## Official Height Standard Change

From 1 July 2024, Auckland Council adopts the official height standard for New Zealand called New Zealand Vertical Datum 2016 (NZVD2016).

This model was carried out prior to the height standard change.

**All levels included in this modelling report are in Auckland Vertical Datum 1946 (AUK1946/AVD1946).**

Levels in this report can be transformed from Auckland Vertical Datum 1946 into New Zealand Vertical Datum 2016 by applying an offset value of 0.322 m.

For example:

$$H_{NZVD2016} = H_{AVD1946} - \text{Offset Value}$$

A single offset value for the catchment has been taken from the Land Information New Zealand (LINZ) Auckland 1946 to NZVD2016 Conversion Raster therefore this offset should be taken as an approximation only for the catchment.

A more accurate height transformation value can be derived by downloading the conversion raster available on the LINZ website below:
https://data.linz.govt.nz/layer/103953-auckland-1946-to-nzvd2016-conversion-raster/

# North Head Catchment Management Plan

Prepared for
North Shore City Council

June 2000

# *North Head Catchment Management Plan*

*Prepared for*

**North Shore City Council**

*By*

**Beca Steven**
**A division of Beca Carter Hollings & Ferner Ltd**

| | |
|---|---|
| Report Prepared By: | Maree Watson |
| Report Reviewed By: | Paul Mitchell |
| Approved for Issue: | …….<br>Stephen Priestley Job Director |

**June 2000**

## LIST OF TABLES:



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# APPENDICES



*Note: This report is based on the information supplied from the North Shore City Council's GIS database, the District Plan, aerial photographs, plus the NZMS DOSLI 260 series of topographic maps, and a site walk over. This report and recommendations are based on our understanding and interpretation of the available information. The recommendations of the report are therefore subject to the accuracy and completeness of the information available at the time of the study. Should any other information become available, then this report should be reviewed accordingly.*

*This is a strategic study* ***for*** *the North Shore City Council aimed at developing an overall management plan for the catchment. The scope of the study and the information available did not permit a detailed assessment of the stormwater system at all points. For individual sites it will be necessary to carry out site specific studies using the catchment wide data provided in this plan.*

*It should not be copied or used or relied on for any purpose or by any person other than was originally intended. Any questions regarding the contents of this report or recommendations therein should be directed to a Director of Beca Steven.*

# REFERENCES


| | |
|---|---|
| Auckland Regional Council (April 1999) | Erosion and Sediment Control: Guidelines for land Disturbing Activity in the Auckland Region, Auckland Regional Council Technical Publication No. 90 |
| Auckland Regional Council (April 1999) | Guidelines for Stormwater Runoff in the Auckland Region, Technical Publication No. 108. (Prepared by Beca Carter Hollings and Ferner Ltd, April 1999) |
| Auckland Regional Council (November 1992) | Stormwater Treatment Devices Design Guideline Manual, Auckland Regional Council Technical Publication No. 10. (Prepared by Beca Carter Hollings and Ferner Ltd, November 1992) |
| Beca Steven (May 1999) | North Shore City Council Hazard Mapping Report |
| Beca Steven (October 1998) | North Shore City Stormwater Strategy Statement |

# *Glossary*

| | |
|---|---|
| AEP | Annual Exceedance Probability, which is the probability of exceeding a given storm discharge or flood level within a period of one year. Equivalent return period terms are:<br>1% AEP = 1 in 100 year<br>2% AEP = 1 in 50 year<br>10% AEP = 1 in 10 year<br>20% AEP = 1 in 5 year<br>50% AEP = 1 in 2 year |
| ARC | Auckland Regional Council |
| ARPS | Auckland Regional Policy Statement (1999) |
| At Risk | Potential for damage to property or persons due to flooding. |
| BCHF | Beca Carter Hollings and Ferner Ltd |
| BPO | Best Practicable Option |
| Catchment | An area of land above a point or outlet, the topography of which carries by force of gravity the stormwater originating therein into a drainage channel or watercourse. |
| CMP | Catchment Management Plan |
| Design Flows | the critical flows derived from a range of design storm durations, selected as a basis for the design of works in watercourses and catchments. |
| Design Storm | the rainfall event calculated from historical records that can be expected for a specific AEP. |
| Drainage system | The network of pipes, streams, open watercourse and secondary flowpaths which carry flows within a catchment. |
| D/S | Downstream |
| Floodplain | The plan extent of flooding in a given AEP storm. |
| Freeboard | Design margin to allow for factors omitted in the overall design (e.g. settlement of building foundations, uncertainties in flood level estimations, wave action, localised water level variations). |
| Habitable floor | A living area floor level such as lounge, dining room, rumpus, kitchen, bedroom etc. |

| | |
|---|---|
| Level of Service | The flood event that the NSCC primary drainage system can safely accommodate without the need to rely upon the secondary drainage system. (Typically 10% AEP event for residential drainage systems and 5% AEP event for industrial, commercial drainage systems). |
| Main watercourse | The system of open channels, culverts and associated floodplains forming the main backbone of the drainage system within the catchment. |
| MSL | Mean Sea Level |
| NSCC | North Shore City Council |
| Overland flow | Surface water runoff travelling to a channel over the ground surface. |
| Primary system | The pipes, streams and open watercourses that carry the main, frequent or primary flowpath of stormwater within a catchment. |
| RMA | Resource Management Act 1991 |
| Runoff | The fraction of rainfall which runs off the land to the drainage system. |
| Secondary system (flow) | The route taken by excess stormwater when the capacity of the primary flowpath system is exceeded. |
| Subcatchment | A smaller sub-area of the catchment draining to a watercourse. |
| U/S | Upstream |
| Watercourse | Watercourse includes every stream, passage and channel on or under the ground, whether natural or not, through which stormwater flows, whether continuously or intermittently, and includes all land within the 1% AEP floodplain. |

# 1 Executive Summary

The aim of Catchment Management Planning is to manage and control flooding and stormwater related issues on a catchment-wide basis. This report summarises the approach and analysis of issues relating to flooding and stormwater quality management in the North Head catchment. It presents recommendations and sets out a catchment management strategy, a collection of guidelines and recommended works for implementation of effective management of existing and future development in the catchment.

