exceptions are the hot springs motor camp in the centre of the catchment and reserve land along the foreshore.

The houses to the north of Athenree Road are drained to soakage holes via road sumps. The remaining area all drains to the estuary farm drains.

Catchment 5 – Athenree Road Flats

This catchment is also coastal flats with a maximum ground level of RL15.0m. The harbour bounds the area to the south and there is a slight rise on the other three sides that act as catchment boundaries. Urban development is restricted to the north of Athenree Road and the remaining land use is rural residential and rural.

The housing lots have soakage holes but the majority of the catchment drains via road sumps and short pipelines direct to the harbour.

Catchment 6 – Athenree Road Escarpment

This catchment features terrace land in the west, a south facing escarpment and flat land in the east. The terrace land has a mixture of horticulture (kiwifruit) and rural residential urban development. The escarpment is also a mix of horticulture and rural residential (with shoreline reserve) but includes an urban area north of Athenree Road. The flat land has a rural residential land use.

The urban areas north of Athenree Road are drained to a pipeline that discharges to the harbour to the south of the Athenree/Koutunui Road intersection. The remaining area all drain to the estuary farm drains.

Catchment 7 – South Escarpment

This catchment features terrace land in the north and a south facing escarpment along the shoreline. The terrace land has a mixture of horticulture (kiwifruit) and rural residential urban development. The remainder escarpment is a mixture of pasture and scrub with a shoreline reserve running for half it's length. Drainage consists of farm drains to the harbour.

Catchments 8 & 9 – Southern Slopes

The dominant landform in this catchment is the south facing slopes that form into two distinct basins. The landform is similar to Catchment 2 but on larger scale. The land use is a mixture of horticulture (kiwifruit) and rural residential urban development (with shoreline reserve). Drainage consists of farm drains to the harbour.

Catchment 10 – Northern Slopes

The dominant landform in this catchment is the north facing slopes. The land use is a mixture of horticulture (kiwifruit) and rural residential urban development (with shoreline reserve). The area is drained by farm drains to the harbour.

3 STORMWATER DESIGN STANDARDS

3.1 WBOPDC - Subdivision and Development Code of Practice

Future developments at Athenree will be built in accordance with the Western Bay of Plenty Subdivision and Development Code of Practice (effective at that time). The current draft code of practice (May 2000) has several minimum requirements that are of direct relevance to this Plan. The minimum requirements are:

- 3.2.2 - In designing the stormwater system, the primary and secondary flowpath shall be identified to ensure a flood protection system which provides a minimum standard of protection according to the following criteria:
  5 year Average Recurrence Interval flood - The minimum design standard for any primary (piped) stormwater system in the district;
  50 year Average Recurrence Interval plus 500mm freeboard for floors of habitable dwellings within residential, commercial and industrial buildings.

- 3.2.6i) - Where natural open drainage systems or formed channels are to be incorporated in the stormwater drainage system they shall generally be located within a drainage reserve of sufficient width to contain the full design flood flow together with the prescribed freeboard. Such reserves shall generally have maximum batter of 20% (1 in 5) and, where access for maintenance is required, shall include a 4m wide berm for the full length, suitable for truck access.

- 3.2.6iii) - To encourage the best use of the open stream systems the drainage reserves shall where practicable, be linked with other reserve and open spaces such as school sites and accessways to accommodate off road pedestrian and cycle access.

- 3.4.1 - A secondary system, or overland flowpath is to be designed to safely convey stormwater to the specified freeboards in 3.2.3 without undue nuisance. Flows across private property. Flow must be in a defined channel or swale, clear of existing or future building sites and protected by an easement in favour of Council and/or a Consent notice which prohibits ground reshaping and erection of any barriers to secondary flows.

- 3.6.1 - Structures shall be constructed at the inlets and outlets of pipelines to the details shown on the drawings SW18, SW19, SW20 or SW21. Provision must be made for energy dissipation unless it is demonstrated that outlet velocities and soil conditions are such as to make this unnecessary. The design shall ensure non-scouring velocities at the point of discharge.

- 3.6.3 - Where undesirable debris or litter collected by runoff within the catchment will create a nuisance at downstream discharge points the berm pits or yard sump entries shall be fitted with a debris screen similar to that shown on drawing SW17.

- 3.11.2 - Pond design shall follow the guidance of Auckland Regional Council Technical Publication Number 10 and will require consent from Environment BOP. Specific points of focus are: side slopes with safety considerations, ease of maintenance including mowing and silt clean-out, shape and contour for amenity value, an effective outlet structure, overflow design. Council, however, is not in favour of encouraging a proliferation of small stormwater treatment ponds, preferring instead a total catchment approach.

- 3.12 - It should be noted however that the use of soak holes for stormwater disposal is not permitted at Athenree...

3.2 Stormwater Issues & Possible Solutions

Stormwater design for Athenree is similar to other areas of New Zealand in that there are site specific features that impact on the design. The key site features are:

- catchments in the Athenree peninsular discharge direct to the Harbour;
- catchments on the Athenree peninsular range in area from 4 to 35 hectares and have no permanent natural watercourses apart from farm drains.

3.2.1 Protection of Natural Watercourses

A common site specific issue for larger catchments with natural watercourses, is to protect and enhance these valuable resources. This standard was devised to avoid past urban development practices of replacing natural watercourses with manmade concrete or grassed channels. The issues here are the destruction of natural habitats for native flora and fauna and the loss of a natural landform to the community.

Again this is a minor issue for Athenree because the small size of the catchments means that no watercourses exist apart from a few farm drains. However there are 'basins' where post-development flows from hard surfaces would cause or aggravate erosion of the valley floor and a site specific standard is required.

Site Stormwater Standard No. 1 is to provide drainage reserves with low flow pipelines rather than open drains where high velocity erosive flows are expected

from urban developments on steep hillsides. Whilst these reserves will be floodable they offer an excellent opportunity to restore natural habitats that were altered by earlier land uses by planting of native species etc.

3.2.2 Protection of Shoreline Cliffs

Protection of Shoreline Cliffs is an issue in the Athenree peninsular as it is for other coastal peninsular in the District eg Omokoroa. Athenree cliffs have less evidence of slips and appear more stable in general than Omokoroa but site specific standards are required.

Site Stormwater Standard No. 2 is to:

- avoid discharging stormwater flows down cliff faces wherever possible;
- unavoidable road and property discharges should be collected to one point in the clifftop (WBOPDC Code of Practice applies) then conveyed down the cliff face.

3.2.3 Protection of the Tidal Edge

Protection of tidal edge is an issue in Athenree because like other areas of New Zealand the local mangrove ecosystems are sensitive. Inspection of the tidal edge areas along the Athenree peninsular yielded two potential problems.

Firstly the outlet from a steep 'basin' in Catchment 9 had been left unmanaged and the tide had backcut and widened the outlet until it was much larger than necessary for a catchment of approximately 6 hectares. The outlet channel is approx. 50m long and 10m width at the tidal edge. Again site specific standards are required.

Site Stormwater Standard No. 3 is to construct an embankment across outlet channels immediately landward of the mean high water springs tide level. The outlet channel should discharge via a short floodgated culvert (10m length) in the embankment.

