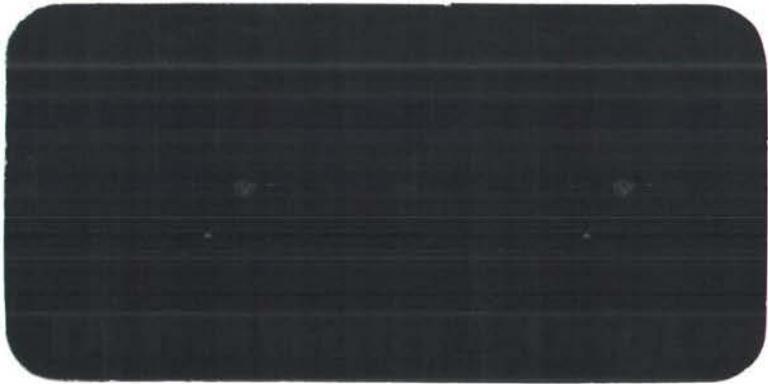


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CONSULTING ENGINEERS



WESTERN BAY OF PLENTY DISTRICT COUNCIL

Te Kauri Village Stormwater
Catchment Management Plan

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EXECUTIVE SUMMARY

The Western Bay of Plenty District Council (WBOPDC) has identified the need for stormwater catchment management in some of the smaller settlements of the Western Bay of Plenty. This document provides an overview of the Te Kauri Village stormwater catchment, describing the catchment's characteristics and stormwater network.

Te Kauri Village is a small settlement north of Katikati with a catchment area of approximately 16 Ha. The catchment is bordered by the coast, horticultural land and farmland. The area is zoned residential.

The existing stormwater network was modelled using the MOUSE drainage software and an ecological assessment of the catchment was prepared by Wildland Consultants.

Network upgrades were recommended as a result of the network modelling. The recommendations are based on maximum probable development using the current Western Bay of Plenty District Council Code of Practice and District Plan constraints. Should any of the current rules or controls change, stormwater discharge constraints may be required for further development.

The estimated cost of the recommended upgrade works totaled \$204,897 excl GST. This work is proposed to start in the 2006/2007 financial year and would take 6 years based on the assumed funding allocation.

The report produced by Wildland Consultants outlines recommendations for future management to protect the stormwater receiving environment. Recommendations include planting, management of the gully and bank stabilisation. The cost of the recommended work is estimated at \$15,000 excl GST, with work proposed to start and finish in the 2012/2013 financial year.

It is recommended that the works be added to the Long Term Council Community Plan (LTCCP) for the residents of Te Kauri Village to discuss and review. This should include the extra planting and the management of the gully and waterways as recommended by Wildland Consultants. The gully and waterway enhancements should be encouraged as community projects.

It is also suggested that land coverage restrictions be placed on the catchment so the impervious area of the catchment does not go above 35% (or the C factor above 0.5).

**Western Bay of Plenty District Council
Te Kauri Village Stormwater
Catchment Management Plan**

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1.0 INTRODUCTION

The Western Bay of Plenty District Council (WBOPDC) has identified the need for stormwater catchment management in some of the smaller settlements of the Western Bay of Plenty. This document provides an overview of the Te Kauri Village stormwater catchment, briefly describing the catchment characteristics and stormwater network.

The existing stormwater network was modeled using the MOUSE drainage software, which allowed the network and recommended upgrades to be assessed for effectiveness.

This catchment management plan also incorporates the results of an ecological assessment of the catchment prepared by Wildland Consultants in November 2003.

2.0 DESCRIPTION OF THE CATCHMENT

Description of the Te Kauri Village Catchment

Te Kauri Village is a small settlement north of Katikati with a catchment area of approximately 16 Ha. The catchment is bordered by the coast, horticultural land and farmland. A map showing the location of Te Kauri Village in is Appendix A.

Soil Type and Characteristics

The soil type is predominantly Katikati sandy loam. This type of soil drains well and does not easily erode. Katikati sandy loam is suitable for residential development (including the installation of septic tanks) and horticulture such as orchards.

Land Use

The Te Kauri Village area is zoned for residential. The catchment has no or very little potential for subdivision and expansion, based on district plan regulations. Appendix B is a map from the WBOPDC district plan and shows the actual zoning boundary's for Te Kauri Village.

3.0 REGULATORY INFORMATION

Western Bay of Plenty Subdivision and Development Code of Practice

The Subdivision and Development Code of Practice (COP) is in place to

“maximise efficient use of resources to ensure that any development in the district is to an appropriate long term, cost effective and minimum uniform standard which benefits the community”.

The COP outlines detailed requirements for the stormwater network. A summary of the main requirements that relate to the Te Kauri Village catchment are as follows:

- The minimum design standard for a primary (piped) stormwater system in the District is a 5 year return period (20% AEP).
- The minimum design standard for stormwater systems to protect important recreation fields, and streets without alternative access is a 10 year return period (10% AEP).
- The minimum design standard for stormwater systems to protect residential property, commercial and industrial buildings is a 50 year return period (2% AEP).
- The minimum design of stormwater systems to protect major communal facilities related to supply of electricity, telecommunications and water and sewage disposal systems and bridges is a 100 year return period (1% AEP).