The objective of the catchment management plan process is to identify and assess the extent of flooding, to evaluate issues related to stormwater quality and to determine solutions for problems identified. This Management plan will form the basis for a comprehensive stormwater discharge consent application to ARC Environment.

In summary the main findings of this study are:

### *Flooding*

One of the significant problems identified through our analysis of the stormwater system is the number of pipes that have inadequate capacity to pass the 10% AEP design flows. The following pipe upgrades have been recommended where pipes are undersized:

- Pipe upgrade at Vauxhall Road (Project 1.0, $ 36,000).
- Pipe upgrade at Rata Street (Project 2.0, $17,000).
- Pipe upgrade at Beaconsfield Street (Project 3.0).
- Pipe upgrade at Burgess Street (Project 4.0, $ 36,000).
- Pipe upgrades within Devonport Domain (Projects 5.0 & 6.0, $310,000).
- Pipe upgrade at Church Street (Project 7.0, $ 110,000).

Also contributing to flooding problems is the relatively flat nature of the catchment and the amount of unserviced properties. It is recommended that unserviced properties throughout the catchment are reticulated (Project 8.0, $3,000,000 - $3,500,000) and residents reminded of their responsibilities with concerns to the management of overland flow.

### *Stormwater Quality*

The assessment of options available to improve stormwater quality within the catchment is influenced by the high priority rating that NSCC have assigned to the eastern portion of the catchment. However, due to the lack of land available, options are reduced to that of source control and stormwater management techniques rather than catchment-wide solutions. Implementation of a filtration device at the service station located on the corner of Vauxhall and Tainui Roads is recommended (Project 9.0) in order to reduce the amount of contaminants entering the receiving environment:

### *Erosion*

For the North Head catchment, coastal erosion is the predominant concern as there are no open channels. Recommendations to mitigate erosion include the investigation of current outfall conditions along the south end of North Head and where erosion is severe, a collector drain is designed to dispose of stormwater via a coastal outfall.

# 2 Introduction

## 2.1 Scope

In line with the North Shore City Stormwater Strategy Statement (Beca Steven, 1998) Council is undertaking a programme of developing stormwater catchment management plans for all catchments within the City. This plan has been prepared for the North Head catchment as described in Section 3.1. In preparation of this plan the following elements have been studied.

- Information gathering and survey
- Public Consultation (including a stormwater questionnaire)
- Flood estimation, catchment modelling and drainage system upgrade requirements
- Assessment of flood mitigation options
- Water Quality
- Erosion Control
- Environmental Impact Assessment of proposed works
- Management Strategies

## 2.2 Objective

The primary objective of this plan is to assess flood mitigation, stormwater quality and erosion issues within the catchment as follows:

### *2.2.1 Flood Mitigation*

To identify existing flooding conditions and any which may arise from future development within the North Head Catchment, to recommend remedial works to alleviate flooding, and prepare a management strategy to guide development within the catchment.

### *2.2.2 Water Quality*

To determine potential sources of stormwater contamination and to identify works or policies to mitigate or control the effects of that contamination. However, it must be noted that while sediment runoff is a significant water quality issue, especially in developing upper catchments, sediment control is a function of the ARC and is managed through the land use consent process.

### *2.2.3 Erosion Control*

To make recommendations for protection measures and to examine future risks associated with increased development.

## 2.3 Purpose

The plan will be used for the following purposes:

- As the basis of an application to the Auckland Regional Council (ARC) under the Resource Management Act 1991 (RMA) for a Comprehensive Consent to discharge stormwater from the catchment.
- Prioritising and planning of future stormwater capital works
- Preparation of flood hazard plans
- Establishment of land use controls and other stormwater management policies where required
- To provide guidance for system management and maintenance

## 2.4 Legislative Background

Under the RMA, the ARC has powers to control, by way of resource consents, the discharge of contaminants or water into water (Sections 15, 30(1)(f) and 87). Current stormwater discharge consents held by ARC within the North Head catchment are shown in Table 2.1.

**Table 2.1 Stormwater Consents Currently held by ARC in the North Head Catchment**

| File Ref | Consent ID | Consent Holder | Purpose | Site Address | Map Ref. R11 | Status |
|---|---|---|---|---|---|---|
| H928345 | 20783 | NSCC | Construction of 40m long outfall structure | - | 2670800 6483800 | G |
| H928345 | 20865 | NSCC | Combining of s/w outfalls | - | 2670800 6483800 | G |
| H9510634 | 14339 | NSCC | Replace and bury a s/w pipe | Arawa Aveune, Devonport. | 2671600 6485200 | G |

s/w = stormwater
G = Granted

In response to the requirements of the RMA, the ARC has identified the upper Waitemata Harbour as an area that is susceptible to degradation (ARPS, 1999). The objective on water quality in the ARPS is "*to maintain water quality in water bodies and coastal waters which have good water quality, and to enhance water quality which is degraded particularly for the following purposes:*