Secondly, a local example of the sensitivity of the mangrove ecosystem is the apparent loss of mangroves, flattening of the beach profile and shoreline erosion requiring a timber seawall for a small length of the Athenree Motor Camp shoreline. This example has not been researched but apparently the change is due to 'pressure' on the tidal edge zone. This issue is already addressed by the proposed coastal reserves included in the District Plan maps.

4 HYDROLOGY

4.1 Rainfall

Rainfall records for Athenree and the surrounding district are principally daily rainfall recordings supplied by public. There is an automated site in Waihi township approximately 15km north west but the length of record is too short to be reliable and also the town is located in Golden Valley at the foot of the Coromandel Ranges and hence has significantly more intense rainfalls.

The closest automated site with an adequate length of record is at Tauranga Airport that is located approx. 40km south east of Athenree. This record is appended in Attachment 1.

The rainfall data used in the water quantity calculations were sourced from Niwa software entitled HIRDS Version 5.1b (High Intensity Rainfall Data System), see Attachment 1. This methodology is in accordance with WBOPDC Code of Practice - Section 3.2.4.

4.2 Future Land Use

Section 3.2 resolved that stormwater quantity was not a major issue for the Athenree. However, calculations of catchment discharges are required to:

- support design of water treatment devices ie Pollutant Load = Concentration multiplied by Volume;
- quantify peak discharges for consent application data.

Runoff calculations require assumptions to be made about post-development land use in each sub-catchment, see Plan section 2.3. In the case of greenfields development the impervious percentage was assumed to be 50% based on a minimum lot size of 350m^2. In the case of infill development the impervious percentage was assumed to be 50% based on a minimum lot size of 350m^2 and 56% infill.

Table 4.2 below details the key parameters used in the calculations.

Table 4.2: Calculation Parameters

Land Use	Pervious		Impervious	
	% of Area	Runoff Coeff.	% of Area	Runoff Coeff.
Rural	100	0.6	0	0.9
Rural Res	100	0.6	0	0.9
Infill Residential	50	0.6	50	0.9
Residential	50	0.6	50	0.9

5 INDIVIDUAL CATCHMENT CALCULATIONS

5.1 Water Quantity Calculations

Tables 5.1.1 & 5.1.2 list peak flows and landuse for the sub-catchments depicted in Figure 1.

Table 5.1.1: Stormwater Flows, Post – Development

Catchment	Area (ha)	Peak flows (m3/s)		Land Use
		5year, 10 minute ARI	100year, 10 minute ARI	
1	12.4	1.68	4.06	Existing Rural/Infill Res
2a	4.0	0.98	1.89	Infill Res/Res
2b	2.8	0.59	1.39	Infill Res/Res
2c	8.1	1.16	2.19	Infill Res/Res
2d	8.2	1.05	2.60	Existing Rural/Infill Res
3a to 3d	25.8	3.56	6.97	Existing Rural/Infill Res
4a	7.3	1.07	1.95	Infill Res/Res
4b	7.3	1.13	2.18	Infill Res/Res
5	9.8	1.61	2.98	Infill Res/Res
6a to 6d	35.0	4.98	9.74	Existing Rural/Infill Res
7a	7.4	1.22	2.28	Res
7b	4.2	0.93	1.88	Existing Rural/Res
8a & 8b	14.2	2.64	5.01	Res
8c	4.3	0.88	1.74	Res
9a	7.9	1.53	3.03	Res
9b	9.7	1.80	3.57	Res
9c	5.4	1.12	2.24	Res
9d	8.6	1.84	3.62	Res
10a	12.2	2.24	4.24	Res
10b	8.7	1.71	3.32	Res
10c	7.5	1.44	2.87	Res

Table 5.1.2: Stormwater Flows, Pre – Development

Catchment	Area (ha)	Peak flows (m3/s)		Land Use
		5year, 10 minute ARI	100year, 10 minute ARI	
1	12.4	1.68	4.06	Rural/Res
2a	4.0	0.98	1.89	Res
2b	2.8	0.59	1.39	Rural Res
2c	8.1	0.44	0.96	Res
2d	8.2	1.06	2.60	Rural/Res
3a to 3d	25.8	2.59	5.43	Rural/Res/R Res
4a	7.3	0.88	1.65	Res
4b	7.3	0.95	1.91	Res
5	9.8	0.58	1.52	Rural/Res/R Res
6	35.0	2.11	5.52	Rural/Res/R Res
7a	7.4	0.30	0.81	Rural
7b	4.2	0.65	1.55	Rural
8a & 8b	14.2	1.08	2.94	Rural
8c	4.3	0.50	1.26	Rural
9a	7.9	0.83	2.07	Rural
9b	9.7	1.13	2.73	Rural
9c	5.4	0.65	1.67	Rural
9d	8.6	1.08	2.68	Rural
10a	12.2	0.84	2.30	Rural
10b	8.7	0.80	2.16	Rural
10c	7.5	0.69	1.86	Rural

Flows were calculated using Willings Software XP-RAFTS and checked by manual calculations using the Rational Method. The programme XP-RAFTS is widely used in Australia as a planning stage rainfall-runoff-basin routing model with time as a variable. The model is ideal for investigations like this one, where flows from rural catchments need to be simulated for both the existing and fully developed scenarios. A comparison of flows in Attachment 2 shows that the Rational Method tends to overestimate flows where catchments are relatively flat. An explanation is that in the Rational Method the time of concentration adjustment to the rainfall intensity tends to overestimate the effect of relatively flat slopes in comparison with the XP-RAFTS software where the effect of slope is input directly for a runoff calculation.

Flowrates were calculated for existing urban areas assuming that the impervious percentage had been increased from 33% to 50% after infill development had taken

place. These flow results were used to determine the size of duplication of stormwater assets in these areas to cater for the increase in runoff.

5.2 Water Quality Calculations

WBOPDC Code of Practice requires that 'S3.11.2 – Pond design shall follow the guidance of Auckland Regional Council Technical Publication Number 10 and will require consent from Environment BOP.' Table 5.2 lists the pond areas, if required, for each sub-catchment that drains to that pond. The calculations were based on the ARC document referenced above.