Western Bay of Plenty District Plan

Residential Zone rules specify the following as a controlled activity;

“More than one dwelling per lot, subject to a minimum net land area of 350m² per dwelling on sewered lots and 800m² on unsewered lots”

The Te Kauri Village catchment is unsewered and section 5.3.2 (b) specifies that *“subdivision in the Residential Zone at Kauri Point is not provided for”*.

Environment Bay of Plenty

Environment Bay of Plenty (EBOP) has approved General Authorisation No 8 to provide for relatively small stormwater discharges. This authorisation dates back to the Water and Soil Conservation Act which permitted a Regional Council to authorise a number of minor or inconsequential uses of natural water by issuing a General Authorisation. When the Resource Management Act came into effect each General Authorisation became incorporated into the regional rules.

The provisions of General Authorisation No 8 are as follows:

“Clean stormwater may be discharged (excluding waste) into natural water provided that:

- a) The maximum discharge shall not exceed the flow from a 300 mm pipe on a flat grade or equivalent of 80 litres per second.*
- b) The suspended solids concentration of the water discharged does not exceed 150 g/m³.*
- c) The water discharged is substantially free of grease and oil.*
- d) The works shall be designed, constructed and maintained in such a manner so as not to cause erosion or flooding or to adversely affect any land or property owned or occupied by another person”.*

4.0 EXISTING INFORMATION

Stormwater Network

The catchment currently consists of 859 metres of stormwater pipe, 6 manholes and 8 catch pits. The pipes in the catchment are 225 mm and 300 mm in diameter and are mostly made of concrete. A few pipes have no documented material. Appendix C shows a map of the existing stormwater reticulation.

There is one discharge point in the Te Kauri Village catchment (see the Wildland report Figure 2 in Appendix C).

- Chelmsford Street Channel

The receiving stormwater channel for the catchment is located on the western side of Chelmsford Street. This channel lies outside the actual Te Kauri Village catchment area and discharges to the harbour between the Ongare Point and Te Kauri Village catchments.

Marine Receiving Water Quality

EBOP regularly sample five sites throughout the bathing season (the start of November till the end of March) near the Te Kauri Village catchment. The location of the sites is shown in appendix A. Following is a table showing the sampling sites, sample site number and the median enterococci value (cfu/100ml) for the 2003/2004 bathing season.

<i>Sampling Site</i>	<i>Sampling Site Number</i>	<i>Median Enterococci Result (cfu/100mL)</i>
Ongare Point – End of Ongare Pt Road	BOP160023	3
Tanners Point Beach	BOP160031	30
Anzac Bay – Bowentown Domain	BOP160028	24
Pios Ocean Beach	BOP160029	3
Athenree Motor Camp	BOP160030	9

All the sampling results are assessed against the Marine Water Quality Guidelines which are as follows:

Safe Mode	single sample < 140 cfu/100ml
Amber / Alert Mode	single sample > 140 cfu/100ml
Red / Action Mode	2 consecutive samples over 280 cfu/100ml

In the 2003/2004 bathing season only one sample was higher than 140 cfu/100ml, the rest are all under. This higher sample was taken at the Anzac Bay site and recorded 180 cfu/100ml. The following samples were back in the safe mode zone.

Ecological Characteristics

A report prepared in November 2003 by Wildland Consultants for Duffill Watts and King Ltd presented a summary of ecological information, habitat and vegetation characteristics of the Te Kauri Village area. They collated information from the Western Bay of Plenty District Plan, Bay of Plenty Regional Coastal Environment Plan (RCEP) and previous reports commissioned by the Bay of Plenty Regional Council. A summary of this information is shown below.

Four significant natural areas were identified from the WBOPDC District Plan and RCEP. These are as follows (see the Wildland report Figure 1 in Appendix C):

Western Bay of Plenty District Plan

- Site S8 Tauranga Harbour Landward Edge

This area is identified as visually significant and includes all the land 40 metres inland from mean high water springs (MHWS). The Tauranga Harbour is recognised in the RCEP as an “Area of Significant Conservation or Cultural Value” and also as an “Outstanding Natural Feature or landscape”.

- Site U13017 Kauri Point Historic Reserve

This area is administered by the Department of Conservation (DoC). The area is mown grassland with a coastal pohutukawa forest (See Site SSL-9 below).

Bay of Plenty Regional Coastal Environment Plan

- Site SSL-9 Kauri Point

This area is classed as a good example of indigenous vegetation that includes a good remnant of pohutukawa forest.

- Site S7 – Kauri Point Vegetated Margin

A regionally significant natural feature and landscape (See SSL-9 above)

Vegetation and Habitats

The Te Kauri Village catchment has no waterways with the stormwater being directed into a receiving channel out of the catchment area.

The channel flows through a privately owned orchard and then through pastoral land prior to discharging into the Tauranga Harbour. Watercress can be found in the channel along with exotic species such as tradescantia, scrambling fumitory, Scotch thistle, dock, tuber lader fern, acrum lily, cleavers and black nightshade on the riparian margin. Tree species on the riparian margin include Eucalyptus, crack willow and rank grasses. The lower reaches of the channel are at risk from erosion due to the lack of riparian vegetation.

5.0 CONSTRAINTS AND MODELLING ANALYSIS

The WBOPDC data for the Tanners Point catchment was adapted and used together with a detailed topographical survey of the entire catchment for the construction of a MOUSE drainage model of the area. This method of analysis allows accurate representation of existing and future systems and is only limited by the accuracy of the data used. A topographical survey of the catchment confirmed council GIS data of existing reticulation features.