*Estuaries and harbours: protection of aquatic ecosystems, recreation, fishing and shell fish gathering, cultural and aesthetic purposes. ...*

*iv) Lakes, rivers and streams: protection of aquatic ecosystems, recreation, food gathering, water supply, cultural and aesthetic purposes.*

Policy 8.4.7 of the ARPS covers stormwater and sediment discharges:

*"All new developments discharging stormwater, whether allowed as a permitted activity or by a resource consent, shall adopt appropriate methods to avoid or mitigate the adverse effects of urban stormwater runoff on aquatic receiving environments.*

*The ARC will promote stormwater quality control on a catchment-wide basis to avoid or mitigate the adverse effects of urban stormwater runoff on aquatic receiving environments.*

*All land disturbance activities which may result in elevated levels of sediment discharge shall be carried out so that the adverse effects of such discharges are avoided, remedied, or mitigated.".*

The ARC propose the following methods to achieve policy 8.4.7:

"A strategy to prioritise catchments for retro-fitting within existing development will be developed and agreed jointly at a date to be agreed upon by the ARC and relevant TAs [territorial authorities].

5. *The ARC will encourage TAs to reduce stormwater contamination by adopting the 'best practicable option' for catchment-wide stormwater quality control in consultation with the ARC.". ...*

Policy 8.4.21 relates to areas susceptible to water quality degradation, and states that

2. *"Priority shall be given to maintaining, and where possible improving, water quality in areas which are susceptible to degradation and/or have special values (as listed in Tables 8.1 and 8.2 and shown in Map Series 5 - Sheets 1-4)."*

The Proposed North Shore District Plan (1994) also sets out objectives, policies, and methods with respect to catchment management, thus:

***Objective: Stormwater Control***

*To adopt a comprehensive approach to river and stream system management and minimise stormwater contaminants and sediment discharge from land based activities.*

***Policies***

1. *By identifying, in advance of development, streams, watercourses and wetlands to be protected from development.*

2. *By prohibiting development in areas which are subject to a 1-in-100 year flood for the fully urbanised catchment.*

3. *By taking all necessary steps to achieve a stable hydrologic system during urbanisation.*

4. *By identifying opportunities for employing natural means of control of urban runoff.*

5. *By identifying in advance of development areas of land required for detention ponds and wetland filtering systems.*

6. *By requiring silt detention and water quality treatment for stormwater runoff, post development as well as during land development.*

7. *By continuing to develop comprehensive catchment management plans in advance of developing urbanisation.*

8. *By imposing an integrated set of land development controls in order to limit the potential generation of urban runoff through:*

   - *restrictions on earthworks and vegetation removal in particularly vulnerable areas*

- *limiting impervious within the catchment, and encouraging the use of porous surfaces*

- *using natural features for treatment purposes where practicable*

- *by encouraging the use of holding tanks for roof runoff, wherever practicable.*

9. *By using specific design, and maintenance of vegetation, within and adjacent to natural river or stream valleys, so as to intercept sediment, protect against erosion and provide suitable habitats for birds and aquatic fauna.*

10. *By retaining land in floodplains as open space wherever practicable.*

11. *By ensuring that flood channels and open main drains are unobstructed by development.*

12. *By avoiding the construction of barriers to migratory fish.*

***Objective: Stream Protection***

*To protect the natural character and ecological amenity and recreational value of rivers, streams and other natural bodies of water.*

***Policies***

1. *By restricting the diversion or modification of natural watercourses.*

2. *By requiring stormwater discharges to be kept within environmentally acceptable levels at the point of entry into receiving waters.*

3. *By requiring treatment for stormwater quality as well as flow and sediment control in sensitive catchments with high ecological value.*

4. *By acquiring land alongside rivers, including streams, for public access, habitat, water quality and landscape protection.".*

***"Objective***

*To minimise the adverse effects of urbanisation on water courses and receiving environments.*

***Policies***

1. *By ensuring that the potential for sediment generation during development is minimised by limiting the intensity of development on steeper land and land close to sensitive water bodies, protecting natural water courses and valley systems, and keeping natural vegetation cover on steeper slopes, esplanades and other reserve areas.*

2. *By ensuring that the extent of earthworks proposed as part of any subdivision application is assessed on the basis of slope, length of slope , soil type, vegetative cover, proximity to water-courses and erosion control measures proposed within any sub-catchment, and restricted where necessary.*

3. *By ensuring that in the case of lots on steeper land, the location of building platforms and vehicular access is selected to minimise earthworks.*

4. *By ensuring that satisfactory means, within subcatchments, of achieving long-term water quality in adjacent waterways, without environmental damage, is developed before subdivision is approved."*

## 2.5 Responsibility for Flood Mitigation

It is the responsibility of NSCC to ensure that the passage of stormwater through a catchment does not pose a hazard to residents. Appendix A gives NSCC policy on open watercourses and piped drains. NSCC must ensure that in addition to the primary drainage system, effective and efficient secondary flowpaths exist to pass excess flows safely. Ideally, these secondary flowpaths will be protected by a covenant on the title even where they pass through private land, with the owner being advised (or educated) of the necessity of keeping the flowpath free from obstruction. When permitting infill or new development, NSCC must ensure that new floor levels are constructed clear of the 1% AEP flood level. Where development is allowed to encroach into a designated or identified secondary flowpath, provision must be made to allow the excess flows to pass without causing damage.