Table 5.2: Stormwater Treatment Pond Dimensions

Catch-ment	Perv. Area (ha)	Imp. Area (ha)	Total Area (ha)	Pond Dimensions			Land Use
				Pond Dim. (m)	Total Volume (m^3)	Status of Concept	
1	12.4	0	12.4	N/A	N/A	N/A	Existing Rural/Res
2a	2.3	1.7	4.0	5 x 20 x 1.0	100	OK	Res
2b	1.6	1.2	2.8	5 x 14 x 1.0	70	OK*	Res
2c	4.7	3.4	8.1	10 x 62 x 1.0	621	OK*	Res
2d	8.2	0	8.2	N/A	N/A	N/A	Existing Rural/Res
3a	3.8	1.9	5.7	10 x 44 x 1.0	437	Not OK**	Existing Rural/Res
3b	4.5	3.3	7.8	10 x 60 x 1.0	598	Not OK**	Res
3c	2.8	2.1	4.9	10 x 37 x 1.0	371	OK	Res
3d	4.2	3.1	7.3	10 x 60 x 1.0	554	Not OK**	Res
4a	4.2	3.1	7.3	10 x 55 x 1.0	554	Not OK**	Res
4b	4.2	3.1	7.3	10 x 55 x 1.0	554	Not OK**	Res
5	4.9	4.9	9.8	10 x 76 x 1.0	760	OK	Res
6a	4.8	4.9	9.7	10 x 75 x 1.0	754	OK	Res
6b	2.7	2.7	5.4	10 x 41 x 1.0	414	OK*	Existing Rural/Res
6c	4.0	4.0	8.0	10 x 62 x 1.0	619	Not OK**	Res
6d	5.6	5.6	11.8	10 x 90 x 1.0	900	Not OK**	Res
7a	3.7	3.7	7.4	10 x 57 x 1.0	573	OK	Res
7b	4.2	0	4.2	N/A	N/A	N/A	Existing Rural/Res
8a	5.6	5.7	11.3	10 x 87 x 1.0	871	OK	Res
8b	1.4	1.5	2.9	10 x 23 x 1.0	230	OK	Res
8c	2.1	2.2	4.3	10 x 33 x 1.0	325	OK	Res
9a	3.9	3.9	7.8	10 x 47 x 1.0	468	OK*	Res
9b	4.8	4.9	9.7	10 x 62 x 1.0	620	OK	Res
9c	2.7	2.7	5.4	10 x 42 x 1.0	414	OK	Res
9d	8.6	0	8.6	N/A	N/A	N/A	Res
10a	6.1	6.1	12.2	10 x 94 x 1.0	941	OK	Res

Catch-ment	Perv. Area (ha)	Imp. Area (ha)	Total Area (ha)	Pond Dimensions			Land Use
				Pond Dim. (m)	Total Volume (m^3)	Status of Concept	
10a	6.1	6.1	12.2	10 x 94 x 1.0	941	OK	Res
10b	4.3	4.4	8.7	10 x 67 x 1.0	667	OK	Res
10c	3.7	3.8	7.5	10 x 58 x 1.0	575	OK	Res

* Existing pond size is adequate or could be extended

** No site for large pond.

5.3 Land, Capital, Maintenance & Operating Cost Calculations

Attachment 3 contains stormwater management cost estimates for all catchments in the study area. In greenfields development catchments the costs include land for wet ponds and channels, floodgates and operation and maintenance of the total Athenree stormwater assets to be owned by Council. Retrofitted pipework has been costed assuming a duplication of existing pipework in infill areas that exceed 33% impervious, see report Section 3.4.3.

Wet ponds (treatment option 1) is costed because it is a key method of stormwater treatment, see Plan. Grassed swales (treatment option 2) and in-sump filters (treatment option 3) do not have adequate sediment capacity and are only considered where both wet ponds and grassed swales are not suitable. These works are to be funded by Development Impact Fees or other cost recovery.

Grassed swales for greenfields development were costed at $10,000/ha to cover all costs that are additional to conventional kerb and gutter drainage eg driveway crossings, extra excavation - see Appendix 3.2. Grassed swales for infill development were costed at $30,000/ha. The extra costs relate to retrofitting swales into an existing urban area including earthworks, services relocation, driveway crossings and extension of the kerb & gutter drainage system.

Operation and maintenance of assets are assumed to be funded by Council directly from rates (1 man year - $40k, 1 vehicle year - 20,000km x $0.75/km = $15k, plant eg mower $15k, plant & labour hire $15k, Total = $75k/yr). This O&M cost allows for the whole catchment area at the rate of $356/ha of urban development. Asset replacement costs are not calculated in this report.

New urban catchments vary in that some existing wet ponds may be operated and maintained privately and other wet ponds may be earmarked for hand-over to Council at a future date. In any case, land costs have been calculated at $25k/ha

interest rate). Operation and maintenance of assets are assumed to be funded by Council as described above. Future urban catchments will have stormwater treatment devices built progressively to match the area developed.

5.4 Investigation, Resource Consent and Monitoring Cost Calculations

Any programme to monitor stormwater quality has to be carefully designed in order to produce data that will aid future management of the stormwater system.

Stormwater flows are highly variable and therefore contaminant concentration measurements constituent low-grade data unless coupled with a flowrate measurements at the time of sampling. Stormwater quality data is then expressed as a pollutant loading (where Load = Concentration x Flow). The issue is that collection of the two types of data is often uneconomic.

The preferred methodology to monitor the affect of Athenree's stormwater on the environment is a visual ecological assessment. This methodology has the advantage that it monitors the environmental effects directly rather than relying on the analysis of water quality parameters.

Urban stormwater impacts tidal edge ecosystems by a combination of reduced water quality, unfavourable flow regimes, and degradation of the tidal edge vegetation. Monitoring is assumed to focus on annual visual ecological assessments for the whole Athenree peninsular. The costs assumed for this work are $10k/yr plus an allowance for continuous water quantity & quality measurement using analysis equipment or water quality sampling on an as needed basis $5k/yr. Total Council monitoring costs = $15k/yr.

Council's investigation and consenting costs are dependent, initially, upon Council's approval of investigations recommended in this Plan. For example ecological and water sampling work in the Athenree to date has been minor with Athenree ecosystem being considered as a small part of Tauranga Harbour studies. The rate of urban development will have a major effect on Council's costs. This Plan assumes low option population projections however this could change in the future. Total Council investigation and consenting costs = $50k/yr.

5.5 Calculation of Financial Contributions (or Other Funding Source)

The study brief required annual expenditure for the expansion and upgrade of infrastructure. The project team have concluded that it is extremely difficult to estimate where development will occur if large tracts of land are to be rezoned residential with few planning controls to restrict leapfrog development. The latter

is considered highly probable as parts of the catchment have water views and are likely to be considered more marketable by developers and more desirable by the housing market.

Further, population projections currently used by Council indicate that the annual growth at Athenree over the next 20 years will be small, on average around 12 additional households per year (Attachment 4). This low level of growth renders loan funding large tracts of trunk infrastructure expensive, as recoupment of capital cost would take a considerable number of years. This is not considered to be sustainable and is likely to place a significant burden on future generations to service the debt. It is therefore recommended that Council rezone part of the study area at a time. The new zoning should be immediately adjacent to the existing infrastructure to ensure systematic growth. Development can then progressively expand into the newly zoned urban area. This will reduce loan-funding costs and minimise debt while providing opportunity for the Athenree community to expand.

The current uncertainty with regard to Council's approach to rezoning means that it is not possible to calculate an accurate Financial Contribution at this time.