The maximum probable development potential in the catchment was approximated by assuming a maximum impervious ratio of 35% (this equates to a C factor of 0.5) which is based on a statistical development figure for Katikati prior to reticulated sewerage. The maximum development potential therefore is based on current Code of Practice and District Plan requirements, a minimum lot size of 800m². Should permitted activities change the recommendations may no longer be representative. The Tahawai area population is expected to grow by approximately 34% by the year 2021 with the possible expansion at Tanners Point absorbed by infill subdivision and rezoning. Infill subdivision is covered by the assumed maximum impervious ratio and current development constraints. Adjacent catchments are independent of the currently zoned residential catchments.

The annual exceedance probability (AEP) used was 2% (i.e. equivalent to a 50 year return period) to determine potential areas of flooding. In all cases piped reticulation was sized using a 20% AEP event, unless no safe secondary flowpath was available, in which case the 2% AEP was used.

It has been assumed in this study that no reticulated sewerage will be available. If this should change the recommended upgrades in this report may not meet Councils current LOS (level of service) requirements without additional constraints on private stormwater discharges.

5.0 MOUSE NETWORK MODELLING ANALYSIS

The WBOPDC data for the Te Kauri Village catchment was adapted and used together with a detailed topographical survey of the entire catchment for the construction of a MOUSE drainage model of the area. This method of analysis allows accurate representation of existing and future systems and is only limited by the accuracy of the data used. A topographical survey of the catchment confirmed council GIS data of existing reticulation features.

The current level of development in the catchment was determined by measuring the total impervious area using aerial photographs. The maximum probable

development potential in the catchment was approximated by assuming a maximum impervious ratio of 22% (this equates to a C factor of 0.45) which is based on a statistical figure for Katikati. The Tahawai area population is expected to grow by approximately 34% by the year 2021 with possible expansion at Te Kauri Village absorbed by infill subdivision and rezoning. Infill subdivision is covered by the assumed maximum impervious ratio. Adjacent catchments are independent of the currently zoned residential catchments.

The annual exceedance probability (AEP) used was 2% (i.e. equivalent to a 50 year return period) to determine potential areas of flooding. In all cases piped reticulation was sized using a 20% AEP event, unless no safe secondary flowpath was available, in which case the 2% AEP was used.

6.0 IDENTIFIED STORMWATER PROBLEMS

Network

The MOUSE model was used to check the capacity of the existing stormwater system, determine flooding levels and identify required upgrades to the system. There are two identified floodable areas, one between Chelmsford and Princes Streets and the other between Princes Street and Esplanade Road; both are flood prone in heavy rain events. These problems are due to the development of sections across the natural flow paths, increasing the risk of flooding in the properties in a 50 year flood. The existing piped stormwater system would be unable to cope with the predicted flow resulting in the excess water flowing through the properties. For this reason these systems have been given a high priority.

The removal of deficient systems has been prioritised using three categories; high, medium and low. The following criteria were used to categorise these systems.

1. High – Upgrades of deficient systems that could cause major flooding of private property if not upgraded.
2. Medium – Upgrades of deficient systems to alleviate flooding of private property.
3. Low – Upgrades of deficient systems in flooding areas that do not cause major problems and do not flood private property.

Deficient systems are those which do not meet Councils current code of practice requirements either under existing development or maximum probable development. Details of the deficient systems are listed in Appendix E and illustrated in Appendix F.

Ecological

In the lower reaches of the receiving stormwater channel the banks are at risk of erosion due to a lack of riparian vegetation.

Pollution

No industrial or commercial areas exist at Te Kauri Village. Catchments are residential or rural/residential use with relatively low traffic volumes, producing limited pollution potential. No specific treatment systems are recommended other than the control of erosion caused by high velocity stormwater flows.

7.0 REMEDIAL METHODS

All recommended remedial methods are determined using maximum probable development information based on the current Code of Practice and District Plan constraints (see section 5). It is assumed that no reticulated wastewater system will be available for this area therefore minimum section sizes are 800m² (similar to Katikati before reticulated sewerage was installed).

Network

Details of the recommended upgrades, predicted costs and proposed programme are shown in appendices E and G. The Development Impact Fee (DIF) contribution is the estimated proportion of the cost of increasing the pipe sizes if subdivision was to occur. This was calculated by looking at the parcel sizes in the catchment and working out the percentage land area that could be developed. This percentage of the estimated upgrade cost was the total DIF amount.

The order of work listed in the proposed works programme (appendix G) was established by ranking the work based on priority. The work was then grouped so work in similar areas is carried out in consecutive years. It is possible to change the order of the work within each priority category.

Methods other than a piped system were considered but topographical and space constraints prevent other options such as swales being used.

Appendix F contains a map showing green coloured areas which can be developed without any upgrade of the stormwater systems. Red areas require stormwater upgrades before development can occur, or restrictions placed on new stormwater discharges.

The approximate cost of the proposed capital works is \$204,897 excl GST. This work is proposed to be started in the 2006/2007 financial year and would take 6 years based on current funding allocation.

Ecological

The report produced by Wildland Consultants outlines recommendations for future management to protect the stormwater receiving environment. The report recommends the following to improve the ecological well being of the catchment.

- Plant the unvegetated riparian margins with indigenous species to stabilize banks and provide habitat for aquatic and terrestrial species.
- Consider options for a stormwater detention system, if required¹.