Owners have a responsibility to manage their own site to ensure that localised surface water does not cause a problem to themselves or their neighbours. They have a legal obligation to accept stormwater, which is generated upstream, provided that water is not illegally concentrated onto their property.

Flooding of habitable floors can arise from a number of conditions that occur naturally on properties. Owner / resident responsibilities and Council responsibilities for flood mitigation are described as follows:

**Responsibility of Property Owner/Resident**

- overland flow entering buildings
- alteration or restriction of the natural secondary flowpaths by any means, e.g. landscaping, construction of retaining walls, layout of driveways, building extensions or modifications, fencing or walling, etc
- private alteration of primary drainage systems either open drains or piped systems
- ground water seepage into buildings
- NSCC require owners, when carrying out development, to prepare a site stormwater management plan to show how the above issues are to be managed

**Responsibility of NSCC**

- to define and protect floodplains associated with the main watercourse
- to manage the primary drainage system that give rise to damage to buildings (either directly or because of excessive flow in the secondary drainage system) or excessive nuisance to the public (e.g. frequent blocking of access).
- To ensure adequate maintenance and capacity of the primary and secondary systems.

Administration of:

- floor level controls
- protection to secondary flowpaths

## 2.6 Responsibility for Stormwater Quality

ARC have a Proposed Regional Policy Statement (ARC, 1993). Within this document, the ARC seek to obtain the:

*"steady reduction of sediment, sewerage overflows and other contaminants into waterways, and the*

*prevention of discharges of toxic and persistent contaminants which may have an adverse effect on aquatic ecosystems."*

The ARC aim to meet these objectives through the implementation of the following policies (amongst others):

*"All new developments discharging stormwater, ... shall include stormwater quality controls which are demonstrated to be the best practicable option*

*Catchments containing existing urban development and experiencing stormwater quality problems shall be retrofitted with stormwater quality controls which are demonstrated to be the best practicable option in accordance with a prioritised programme."*

NSCC have to ensure (under the consent conditions) that catchment water quality improves.

## 2.7 Responsibility for Erosion and Sediment Control

The owner has a responsibility to:

- Maintain streambanks within their property boundaries

NSCC is responsible for the maintenance of streams located within Council reserves and any major work required on the streams within the catchment.

With concerns to further development within the catchment, developers have to apply for a land use consent. Under which is the provision to supply an Erosion and Sediment Control Plan as part of the application. Where the amount of earthworks involved is considerably large, the Contractor (under the provision of the developers land use consent) may provide the Erosion and Sediment Control Plan.

## 2.8 Health and Safety

Open spaces used by children are potentially dangerous if they function as watercourses or flood detention areas. Typical safety measures include:

- Culvert inlet grilles also acting as trash racks.
- Fencing detention areas

Grilles at culvert inlets are prone to blocking and therefore the potential for any resultant flooding must be carefully evaluated. While grilles over culvert inlets may prevent a child from being swept

down a storm sewer, they do not remove the threat to the child's life. The pressure of the water passing through the grille will trap objects on the grille generally below water level making them difficult to find and very dangerous to remove. If the culvert is only a short section of pipe (10 to 20m) then the grille may pose a greater threat to safety than being swept through the culvert.

Fences surrounding detention areas is not common practice. This particular safety measure may well prevent children from entering a detention area but does not allow them to exit the area freely. An alternative to fencing is to have a dry pond or a flat slope on the sides to allow for easy egress.

Health and safety is also associated with stormwater quality, since residents may come in contact with the coastal water into which the stormwater is discharged. Risks may arise from both infrequent exposures to acute concentrations of contaminants and frequent long-term, low-level exposure (for example from swimming in the seawater surrounding the North Head catchment). Trace organics and some dyes and detergents are potential health hazards if they come in contact with the skin. Some of these substances will also promote dermal absorption of other contaminants. The following contaminants potentially pose a health risk if ingested in sufficient quantities.

- Bacteriological organisms (notably from foulwater overflows which may enter the stormwater system)
- Heavy metals
- Hydrocarbons
- Trace organics
- Tannins
- Dyes and detergents.

Threats to health and safety of those in the North Head catchment include:

- Fast flowing water from culvert outlets poses safety risks during storm events
- Foulwater overflows may occur without warning due to blockages or pipe failures or during flood events and may enter the stormwater system to eventually discharge into the seawater surrounding the North Head catchment.
- Water quality in some locations may pose a health risk.

Alternatives for reducing the risk include:

- Educating residents on the risks associated with fast flowing water and watercourse structures
- Reducing or eliminating the frequency and duration of foulwater overflows, which enter the stormwater system
- Advertise potential risks by placing signs adjacent to the relevant area
- Contaminant treatment options.

# 3 Description of Catchment

## 3.1 Location and Extent

North Head catchment (refer Figure 3.1) is situated on the North Shore and drains towards the east coast. The top of the catchment is narrow but widens at the bottom stretching from Devonport Beach to North Head. The boundary follows the coast from Narrow Neck Beach around North Head to the west end of Devonport Beach. It then extends through the middle of Mt Victoria and along Vauxhall Road back towards Narrow Neck Beach. The total area of the catchment is approximately 106 hectares of mainly residential development.

## 3.2 Geology and Soil

The soils in the North Head catchment are made up of two predominant types. The first type covers the northern part of the catchment and includes Quaternary sediments, which have been transported into place. The second type is associated with the volcanoes and includes ash, tuff, and weathered basalt. These are relatively permeable, possibly allowing for soakage of stormwater. The North Shore Hazard Mapping Report (May 1999) identifies part of the catchment as possibly suitable for low flow soakage and the rest of the catchment as unsuitable for low flow soakage (refer Figure 5.3).