National Institute of Water and Atmospheric Research Ltd.
Rainfall Depth-Duration-Frequency

Annual maxima rainfall (mm) for specified durations

Tauranga Aero — Data period 1967-1995

Duration	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h
1967	999.9	999.9	999.9	999.9	999.9	999.9	999.9	112.5	124.2	126.0
1968	14.2	20.1	20.8	35.1	49.3	61.2	71.4	80.0	83.1	83.1
1969	999.9	999.9	999.9	999.9	999.9	999.9	999.9	73.4	80.3	93.7
1970	999.9	999.9	999.9	999.9	999.9	999.9	999.9	97.0	103.4	111.8
1971	10.2	20.3	25.4	40.0	59.6	73.0	94.2	94.2	110.7	130.6
1973	5.6	999.9	12.5	20.1	34.7	72.0	92.4	126.8	141.2	141.4
1974	999.9	999.9	999.9	999.9	999.9	999.9	999.9	133.8	168.7	209.7
1975	999.9	999.9	999.9	999.9	999.9	999.9	999.9	69.0	72.4	84.7
1976	7.4	11.6	14.7	19.6	31.4	63.9	69.1	71.4	92.0	128.2
1977	14.9	18.3	19.7	20.7	30.5	60.1	75.3	89.6	106.6	107.6
1978	17.3	32.7	37.6	52.7	62.1	100.0	129.2	133.0	133.4	133.4
1979	16.8	25.7	34.6	61.5	88.6	116.4	155.7	189.3	276.9	305.9
1980	999.9	999.9	999.9	999.9	999.9	999.9	999.9	117.0	147.0	147.8
1981	9.1	13.6	19.3	22.4	22.5	46.3	59.1	101.6	157.4	182.2
1982	999.9	999.9	999.9	999.9	999.9	999.9	999.9	64.1	77.0	79.4
1983	999.9	999.9	999.9	999.9	999.9	999.9	999.9	114.1	129.2	129.5
1984	999.9	999.9	999.9	999.9	999.9	999.9	999.9	95.2	97.0	97.0
1985	12.5	16.4	19.1	24.9	33.6	56.2	58.3	86.5	95.8	96.2
1986	8.3	14.5	19.8	32.4	36.8	44.1	63.4	64.2	64.2	64.2
1987	16.4	26.3	33.0	45.9	52.2	62.4	89.1	117.0	141.6	141.6
1988	10.2	18.0	23.9	27.7	29.0	52.3	69.5	139.0	148.8	149.5
1989	10.1	15.1	16.0	17.4	25.3	35.5	49.3	79.6	105.1	110.0
1990	7.5	11.5	14.7	24.7	37.7	50.0	61.5	62.9	71.4	72.2
1991	5.6	9.6	12.8	16.8	29.3	35.7	58.0	70.5	70.5	73.7
1992	7.8	12.5	15.6	22.4	37.5	69.0	91.6	104.7	105.8	119.6
1993	4.3	6.1	7.9	13.1	17.4	25.9	36.6	51.0	52.3	52.5
1994	13.7	22.1	25.4	38.2	49.5	72.1	74.2	80.0	86.6	90.8
1995	8.1	14.1	20.7	32.4	42.6	66.1	89.8	97.8	98.0	108.4
Average	10.5	17.1	20.7	29.9	40.5	61.2	78.3	97.0	112.2	120.4
Std Dev	4.0	6.6	7.8	13.0	16.8	21.5	27.8	30.1	44.5	50.5
Maximum	17.3	32.7	37.6	61.5	88.6	116.4	155.7	189.3	276.9	305.9
Minimum	4.3	6.1	7.9	13.1	17.4	25.9	36.6	51.0	52.3	52.5
# Obs	19	18	19	19	19	19	19	28	28	28

National Institute of Water and Atmospheric Research Ltd.
Rainfall Depth-Duration-Frequency

Tauranga Aero — Data period 1967-1995

Rainfall depths (mm)

ARI	Duration									
(y)	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h
2	9.8	16.0	19.4	27.7	37.7	57.6	73.8	91.9	105.2	112.6
5	13.7	22.1	26.6	39.6	52.6	76.9	98.1	119.2	142.7	154.5
10	16.2	26.2	31.4	47.5	62.5	89.7	114.1	137.2	167.5	182.2
20	18.7	30.1	35.9	55.0	72.0	102.0	129.6	154.5	191.3	208.7
30	20.1	32.4	38.6	59.4	77.4	109.1	138.4	164.5	204.9	224.0
50	21.8	35.2	41.9	64.8	84.2	117.9	149.5	176.9	222.1	243.2
60	22.4	36.2	43.0	66.8	86.6	121.1	153.5	181.3	228.1	250.0
70	23.0	37.0	44.0	68.4	88.7	123.7	156.8	185.1	233.3	255.7
80	23.4	37.8	44.9	69.8	90.4	126.0	159.7	188.3	237.7	260.7
90	23.8	38.4	45.6	71.1	92.0	128.0	162.2	191.2	241.6	265.0
100	24.2	39.0	46.3	72.2	93.4	129.8	164.5	193.7	245.1	268.9

EV1 distribution parameters

Mode	8.6	14.0	17.0	23.8	32.9	51.3	65.9	83.1	93.1	99.1
Scale	3.4	5.4	6.4	10.5	13.1	17.1	21.4	24.0	33.1	36.9

Standard error of rainfall depths (mm)

ARI	Duration									
(y)	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h
2	0.8	1.3	1.5	2.5	3.1	4.1	5.1	4.7	6.5	7.2
5	1.2	2.0	2.3	3.7	4.7	6.0	7.6	6.9	9.5	10.7
10	1.6	2.7	3.1	5.1	6.3	8.2	10.3	9.5	13.0	14.5
20	2.1	3.5	3.9	6.5	8.1	10.6	13.3	12.1	16.7	18.6
30	2.4	3.9	4.5	7.4	9.2	12.0	15.0	13.7	18.9	21.1
50	2.7	4.5	5.1	8.4	10.6	13.7	17.2	15.8	21.7	24.2
60	2.9	4.7	5.4	8.8	11.0	14.3	18.0	16.5	22.7	25.3
70	3.0	4.9	5.6	9.2	11.5	14.9	18.7	17.1	23.5	26.3
80	3.1	5.0	5.7	9.5	11.8	15.3	19.3	17.6	24.3	27.1
90	3.1	5.2	5.9	9.7	12.1	15.8	19.8	18.1	24.9	27.8
100	3.2	5.3	6.0	9.9	12.4	16.1	20.2	18.5	25.5	28.5

HIRDS Version 1.50b
High Intensity Rainfall Design System

Table of rainfall depths and standard errors (mm)
Location: Athenree 37 27S 175 58E

Rainfall depths (mm)

ARI	Duration										
(y)	10m	20m	30m	1h	2h	3h	6h	12h	24h	48h	72h
2	12	17	22	31	44	53	74	100	136	168	187
5	17	24	30	43	59	71	98	133	181	224	249
10	20	28	35	50	69	83	114	155	211	261	290
20	23	33	41	58	78	94	130	176	239	297	329
30	24	35	44	62	83	100	138	188	256	317	351
50	27	38	47	67	90	108	150	203	276	342	380
60	27	39	49	69	92	111	154	209	283	351	390
70	28	40	50	71	94	114	157	213	290	359	398
80	28	41	51	72	96	116	160	217	295	366	406
90	29	41	52	74	98	118	162	221	300	372	412
100	29	42	52	75	99	119	165	224	304	377	418

Standard errors (mm)