The cost of this work is expected to be around \$15,000 excl GST, with work starting in the 2012/2013 financial year. This work could become part of community projects.

8.0 RECOMMENDATION

It is recommended that the suggested capital works be added to the Long Term Council Community Plan (LTCCP) for the residents of Te Kauri Village to discuss and review the proposed works programme. This should include the extra planting recommended and the management of the gully and waterways as recommended by Wildland Consultants. The riparian margin enhancement should be encouraged as community projects. A suggested programme of works is given in Appendix G.

It is also suggested that land coverage restrictions be placed on the catchment so the impervious area of the catchment does not go above 35% (or the C factor above 0.5).


¹ Consultation and Collaboration with the landowner will be required.


APPENDIX A

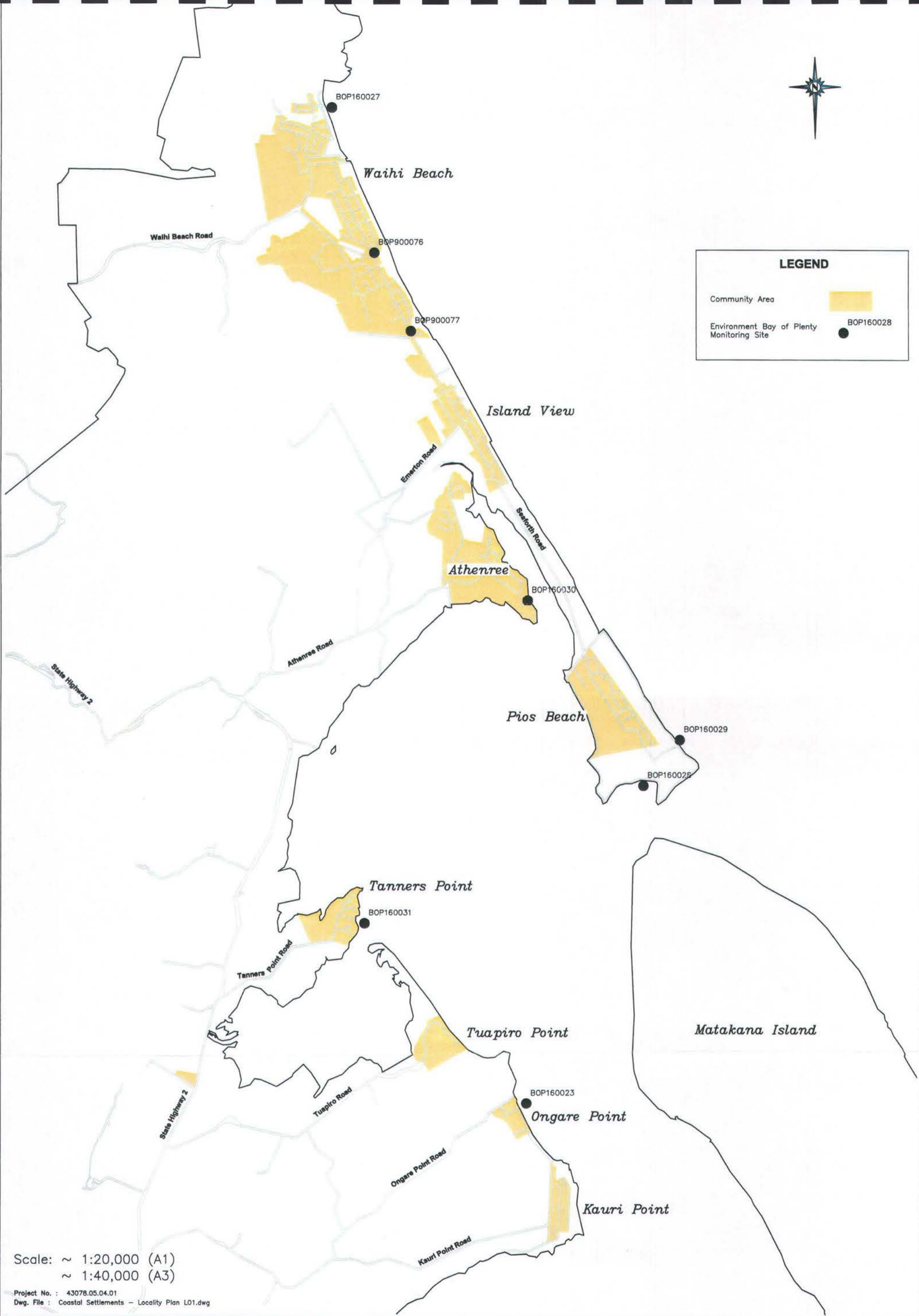
Location of the Te Kauri Village Catchment and EBOP Sampling Sites



LEGEND



Community Area 

Environment Bay of Plenty Monitoring Site  BOP160028



Scale: ~ 1:20,000 (A1)
 ~ 1:40,000 (A3)

Project No. : 43078.05.04.01
 Dwg. File : Coastal Settlements - Locality Plan L01.dwg