## 3.3 Land Use

Current land use is shown in Figure 3.2 as per the North Shore City Proposed District Plan (1994). The predominant land uses within the catchment are Residential Zones 3A & 3C. Zone 3C allocates those areas as having significant building heritage values. In addition, Residential Zone 6C covers a small area to the south of Narrow Neck Beach and is under the jurisdiction of the Royal New Zealand Navy. The catchment also includes Recreational Zones 1, 2, 3 & 4. Zone 1 is associated with the coastal areas and the volcanic cones of Mt Victoria and North Head, while Zone 2 designates Devonport Primary School. Zone 3 is land designated to water related activities, and in this case appears to be a boat maintenance area, while the Devonport Domain is designated as Recreational Zone 4. The last land use designation is that of Business Zone 1 which relates to small retail centres scattered throughout the community.

The Proposed District Plan indicates that impervious areas could increase to 70% of the site in residential zones. This is unlikely in lower density areas such as Residential Zones 3A & 3C, although it is more probable in higher density areas such as Residential Zone 6. However, in estimating future flood flows, impervious areas have been estimated to reach 70% of the total site area for all residential zones.

# 4 Public Consultation

## 4.1 Questionnaire

The main thrust of Public Consultation was conducted through a self-completed questionnaire, which was distributed to residents within the North Head catchment. Approximately 1300 questionnaires were sent, and 142 responses were received, a return of approximately 11%. The aim of this approach was to enable the identification of priorities for the study and to provide a focus for the development of the Management Plan.

A copy of the questionnaire and summary of the results are included in Appendix B. Direct responses to residents' completed questionnaires were outside the scope of this report. The information gained from this part of the consultation process, however, has been invaluable in identifying stormwater quality and quantity issues.

The questionnaire results highlight a number of flooding problems, some of which are 'private' and others require Council work to remedy. Without a specific investigation of each case, a final demarcation of responsibility is not appropriate. The approach in this study has been to identify the nature of the problem, and comment on this in the questionnaire summary table (refer Appendix B). Where a specific future works project has been identified, Council responsibility is assumed. 'Unserviced area' indicates that Council may need to address the issue, but further specific study is required. 'Overland flow' generally implies that it appears to be a local issue of surface water management, and the responsibility of the landowner. Where overland flow comes from the roadway or reference is made to blocked catchpits, there is likely to be a need for Council to investigate and remedy the situation.

- Habitable floor and property flooding
- Blocked catchpits
- Overland flow problems
- Flooding coinciding with high tide
- Unserviced properties
- Infill housing
- Stormwater quality and hence quality of the beaches
- Foulwater overflows contaminating the Bays
- Coastal erosion

Although foulwater overflows are not strictly a stormwater Catchment Management Plan issue and are outside the scope of the study, they become important if stormwater quality in the catchment is compromised.

The questionnaire responses also indicate that residents in the North Head catchment are sensitive to the issue of stormwater quality and the perceived impacts on the receiving environment. This has been increased in part by the degree of attention water quality related issues are getting in the media at present.

A number of residents commented on flooding coinciding with high tide. They reported street flooding due to the egress of tidal waters up the stormwater outlets, preventing stormwater from freely exiting the drainage system.

## 4.2 Iwi Consultation

Consultation with iwi was carried out by way of a letter detailing the CMP process and its objectives. Input was sought from the following iwi groups:

- Kawerau a Maki Trust, Saul Roberts
- Te hao o Ngati Whatua, Bill Kapea
- Ngati Paoa Whanau Trust Board, Hariata Gordon
- Ngapuhi, Paea Barns
- Hauraki Maori Trust Board, Liane Ngamane
- Ngati Whatua o Orakei Maori Trust Board, Ngarimu Blair
- Te Tinana o Ngati Whatua, Pamera Warner

Letters received from iwi in response to consultation are included in Appendix B and will form part of the Resource Consent application.

## 4.3 Other Group Consulted

A letter detailing the CMP process and its objectives was also sent to the following community groups:

- Royal Forest and Bird Protection Society of NZ Inc, Jim Lewis
- North Shore City Council Parks Department, Lee Busby

As result of the letter Beca Steven met with representatives of the Royal Forest and Bird Protection Society of NZ and the Three Streams Reserve. A list of their concerns is included in Appendix B.

## 4.4 Community Board

This process provides for a presentation of the CMP to be given to the appropriate community board. The presentation covers the general character of the drainage system, and issues and options applicable to the catchment. Discussion between board members and the public can occur and the feedback from this process is taken into consideration during final compilation of the report.

It was suggested at the Devonport community Board meeting (16th May, 2000) that beach outfalls particularly along Cheltenham Beach where brought back to the headwall.

***It is recommended that Council investigate the option of shortening beach outfalls back to the headwall.***

## 4.5 Resource Consent Process

Obtaining a resource consent involves a written application (including the CMP) by NSCC to ARC, followed by notification of the application to the public. The public replies with submissions to ARC, which are resolved through direct discussions with concerned residents or groups. Input from the public consultation process will be incorporated into the final CMP. Once this process of consultation is complete, the ARC will assess whether a resource consent is granted. The ARC decision can be appealed to the Environment Court.