ARI	Duration										
(y)	10m	20m	30m	1h	2h	3h	6h	12h	24h	48h	72h
2	1	2	2	3	4	5	7	9	13	16	18
5	2	2	3	4	5	6	8	11	15	18	20
10	2	3	3	5	6	7	10	13	18	22	25
20	2	3	4	6	7	8	11	15	21	27	30
30	3	4	5	7	7	9	12	17	24	30	34
50	3	4	5	7	8	10	13	19	26	34	38
60	3	4	5	8	8	10	14	19	27	35	39
70	3	5	6	8	8	10	14	20	28	36	41
80	3	5	6	8	8	10	15	21	29	37	42
90	3	5	6	9	9	11	15	21	30	38	43
100	3	5	6	9	9	11	15	21	30	39	44

6 ATTACHMENT 1- 5

6.1 Attachment 1 - Rainfall Records & Hirds Data

6.2 Attachment 2 – Stormwater Flows Assessment

Attachment 2 – Discharge Calculation Comparison

Catchment	Total Area (ha)	5yr 10min RAFTS flows (m^3/s)	5yr 10min Rational Methods Flows
1	12.4	1.68	2.11
2a	4.0	0.59	0.71
2b	2.8	0.53	0.52
2c	8.1	0.98	1.61
2d	8.2	NC	NC
3	25.8	3.26	5.10
4a	7.3	0.88	1.45
4b	7.3	0.95	1.45
5	9.8	1.17	1.95
6	35.0	4.06	6.87
7a	7.4	0.92	1.47
7b	4.2	NC	NC
8a	14.2	2.09	2.81
8b	4.3	0.73	0.85
9a	7.9	1.20	1.50
9b	8.0	1.23	1.58
9c	5.4	0.96	1.07
9d	8.6	NC	NC
10a	12.2	1.79	2.41
10b	8.7	1.42	1.72
10c	7.5	1.23	1.49

6.3 Attachment 3 – Stormwater Management Cost Estimates

Attachment 3 - Stormwater Treatment - Land, Capital Works, Operation & Maintenance Costs

Catchment Data		Existing Urban Area (ha)	Reserve Land, Floodgates & Pipework for Infill of Existing Residential (Common to All Options)				Treatment Option 1 - Wet Ponds (m3)		Treatment Option 2 Swales @$30k/ha*** @$10k/ha***	Treatment Option 3 In-sump Filters @ $5k/ha	Best Treatment Option ($)	Total Capital Cost ($)	O&M** ($)
No.	Catchment Area (ha)		Area (ha)	Land* @ $25k/ha	F/G* ($)	Pipework @$10k/ha	Dimensions based on ARC 1992 (m)	Wet Pond* ($)					
1	12.4						N/A			$5,000	$5,000	$5,000	$4,418
2a	4.0	1.05	0.12	$3,000		10450	5 x 20 x 1.0	$40,800			$40,800	$54,250	$1,425
2b	2.8		0.12	$3,000			5 x 14 x 1.0	$0			$0	$3,000	$998
2c	8.1	8.10	0.12	$3,000		81000	N/A	$0			$0	$84,000	$2,886
2d	8.2	2.05				20480	N/A			$10,240	$10,240	$30,720	$2,922
3a	5.7	2.90				29000	N/A			$14,500	$14,500	$43,500	$2,031
3b	7.8	6.53				65280	N/A			$32,640	$32,640	$97,920	$2,779
3c	4.9	3.55	0.14	$3,500		35520	10 x 37 x 1.0	$79,000	$147,000		$79,000	$118,020	$1,746
3d	7.3						N/A			$36,500	$36,500	$36,500	$2,601
4a	7.3	7.30				73000	N/A			$36,500	$36,500	$109,500	$2,601
4b	7.3	7.30				73000	N/A			$36,500	$36,500	$109,500	$2,601
5	9.8	2.05	0.12	$3,000	$27,000	20480	10 x 76 x 1.0	$128,000	$98,000		$128,000	$178,480	$3,492
6a	9.7		0.20	$5,000	$27,000		10 x 75 x 1.0	$128,000	$97,000		$128,000	$160,000	$3,456
6b	5.4	4.67				46720	10 x 41 x 1.0	$79,000			$79,000	$125,720	$1,924
6c	8.0				$27,000		10 x 62 x 1.0	$128,000	$80,000		$128,000	$155,000	$2,850
6d	11.8						10 x 90 x 1.0	$128,000	$118,000		$278,000	$278,000	$4,204
7a	7.4						10 x 57 x 1.0	$128,000	$74,000		$228,000	$228,000	$2,637
7b	4.2		0.22	$5,500	$27,000		N/A			$5,000	$5,000	$37,500	$1,496
8a	11.3		0.77	$19,200	$27,000		10 x 87 x 1.0	$128,000	$113,000		$128,000	$174,200	$4,026
8b	2.9						10 x 23 x 1.0	$40,800	$29,000		$115,800	$115,800	$1,033
8c	4.3						10 x 33 x 1.0	$79,000	$43,000		$129,000	$129,000	$1,532
9a	7.8		0.36	$9,000	$27,000		10 x 47 x 1.0	$79,000	$78,000		$79,000	$115,000	$2,779
9b	9.7		0.62	$15,500	$27,000		10 x 62 x 1.0	$128,000	$97,000		$128,000	$170,500	$3,456
9c	5.4		0.26	$6,500	$27,000		10 x 42 x 1.0	$79,000	$54,000		$79,000	$112,500	$1,924
9d	8.6		0.32	$8,000	$27,000		N/A			$43,000	$43,000	$78,000	$3,064
10a	12.2		0.18	$4,500			10 x 94 x 1.0	$128,000	$122,000		$128,000	$132,500	$4,347
10b	8.7		0.18	$4,500			10 x 67 x 1.0	$128,000	$87,000		$128,000	$132,500	$3,100
10c	7.5		0.30	$7,500			10 x 58 x 1.0	$128,000	$75,000		$128,000	$135,500	$2,672
TOTAL	**210.5**	**45.5**		**$100,700**				**$1,756,600**	**$1,312,000**	**$219,880**	**$2,351,480**	**$3,150,110**	**$75,000**

* Stormwater works typically built outside subdivision and built at no cost to council or funded by developers via Development Impact Fees (F/G = Floodgate, bund and protection)

** Operation & Maintenance (O&M) of stormwater assets including assets built by developers in road, stormwater and coastal reserves funded directly or through DIF's

*** Retorfit grassed swale to existing urban area, cost = $30,000/ha and additional cost for new urban area, cost $10,000/ha of existing catchment. All estimates indicative only.