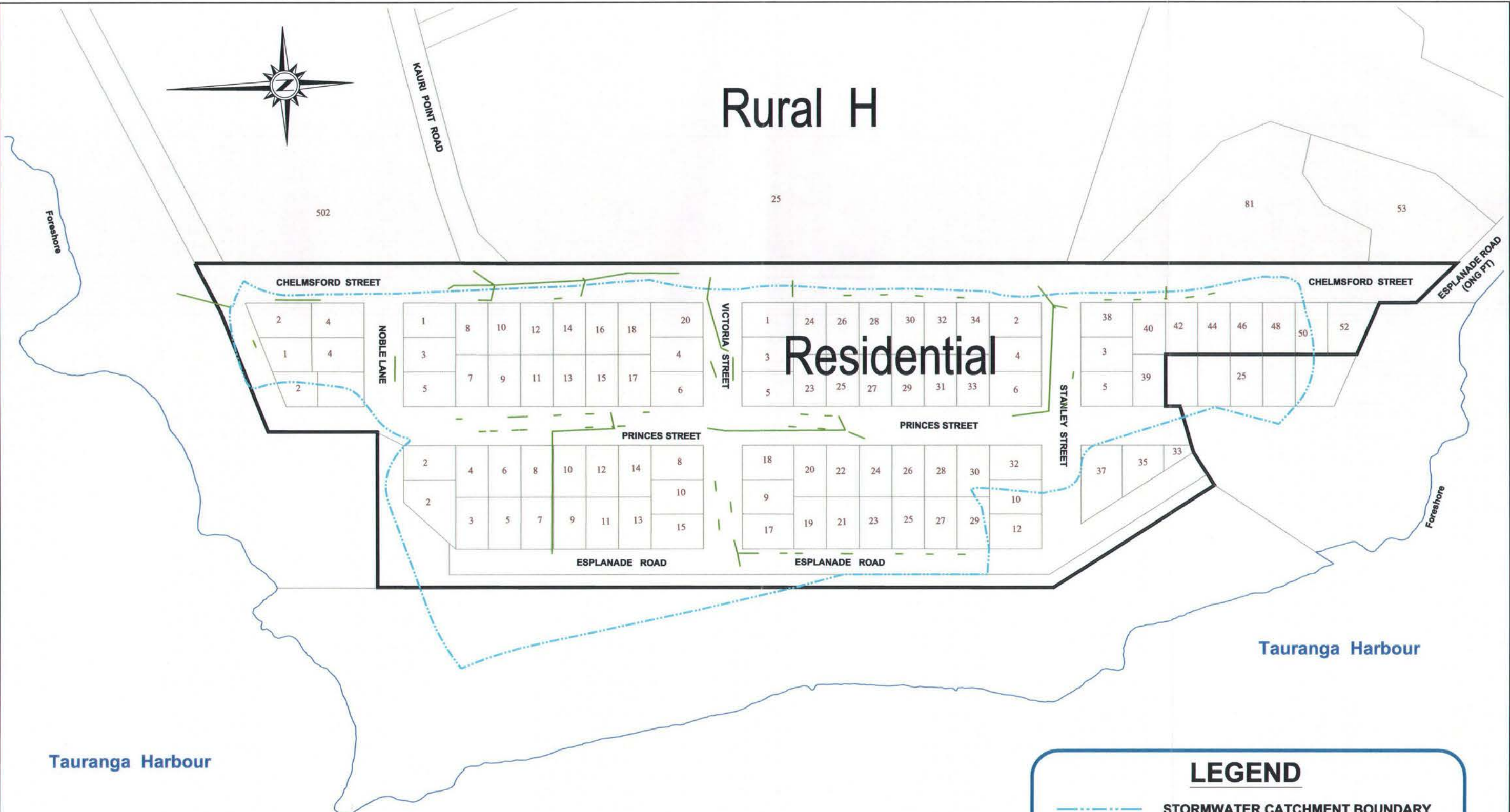
<p>Client</p> 	<p>Project</p> <p>COASTAL SETTLEMENTS CATCHMENT MANAGEMENT PLAN</p>	<p>Sheet Title</p> <p>LOCALITY PLAN</p>	<p>Job No.</p> <p>43078</p>	<p>Sheet No.</p> <p>L01</p>	
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APPENDIX B

**Te Kauri Village District Plan Zoning Area and
Existing Stormwater Pipe Network**

Rural H

Residential



LEGEND

- - - - - STORMWATER CATCHMENT BOUNDARY
- PLANNING ZONE BOUNDARY
- - - - - EXISTING STORMWATER RETICULATION
- PARCEL BOUNDARIES



Scales: ~ 1:1500 (A1)
 ~ 1:3000 (A3)

Project No. : 43078.05.04.01
 Dwg. File : Coastal Areas P01-4_zoning.dwg Kauri Pt. P03

APPENDIX C

Wildland Report “Ecological Assessment of Stormwater Catchments of Te Kauri Village, Western Bay of Plenty District”

ECOLOGICAL ASSESSMENT OF
STORMWATER CATCHMENTS AT
TE KAURI VILLAGE,
WESTERN BAY OF PLENTY DISTRICT

NOVEMBER 2003

Contract Report No. 773d

Report prepared for

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PROJECT TEAM

William Shaw - Project management, oversight, report compilation.

Fiona Fields - Field work, report compilation.

Ian Kusabs - Fisheries assessment.

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1. INTRODUCTION

This project was commissioned by Duffill Watts and King for the Western Bay of Plenty District Council. The objectives of the project were to provide information to underpin the future management of stormwater in Te Kauri Village, a small settlement north of Katikati in the Western Bay of Plenty. The settlement is adjacent to Tauranga Harbour and rural land where the predominant land uses are pastoral and horticultural.