# 5 Flood Management

## 5.1 Introduction

This section of the report discusses issues, which have been identified as being of concern in relation to flooding. Existing flooding problems have been identified through questionnaire responses and flood flow estimation. Future flooding problems have been assessed through the same process and an assessment made of the remedial works based on both existing and developed scenarios. A flood management strategy has been developed which includes policies for dealing with the identified issues, for maintenance of the existing system, and for infill development within the catchment.

In terms of addressing extreme flooding issues, the projects recommended in this CMP represent the best practicable option. These projects will enable the existing stormwater infrastructure to be used more effectively. It must be recognised, however, that the land use development and stormwater infrastructure are constraints to the safe discharge of stormwater during extreme flood events. Full implementation of the projects will not eliminate flooding, but will reduce the likelihood of critical infrastructure and habitable buildings being flooded. The priority attributed to each project is dependent on it being a recognised flooding problem, through consultation and the hazard register.

## 5.2 Flood Estimation

Stormwater runoff from the North Head catchment drains via piped systems to the coastline. With the exception of the extensive piped system that drains most of the Devonport Domain (Subcatchments 6, 7, 8, 9 & 11), the rest of the primary systems are relatively small. Figure 5.1 illustrates the network of pipes that currently discharge stormwater via outlets located along the coastline. Flows are calculated at nodal points shown on Figure 5.1. These nodes were chosen on the basis of pipe sizes larger than 375mm and on areas identified by residents as having capacity problems. Flows for subcatchments with stormwater pipes less than or equal to 375mm in diameter are based on yields (per hectare) estimated for typical land uses within the catchment.

Flood flows within the study area were derived using the graphical method outlined in the ARC's Technical Publication No. 108 (TP108) – *Guidelines for Stormwater Runoff Modelling in the Auckland Region* (refer Appendix C for technical description). TP108 is based on the US Soil Conservation Service (SCS) model. It includes a standard Auckland design rainfall storm, guidelines for selecting rainfall loss parameters for typical Auckland soils, a regionally calibrated equation for estimating catchment times of concentration and a standard unit hydrograph.

This graphical method was used on the smaller catchment areas rather than the graphics based stormwater modelling software package XP-SWMM32. XP-SWMM32 is more applicable to larger catchments, which was not the case for the North Head study area. Summaries of catchment characteristics and nodal flows are included in Tables C.1 and C.2 (refer Appendix C), respectively. Our assessment of stormwater flooding is based on a review of NSCC records, questionnaire responses and visits to problem areas. Verification of the stormwater modelling was achieved through comparison with the questionnaire results. It is probable, however, that problem areas exist at some locations, but have not been identified at this stage.

## 5.3 Identification of Flood Hazard Areas

### 5.3.1 Existing Flooding Conditions

The results from the flood estimation analysis show that (for the existing scenario) the catchment typically yields 0.18$m^3/s/ha$ (10% AEP) and 0.28$m^3/s/ha$ (1% AEP), respectively. For the developed scenario the catchment typically yields 0.20$m^3/s/ha$ (10%AEP) and 0.30$m^3/s/ha$ (1% AEP), respectively. Nodal flows shown in Table C.2 (refer Appendix C) indicates that a most of the primary drainage systems have inadequate capacity to pass design flows (10% AEP, refer Table 5.1 and Figure 5.1). This means that secondary flow (shown in Figure 8.1) occurs more frequently within this catchment. Secondary flow results from the above ground flow of stormwater in excess of the capacity of the primary drainage system.

***Table 5.1: Assessment of Stormwater Reticulation Capacity (10% AEP Flows)***

| Node | Downstream Pipe Diameter (mm) | Land Use | | Recommendations |
|---|---|---|---|---|
| | | Existing Capacity | Developed Capacity | |
| Node 2 | 300 | Inadequate | Inadequate | Low-priority upgrade to 525mm pipe, however, no problems reported. Review in 5 yrs. (refer Project 1.0) |
| Node 4 | <300 | Marginal | Inadequate | Questionnaire response received, upgrade to 375mm pipe (refer Project 2.0). |
| Node 6 | <300 | Marginal | Inadequate | Already on Hazard database as a project (No. 623), increase priority rating and review hazard 'status' once works are completed (refer Project 3.0). |
| Node 7 | <300 | Marginal | Inadequate | Questionnaire response received, upgrade to a 375mm pipe and install splaypits (refer Project 4.0). |
| Node 8 | 450 | Inadequate | Inadequate | No problems reported as secondary flow on sports field, low-priority upgrade to 975mm pipe, review in 5 yrs (refer Project 5.0). |
| Node 9 | 450 | Inadequate | Inadequate | No problems reported as secondary flow on sports field, low-priority upgrade to 975mm pipe, review in 5 yrs (refer Project 5.0). |
| Node 11 | 450 | Inadequate | Inadequate | No problems reported as secondary flow on sports field, low-priority upgrade to 675mm pipe, review in 5 yrs (refer Project 6.0). |
| Node 14 | 300 | Inadequate | Inadequate | Problems reported downstream, upgrade to a 675mm pipe (refer Project 7.0). |
| Node 15 | 300 | Inadequate | Inadequate | Problems reported at No. 7 Church Street, upgrade to 675mm pipe (refer Project 7.0). |

**Note:** There are no invert and manhole level data available for this catchment. Existing pipe gradients are based on our assessment of the topography. Recommended works are therefore indicative of this.

The first problem occurs downstream of Node 2. Our modelling analysis suggests that the primary system at this location has inadequate capacity to pass the 10% AEP design flow. No questionnaire responses have been received in the vicinity of this location, therefore, it is recommended that the project is a low priority and is reviewed again in 5yrs (refer Project 1.0).