6.4 Attachment 4 – Population Data

Summary

AREA UNIT	YEAR																
	1996	1996	2001 Estimate			2006 Estimate			2011 Estimate			2016 Estimate			2021 Estimate		
			Stats NZ	WBOPDC		Stats NZ	WBOPDC		Stats NZ	WBOPDC		Stats NZ	WBOPDC		Stats NZ	WBOPDC	
	Census	June est.	Med	Low	High	Med	Low	High	Med	Low	High	Med	Low	High	Med	Low	High
Waihi Beach	1914	1950	2200	2100	2100	2400	2400	2400	2600	2700	2800	2800	3000	3300	3000	3300	3800
Island View/Pios	567	580	710	700	700	760	790	800	820	850	900	860	890	1000	910	940	1100
Athenree	504	510	580	590	590	640	690	740	700	790	940	760	890	1140	800	990	1340
Tahawai	1426	1450	1650	1700	1700	1850	1900	2000	2000	2100	2300	2200	2200	2600	2300	2300	2900
Katikati	2661	2700	3000	3200	3200	3200	3600	3800	3500	4000	4400	3700	4400	5000	3800	4800	5600
Aongatete	1977	2000	2400	2400	2400	2700	2700	2900	3100	3000	3400	3400	3200	3900	3800	3400	4400
Matakana Is	230	240	260	250	250	280	260	280	300	270	300	330	270	330	360	280	370
Omokoroa	1587	1600	1800	1800	1800	2000	2500	2800	2200	3300	4600	2300	4100	7100	2500	4900	9500
Te Puna	2374	2400	2800	2700	2700	3100	3000	3300	3500	3300	3800	3800	3600	4300	4100	3900	4800
Minden	3127	3200	3800	3900	3900	4300	4500	4900	4900	5000	5900	5500	5400	6900	6100	5700	7900
Kaimai	3793	3900	4600	4700	4700	5400	5400	5700	6200	6000	6700	7100	6500	7700	8000	6900	8700
Ohauiti-Ngapeke	551	570	630	650	650	700	730	750	760	810	840	830	870	920	890	910	1000
Upper Papamoa	1617	1650	1800	1900	1900	1900	2000	2200	2000	2100	2400	2100	2200	2700	2200	2300	2900
Te Puke West	2771	2800	3000	3000	3000	3200	3100	3300	3300	3300	3600	3400	3500	3900	3500	3600	4200
Te Puke East	3724	3800	4000	4100	4100	4200	4300	4500	4300	4400	4900	4400	4600	5300	4500	4700	5700
Rangiuru	1879	1950	2100	2100	2100	2200	2200	2300	2300	2200	2500	2300	2300	2700	2400	2300	2900
Maketu	987	1000	1100	1040	1040	1200	1070	1140	1250	1110	1260	1300	1150	1390	1400	1190	1540
Paengaroa	731	750	810	810	810	860	850	870	900	890	920	940	920	970	980	940	1020
Pongakawa	2551	2600	2800	2800	2800	3000	2900	3100	3200	3000	3400	3400	3100	3700	3500	3200	4000
DISTRICT TOTAL	**34971**	**35650**	**40040**	**40440**	**40440**	**43890**	**44890**	**47780**	**47830**	**49120**	**55860**	**51420**	**53090**	**64850**	**55040**	**56550**	**73670**

Note : 1996 June est. are Statistics NZ 30 June estimates which includes people absent overseas on census night and adjustment for census undercount.These were used by Statistics NZ for their projections and hence also by the District Council.

3 sets of estimates are presented based on the 1996 Census-Statistics NZ medium projections,and WBOPDC low and high projections.

6.5 Attachment 5 - Net Present Value Assessment of Asset

ATTACHMENT 5 - WET PONDS, GRASSED SWALES & IN-SUMP FILTERS - NETT PRESENT VALUE ANALYSIS

1 - Wet Ponds

	2000	2001	2002	2003	2004	2005	2006	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Labour & Maintenance	$2,500	$2,500	$2,500	$2,500	$3,500	$2,500	$2,500	$2,500	$2,500	$3,500	$2,500	$2,500	$2,500	$2,500	$3,500	$2,500	$2,500	$2,500	$2,500	$3,500	$2,500	$2,500	$2,500	$2,500	$3,500
Annual Costs	**$2,500**	**$2,500**	**$2,500**	**$2,500**	**$3,500**	**$2,500**	**$2,500**	**$2,500**	**$2,500**	**$3,500**	**$2,500**	**$2,500**	**$2,500**	**$2,500**	**$3,500**	**$2,500**	**$2,500**	**$2,500**	**$2,500**	**$3,500**	**$2,500**	**$2,500**	**$2,500**	**$2,500**	**$3,500**
Wet pond capital costs	$128,000																								
Capital Costs	**$128,000**																								
Annual Costs (NPV 25)	**$24,179**																								
Total Costs	**$152,179**																								

2 - Grassed Swales

	2000	2001	2002	2003	2004	2005	2006	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Labour & Maintenance	$0	$0	$0	$0	$13,500	$0	$0	$0	$0	$13,500	$0	$0	$0	$0	$13,500	$0	$0	$0	$0	$13,500	$0	$0	$0	$0	$13,500
Annual Costs	**$0**	**$0**	**$0**	**$0**	**$13,500**	**$0**	**$0**	**$0**	**$0**	**$13,500**	**$0**	**$0**	**$0**	**$0**	**$13,500**	**$0**	**$0**	**$0**	**$0**	**$13,500**	**$0**	**$0**	**$0**	**$0**	**$13,500**
Grassed Swale capital costs	$98,000																								
Capital Costs	**$98,000**																								
Annual Costs (NPV 25)	**$20,072**																								
Total Costs	**$118,072**																								

3 - In-sump Filters

	2000	2001	2002	2003	2004	2005	2006	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Labour & Maintenance	$2,500	$2,500	$2,500	$2,500	$3,500	$2,500	$2,500	$2,500	$2,500	$3,500	$2,500	$2,500	$2,500	$2,500	$3,500	$2,500	$2,500	$2,500	$2,500	$3,500	$2,500	$2,500	$2,500	$2,500	$3,500
Annual Costs	**$2,500**	**$2,500**	**$2,500**	**$2,500**	**$3,500**	**$2,500**	**$2,500**	**$2,500**	**$2,500**	**$3,500**	**$2,500**	**$2,500**	**$2,500**	**$2,500**	**$3,500**	**$2,500**	**$2,500**	**$2,500**	**$2,500**	**$3,500**	**$2,500**	**$2,500**	**$2,500**	**$2,500**	**$3,500**
Wet pond capital costs	$49,000																								
Capital Costs	**$49,000**																								
Annual Costs (NPV 25)	**$24,179**																								
Total Costs	**$73,179**																								