The study identifies and provides an assessment of the inflowing and receiving waterways within the Te Kauri Village stormwater catchment and recommendations are made for future stormwater management. This report provides a description of vegetation and habitats, outlines the species present, and provides an approach to the future management of stormwater in this area.

2. PROJECT OBJECTIVES

Wildland Consultants Ltd were commissioned by Duffill Watts and King to:

- Identify relevant available data sources.
- Collate and review existing information.
- Obtain relevant digital data.
- Assist with the development of objectives for the management of stormwater in Western Bay of Plenty settlements.
- Develop base map(s) showing land cover/vegetation/habitats, and the locations of streams, rivers, wetlands, and any other waterways.
- Map and describe significant natural resources, including networks of natural areas and receiving waters. Include all sites already identified in statutory planning documents.
- Describe and evaluate the relative health/condition of waterways flowing into settlements and receiving stormwater from settlements.
- Assess opportunities to improve stormwater management by the use of riparian protection, planting, stormwater detention, and treatment.
- Undertake above assessments by walk-through surveys along each waterway, capturing a photographic record of each one.

3. METHODOLOGY

Relevant ecological information was obtained from existing sources and significant natural areas within the catchment were identified and mapped.

A walk-through field inspection of each catchment was undertaken in November 2003. Waterways, wetlands, stormwater channels, and outflow points were inspected and assessments were made of ecological values.

4. SUMMARY OF EXISTING ECOLOGICAL INFORMATION

The following is a summary of ecological information for significant natural areas within and immediately adjacent to the Te Kauri Village catchment. This information has been compiled from existing literature sources including District and Regional Plans, and ecological reports, as well as digital data held by Wildland Consultants Ltd.

Beadel (1991) carried out a comprehensive survey and inventory of Tauranga Harbour wetland vegetation for the Bay of Plenty Regional Council. Priority areas for protection were identified and many of these sites have been included in the Seventh Schedule of the Bay of Plenty Regional Coastal Environment Plan (RCEP) - 'Significant Indigenous Vegetation Areas'.

Four significant natural areas, listed below, have been identified and included in the WBOP District Plan and Bay of Plenty RCEP. The locations of these sites are shown in Figure 1.

Western Bay of Plenty District Plan

- Site S8 Tauranga Harbour Landward Edge

This has been identified as a visually significant landscape feature and includes all the land in a strip extending 40 metres inland from Mean High Water Springs (MHWS). Tauranga Harbour is recognised in the Bay of Plenty RCEP as an 'Area of Significant Conservation or Cultural Value' and also as an 'Outstanding Natural Feature or landscape'.

- Site U13017 - Kauri Point Historic Reserve

This is administered by the Department of Conservation. Vegetation consists of mown grassland with coastal pohutukawa forest (see Site SSL-9 below).

Bay of Plenty Regional Coastal Environment Plan





- Site SSL-9 - Kauri Point

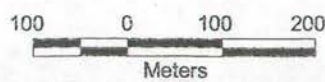
A significant example of indigenous vegetation that includes a good remnant of pohutukawa forest.



Figure 1 Te Kauri Village - Significant Natural Areas

Legend

-  Catchment boundary
-  Stream
-  Significant Ecological Site
-  DOC reserve



- Site S7 - Kauri Point vegetated margin

A regionally significant natural feature and landscape (see Site SSL-9 above).

5. VEGETATION AND HABITATS

The following is a description of the receiving waterways for Te Kauri Village and associated riparian habitats (refer to Figure 2 and Plate 1, Appendix 1).

Site KA1: Chelmsford Street channel

The receiving stormwater channel for Te Kauri Village lies outside the study area boundary, on the western side of Chelmsford Street. The channel flows through privately-owned orchard in the upper reaches and pastoral farmland further downstream, before discharging into Tauranga Harbour. At the time of field inspection there was no flow in the upper channel and it was mostly dry. Watercress (*Nasturtium officinale*) is present within the channel as well as number of exotic plant species present on the riparian margins in the upper reaches including tradescantia (*Tradescantia fluminensis*), scrambling fumitory (*Fumaria muralis*), Scotch thistle (*Cirsium vulgare*), dock (*Rumex obtusifolius*), tuber lader fern (*Nephrolepis cordifolia*), arum lily, cleavers (*Galium aparine*), and black nightshade (*Solanum nigrum*). Tree species along the riparian margins include *Casuarina* spp., *Pinus* Spp. *Eucalyptus* spp., and crack willow (*Salix fragilis*), as well as rank grasses. In the lower reaches of the channel, the banks are at risk of erosion due to a lack of riparian vegetation.

Avifauna recorded at the time of field inspection were Australasian harrier (*Circus approximans*), blackbird (*Turdus merula*), and shining cuckoo (*Chrysococcyx lucidus* ssp. *lucidus*). An assessment of fisheries values within the section of channel that flows through pastoral farmland was carried out by Ian Kusabs in November 1998 using trapping and spotlighting methods. Inanga (*Galaxias maculatus*) and short-finned eel (*Anguilla australis*) were found to be present. Due to its highly modified nature and lack of significant flora or fauna the channel has little ecological value.