The next location of concern is that identified by Subcatchment 4. This is a very low-lying area that drains via a single pipe straight to Cheltenham Beach. Our modelling analysis indicates that the pipe downstream of Node 4 has inadequate capacity to pass the 10% AEP flow. There were also a number of questionnaire responses received that identified flooding occurring on Rata Road. It is recommended that splay pits are installed to increase the capacity of the catchpits and the pipe downstream of Node 4 is upgraded to a 375mm pipe (refer Project 2.0).

Subcatchment 6 is the next area of concern as the primary system downstream of Node 6 has inadequate capacity to pass the 10% AEP design flow. Residents have reported flooding of their section from front to back, occurring on a regular basis. A project already exists on the NSCC's project database (refer Project 623) which includes the installation of splaypits and a pipe upgrade. We recommend that this becomes a high priority upgrade (refer Project 3.0)

The primary system downstream of Node 7 is also under capacity as indicated through our modelling assessment. In order for the system to pass the 10% AEP design flow a 375mm diameter pipe is required (refer Project 4.0). Questionnaire results confirm that flooding occurs within the vicinity of Node 7.

Project 5.0 includes the upgrade of pipes downstream of Nodes 8 & 9. Both of the systems downstream of these nodes have inadequate capacity to pass the 10% AEP design flow. It is recommended that the present pipes are upgraded to 975mm diameter pipes.

The 450mm diameter pipe downstream of Node 11 also has inadequate capacity to pass the 10% AEP design flow. A 675mm diameter pipe is required in this location (refer Project 6.0).

Finally, the last area of concern is the existing 300mm diameter pipe running down Church Street. Our analysis suggests that the primary systems downstream of Nodes 14 and 15 have inadequate capacity to pass both the existing and developed 10% AEP design flow. It is recommended that the pipe is upgraded to a 675mm diameter pipe (refer Project 7.0).

Existing flooding conditions identified in the NSCC Hazard Mapping Report (May 1999) have been assessed in Table 5.2 and are shown on Figure 5.

**Table 5.2 Existing Flood Hazards**

| Hazard Ref. No. | Address | Site Descr. | Source | Date Reported | File Ref. | Assessment | Action |
|---|---|---|---|---|---|---|---|
| A120 | 1/28a Oxford Terrace | R | SIF | 4-Apr-95 | OXF TCE | Existing problem; Flooding overland flowpath. | Leave on hazard register |
| A706 | 7 Church Street | R | SAC | 20-Aug-97 | N/A | Existing problem; Flooding - secondary flowpath. | Addressed by Project 7.0 (review hazard status when project complete). |
| S27 | 17 Beaconsfield Street | R | SPR<br>SAC | 13-Aug-98<br>16-Jul-98 | P. 623<br>N/A | Existing project. | Addressed by Project 3.0 (review hazard status when project complete). |

R = Residential
SAC = Action Line
SIF = Information files
SPR = Projects Database File

***It is recommended that:***

- ***The pipe downstream of Node 2 is upgraded (low-priority) to a 525mm diameter pipe (refer Project 1.0).***
- ***The pipe downstream of Node 4 is upgraded to a 375mm diameter pipe (refer Project 2.0).***
- ***The pipe downstream of Node 6 is upgraded and splaypits are installed according to existing NSCC Project 623 (refer Project 3.0).***
- ***The pipe downstream of Node 7 is upgraded to a 375mm diameter pipe (refer Project 4.0).***
- ***The pipes downstream of Nodes 8 & 9 are upgraded to 975 mm diameter pipes (refer Project 5.0).***
- ***The pipe downstream of Node 11 is upgraded to a 675mm diameter pipe (refer Project 6.0).***
- ***The pipes downstream of Nodes 14 & 15 are upgraded to a 675mm pipe (refer Project 7.0).***

### 5.3.2 Future Flooding Problems

Future flooding problems can be associated with infill development if not managed correctly. Infill development reduces the amount of pervious areas, increasing the amount of runoff. This results in more frequent flooding. The following section draws attention to potential flood management issues, which have been identified within the study area during the catchment overview.

## 5.4 Flood Management Issues

### 5.4.1 Overland Flow

The issues associated with this are:

- Inappropriate management, in some cases of overland flow on individual properties.
- Limited understanding amongst residents of the operation of the drainage system and their responsibilities as regards overland flow.
- Unserviced areas (refer Figure 5.3).

One of the significant flooding problems identified from the questionnaire responses was that caused by overland flow. Overland flow is runoff travelling to the primary drainage system. Within the North Head catchment unserviced properties and large impervious areas are the main causes of overland flow problems. If the ground soakage in the area (refer Figure 5.3 for soakage potential) is not suitable for alleviating excess surface water then it becomes overland flow. The 'Unserviced Areas' maps were defined as part of the May 1999 NSCC Hazard Mapping project. An assessment of stormwater, potable and foulwater GIS files supplied by NSCC GIS section was undertaken as follows:

- Where there was sanitary sewer or water to a property, but no stormwater pipe or drain, the property was identified as unserviced.
- Properties which were higher than the road were also assumed to be serviced by the road drainage. In some cases there was inadequate data to confirm if this was the case, and those properties are identified as unserviced.
- The CMP has not looked at every case individually. There may be areas where there are adequate natural surface flowpaths, or where roofwater can be siphoned to the road. In some cases additional servicing may not be necessary.
- For future works project definition purposes budgets have been set on the basis of servicing the full area identified as unserviced. Before these budgets are committed in an annual plan, the scope of servicing will need to be more clearly defined by assessing each area on an individual basis. We have therefore provided an upper and lower limit for the cost of reticulating unserviced areas within the North Head catchment.