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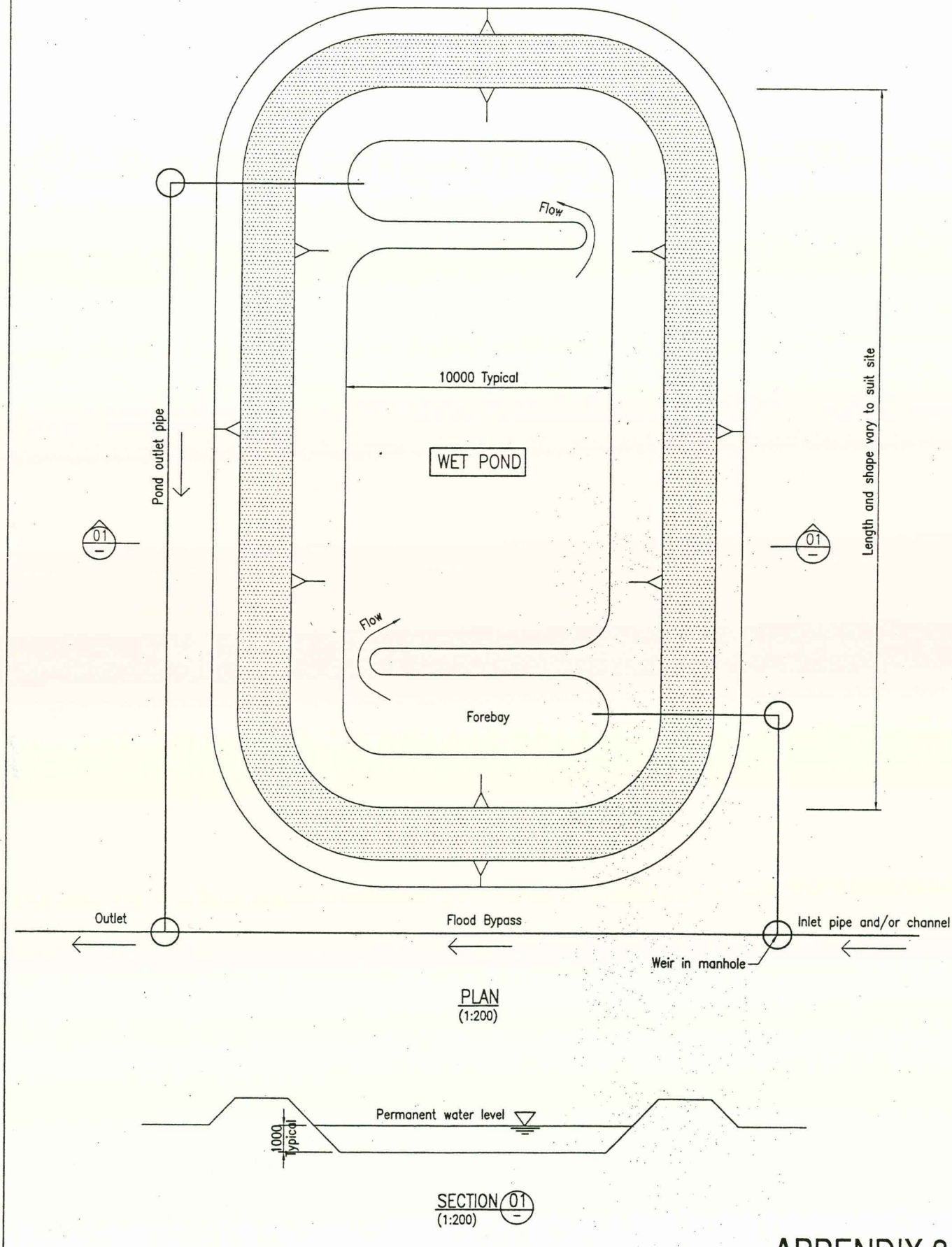
Appendix 3

Treatment Options



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SECTION 01
(1:200)

APPENDIX 3.1

	BY	CHECKED	DATE
DESIGN	K.J.C.		8/00
DRAWN	C.K		8/00
APPROVED			

OPUS INTERNATIONAL CONSULTANTS
Hamilton
Private Bag 3057
Hamilton, New Zealand
Tel: +64 7 838 9344
Fax: +64 7 838 9324

TITLE WESTERN BAY OF PLENTY DISTRICT COUNCIL
ATHENREE STORMWATER PLAN
STORMWATER TREATMENT CONCEPT – WET POND

WET POND

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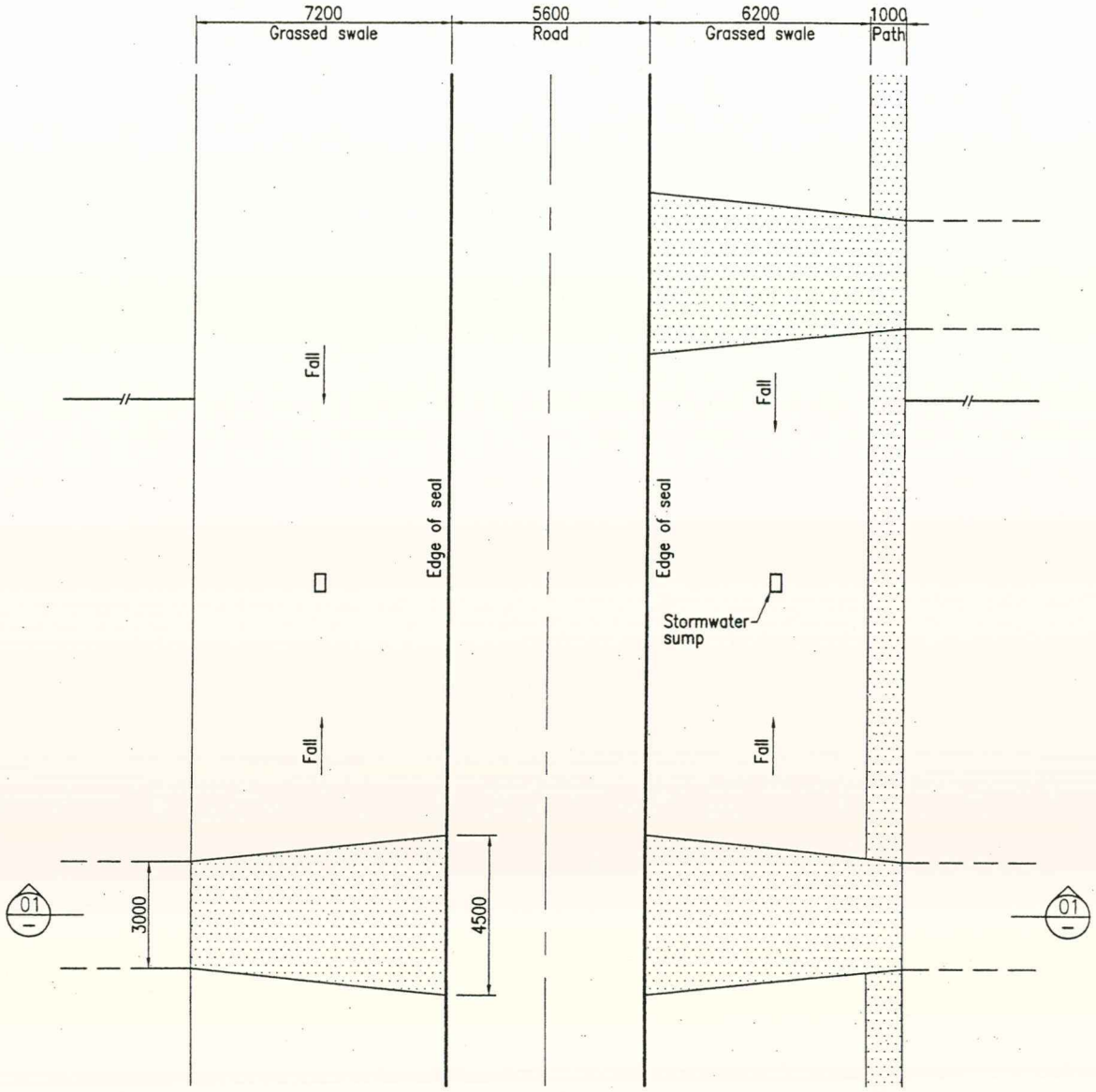