6. FUTURE MANAGEMENT

The following general principles should be followed for stormwater management:

- Ensure that existing ecological values are protected, and enhanced if possible. In the Western Bay of Plenty this includes freshwater wetlands (even if small and degraded), streams (including provision for fish passage if they provide habitat for freshwater fish), remnants of terrestrial indigenous vegetation (even small remnants are of significant ecological value), wader habitat in estuaries, and saltmarsh vegetation and fauna habitats in estuaries.
- Provide detention and settling areas within the stormwater catchment (subject to protection or enhancement of above features), to avoid or minimise inflows of contaminants into receiving waters.














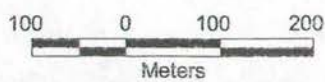
Te Kauri Village

KA1

Figure 2 Te Kauri Village - landcover, stormwater outlets, and channels

Legend

-  Catchment boundary
-  Property boundary
-  Stream/channel
-  Stormwater outlet
-  Stormwater channel
-  KA1 Site ID
-  Residential properties and roads
-  Coastal forest/scrub
-  Pasture/grassland
-  Reserve
-  Primarily horticultural



- Provide information to landowners who contribute stormwater, advising them of the potential damage caused by the introduction of contaminants into the stormwater system.
 - Consult with landowners where stormwater channels and receiving waters are within privately-owned land and work in collaboration (where possible) to achieve a holistic approach to stormwater management.
 - Provide, where possible, vegetated riparian buffers along all open stormwater channels that have actual or potential ecological values (with provision for ongoing maintenance if required).
 - Riparian buffers should be planted with locally-sourced indigenous species appropriate to the site character (lists of species can be provided if required).
- Manage the stormwater system as part of an integrated network of public open space and natural areas recognising that even small streams, wetlands, and other natural features may have significant ecological values.

The receiving waterway for this settlement lies outside the study area boundary. It passes through privately-owned horticultural and pastoral land and it has little ecological value. The channel does not adjoin areas of ecological significance, although the stormwater enters Tauranga Harbour which has been designated as an 'Area of Significant Conservation or Cultural Value' and an 'Outstanding Natural Feature or landscape'. The quality of stormwater entering the harbour from this channel may be improved by planting the riparian margins of lower reaches of the channel that flow through pasture with appropriate indigenous species. This would help to prevent bank erosion and sedimentation of the channel and harbour as well as providing habitat for fish species.

If stormwater flows were to increase it may be worthwhile to consider options for a stormwater detention system in this small valley.

A summary of future management recommendations for Te Kauri Village is as follows:

- Plant the unvegetated riparian margins with indigenous species to stabilise banks and provide habitat for aquatic and terrestrial species¹.
- Consider options for a stormwater detention system, if required.¹

¹ Consultation and collaboration with the landowner will be necessary to achieve these objectives.

REFERENCES

- Beadel 1991: Tauranga Harbour wetland vegetation. Prepared for Bay of Plenty Regional Council.
- DOC 1993: Schedule of sites of significant conservation value. Western Bay of Plenty. *Bay of Plenty District Council Schedule Series No. 01*. Prepared for Western Bay of Plenty District Council.
- Environment Bay of Plenty 2003: Bay of Plenty Regional Coastal Environment Plan. *Resource Planning Publication 2003/08*. Environment Bay of Plenty, Whakatane.
- Western Bay of Plenty District Council 2002: Western Bay of Plenty District Plan. Western Bay of Plenty District Council, Tauranga.

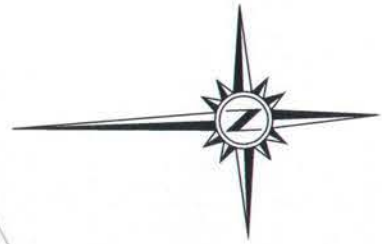
SITE PHOTOGRAPHS



Plate 1: Site KA1: Te Kauri Village - Chelmsford Street channel and stormwater outlet.

APPENDIX D

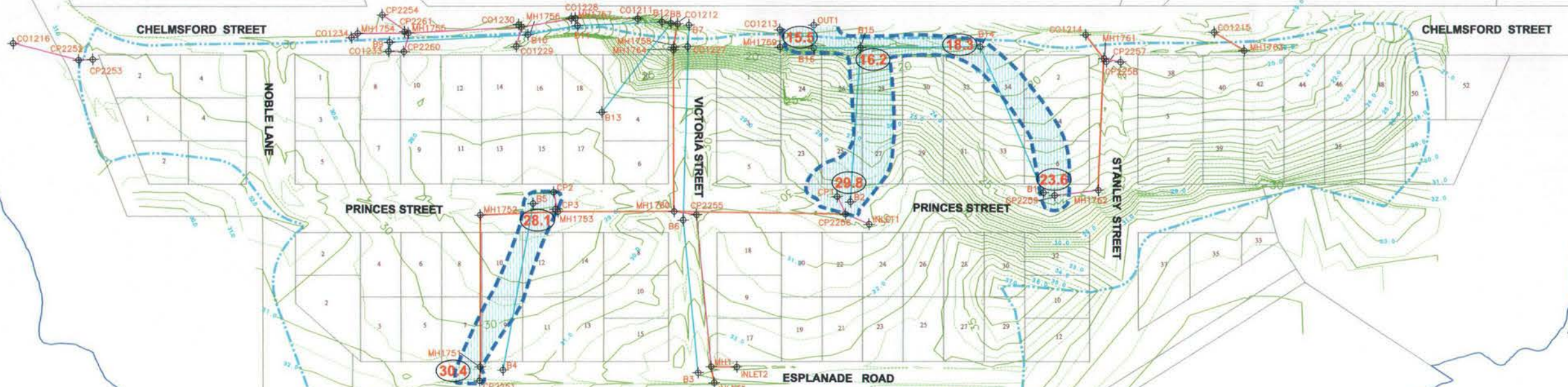
Map of the Floodable Areas



KAURI POINT ROAD

Foreshore

ESPLANADE ROAD (ONG FT)



Tauranga Harbour

Tauranga Harbour



Scales: ~ 1:1500 (A1)
~ 1:3000 (A3)

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- NEW STORMWATER LINE
- EXISTING OVERLAND FLOWPATH
- ADEQUATELY SIZED STORMWATER PIPES
- + CO0019 STORMWATER CATCHPITS / MANHOLES
- EXTENT OF MPD (Max. Probable Development)
50 YEAR FLOOD HAZARD AREA FOR UPGRADED NETWORK
- 4.7 MODELLED PONDING LEVEL FOR UPGRADED NETWORK

APPENDIX E

Recommended Stormwater Upgrades and Costs

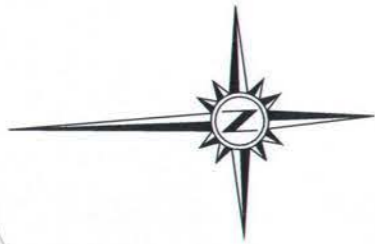
Street name	To	Link From	Priority	Exist size (mm)	New size (mm)	Length (m)	Cost/m (\$)	Amount (\$)	Amount per job group (\$)
Stanley Street	MH1762	MH1761	High	0.300	0.375	82	\$220	\$18,097	\$23,137
	MH1761	CO1214	High	0.300	0.450	19	\$270	\$5,040	
Victoria Street	MH1760	MH1764	High	0.300	0.600	101	\$330	\$33,250	\$38,677
	MH1764	MH1758	High	0.375	0.600	2	\$330	\$596	
	MH1758	CO1212	High	0.300	0.600	15	\$330	\$4,831	
Princes Street - Stage 1	CP2251	MH1751	High	0.300	0.375	9	\$220	\$1,903	\$27,490
	MH1751	MH1752	High	0.300	0.450	95	\$270	\$25,588	
Princes Street - Stage 2	CP2256	MH1760	High	0.300	0.375	107	\$220	\$23,471	\$67,441
	MH1752	MH1753	High	0.300	0.600	48	\$330	\$15,830	
	CP2	MH1753	High	0.225	0.525	12	\$300	\$3,717	
	CP3	MH1753	High	0.225	0.525	2	\$300	\$657	
	MH1753	MH1760	High	0.300	0.600	72	\$330	\$23,767	
Princes Street - Stage 3	MH1760	MH1764	High	0.300	0.600	101	\$330	\$33,249	\$38,677
	MH1764	MH1758	High	0.300	0.600	2	\$330	\$596	
	MH1758	CO1212	High	0.300	0.600	15	\$330	\$4,832	
Esplanade Road	INLET2	MH1	High	0.225	0.300	16	\$180	\$2,881	\$4,718
	INLET3	MH1	High	0.225	0.300	10	\$180	\$1,838	
Chelmsford Street	MH1763	CO1215	Low	0.300	0.375	22	\$220	\$4,787	\$4,787
Total								\$200,142	\$200,142

Cost Covered by DIF's **\$20,014**
 Cost Covered by current residents **\$180,127**

Note: Pipes marked with * are for a 50 year flood.

APPENDIX F

Map of Recommended Stormwater Upgrades



Tauranga Harbour

Tauranga Harbour



LEGEND

- STORMWATER CATCHMENT BOUNDARY**
- NEW STORMWATER LINE**
- EXISTING OVERLAND FLOWPATH**
- ADEQUATELY SIZED EXISTING STORMWATER PIPES**
- ⊕ **STORMWATER CATCHPITS / MANHOLES**
- NO STORMWATER DEVELOPMENT CONSTRAINTS**
- STORMWATER DEVELOPMENT CONSTRAINTS**

Scales: ~ 1:1500 (A1)
 ~ 1:3000 (A3)

Project No. : 43078.05.04.01
 Dwg. File : Coastal Areas P01-4_development.dwg Kauri Pt. P03

Client 	Project KAURI POINT CATCHMENT MANAGEMENT PLAN	Sheet Title STORMWATER MODEL & PROPOSED UPGRADES	Job No. 43078	Sheet No. P03 <small>3 of 4 sheets</small>	
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APPENDIX G

Proposed Works Programme

Proposed Stormwater Works Programme for Te Kauri Village

ID	Task Name	Estimated Cost	2006	2007	2008	2009	2010	2011	2012	2013	
			1	2	3	4	5	6	7	8	
1	Network Upgrades	\$204,897.00									
2	Stanley Street	\$23,137.00									
3	Victoria Street	\$38,677.00									
4	Princes Street - Stage 1	\$27,490.00									
5	Princes Street - Stage 2	\$67,411.00									
6	Princes Street - Stage 3	\$38,677.00									
7	Esplanade Road	\$4,718.00									
8	Chelmsford Street	\$4,787.00									
9											
10	Ecological Projects	\$15,000.00									
11	Plant riparian margins with indigenous species	\$15,000.00									