PLAN
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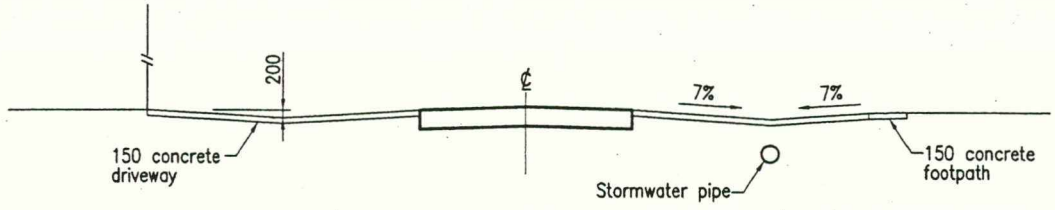

SECTION 01
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APPENDIX 3.2

	BY	CHECKED	DATE
DESIGN	K.J.C.		8/00
DRAWN	C.K		8/00
APPROVED			

OPUS INTERNATIONAL CONSULTANTS
Hamilton
Private Bag 3057
Hamilton, New Zealand
Tel: +64 7 838 9344
Fax: +64 7 838 9324

TITLE WESTERN BAY OF PLENTY DISTRICT COUNCIL
ATHENREE STORMWATER PLAN
STORMWATER TREATMENT CONCEPT – GRASSED SWALES

GENERAL STREET LAYOUT AND CROSS–SECTION

STATUS	DRAFT	FILE	62395.00		
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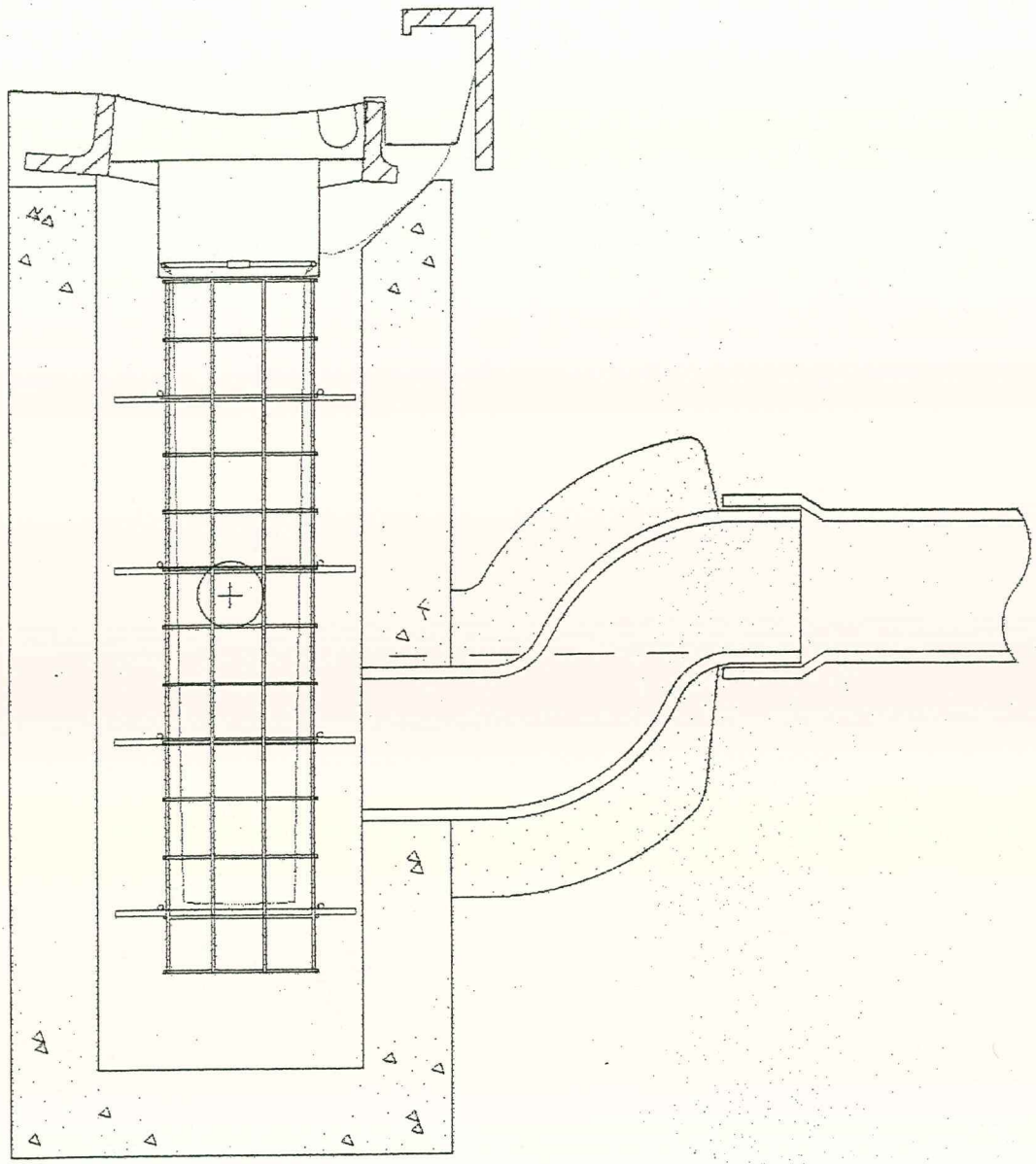

ENVIROPOD

Accepted New Zealand Patent No 299114

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Appendix 4

Proposed District Plan Rules

Appendix 4 – Proposed District Plan Rules

When the Athenree Stormwater Management Plan is completed it must be given status by its inclusion as a subdivision development standards in Section 15 of the district plan. It is envisaged that the revision of Council's draft Code of Practice will also bring some changes to the district plan section 15.

Changes to the district plan should only reference a Structure Plan where it is critical that the activity status change if development does not occur in accordance with that plan (Note Financial Contributions forecasting is sufficient enough reason to require this). When the Athenree structure plan is completed it must be properly referenced as a development standard if Council wishes to require development to comply with it. To achieve this, the following rules are proposed.

Add to Rule 15.3.5.5 Services (e) Stormwater and Land Drainage

New rule

"...(xi) Stormwater Management Areas –Athenree Structure Plan Areas

(a) In case of the Athenree Structure Plan Areas, the stormwater disposal system shall be developed in accordance with the assumptions, recommendations and general layout of the Athenree Stormwater Plan (*date*).

If a development or subdivision proposes to develop a stormwater management system that differs from that recommended by the stormwater plan, then the activity shall be considered a limited discretionary activity.

Council's discretion shall be limited to the following matters:

(i) That the system will be able to be constructed and maintained within a similar budget to that recommended by the Athenree Structure Plan and therefore not undermine Councils Long Term Financial Plan.

(ii) That the system proposed will have the same or better ability to treat stormwater prior to final discharge as recommended by the stormwater plan.

(iii) That the system is compatible with existing development within the catchment or subcatchment.

(iv) That the lifecycle costs of the system are the same or similar (within 10%) of the system recommended by the Athenree Structure Plan and that any additional cost is recoverable through an adjusted financial contributions.

It is recommended that Councils Code of Practice be modified to include the same rainfall data as used by the Athenree Stormwater Plan.