Perhaps a combination of trenches filled with scoria and detention tanks (above ground) on site may alleviate some of the flooding problems occurring because of overland flow. The detained water could be used for household activities such as watering the garden or washing the car. The more complete option would be to reticulate all unserviced properties within the catchment.

The Council can provide assistance by reticulating unserviced areas, educating residents about the drainage system, suggesting the use of alternative techniques such as recycling water and reminding residents of their responsibilities. They can also provide assistance to residents by mediation between property owners on private drainage issues and overland flow management, or they can assist with remediation of habitable floor flooding.

***It is recommended that:***

- ***Unserviced areas are reticulated (refer Project 8.0)***
- ***Residents are reminded of their responsibilities with concerns to overland flow.***

### 5.4.2 Secondary Flowpaths

Obstruction of secondary flowpaths or poorly defined secondary flowpaths needs to be addressed. Inspection of the catchment observed many obstructions to the secondary flowpath. Other secondary flowpath issues appear to have arisen due to localised problems e.g. blocked catchpits. These are comparatively minor but should be identified as general maintenance requirements of the reticulation system.

***The recently introduced practice of addressing site stormwater issues as part of the Building consent process should be encouraged. Further to this, a recommendation of this study is that this practice becomes policy.***

### 5.4.3 Secondary Flow on Roads

Where possible, it is beneficial to use roads as secondary flowpaths. This results in flooding of the road, in many instances preventing traffic use during these periods of flooding. Major roads should only be allowed such flooding in the less frequent events (i.e. flooding in excess of 10% AEP).

Where the low point of the road coincides with a reserve area or a coastal area, it would be preferable to lower the footpath and the grass verge on the downstream side of the road. This would allow stormwater to flow off the road through a well-formed drainage path, with consideration given to erosion issues. This would reduce flooding on the road, allowing traffic to be relatively uninterrupted.

***It is recommended that, where appropriate, roads are used as secondary flowpaths (for the less frequent flood events), and that contouring of the roadside at low points in the road be such that floodwaters flow quickly off the road to a suitable drainage system, rather than ponding and causing inconvenience to traffic.***

### 5.4.4 Construction of Houses on Steep Land

On steeper sites within a catchment it is common for houses to be constructed with basements which are recessed into the steeper side of the site. Many stormwater problems identified in catchments with long-term residential use are due to seepage of the stormwater through basement walls when the ground is saturated. In addition to this seepage, problems are sometimes caused through surface flow entering windows, which open at the outside ground level and / or doors on the uphill side of the house. While careful sealing of the basement walls during construction can serve to alleviate these future problems, thought given to the contouring of the site can ensure that stormwater is directed away from the basement. This is usually a site management problem.

Some coastal properties within the North Head catchment are relatively steep. It is likely that many of the houses on such properties will be constructed with basements or main house levels recessed into the site.

***It is recommended that North Shore City Council adopt as policy the requirement for individuals to address site stormwater issues, including directing overland and secondary flows away from buildings, as part of the building consent application process.***

### *5.4.5 Driveways Leading to Houses Set Below the Road*

It is common practice with new houses to have garages attached to the main dwelling and frequently used rooms for habitable purposes are adjacent to the garage space. There are sites in the North Head catchment where houses have concrete driveways up to the garage door and to the front door of the house. The large areas of concrete paving collect surprising quantities of stormwater even in relatively small storm events.

Where these houses are set below road level and the driveway slopes downhill towards the garage, the driveway acts as a secondary flowpath, collecting stormwater and directing it towards the house. It is usual in these cases to have a cut-off drain along the front of the garage door. However, these are designed for low flow events only, and when the capacity is fully utilised, the overflow is still able to flow into the house. Again, thought should be given to the direction of the secondary flows away from the house, and habitable floors adjacent to the garage set at least 200 mm above ground level.

***It is recommended that North Shore City Council adopt as policy the requirement for individuals to address site stormwater issues (including direction of large flows away from garage entrances) as part of the building consent application process.***

# 6 Stormwater Quality

## 6.1 Introduction

With the introduction of the RMA, Councils have been required to develop techniques and management strategies, to enable sustainable management of the environment and to avoid, remedy and mitigate adverse environmental effects.

The ARC recognises that urban stormwater is a significant carrier of pollutants. ARC Guidelines have been produced that require new developments to treat stormwater to 75% removal of sediment. Existing development is required to achieve this efficiency wherever practicable. This, however, can be expensive and land intensive. Taking this into consideration, ARC requires that best practicable options be used.

The objective of this section is to identify stormwater quality issues within the North Head catchment and to identify options for dealing with these issues. Solutions have been identified to achieve both general and specific stormwater improvements.

To achieve improvements in stormwater quality, a combined approach of education, planning, and physical solutions needs to be implemented.

## 6.2 Stormwater Quality Issues

### 6.2.1 Background

For determining stormwater quality, a key focus is placed upon the receiving environments and the land use (both existing and likely future development) in the catchment. A detailed description of the catchment is included in Section 3, which describes the location, the geology and soils and the current and future land use within the catchment.

Assessment of stormwater quality issues is required when considering the type of treatment that could be required. ARC Technical Publication 10 (TP10) details the methodology for determining and sizing stormwater quality treatment devices. Inputs include the degree of imperviousness of the catchment and consideration of the type of contaminants to be removed.

The receiving environment for the North Head catchment is the east coast between Narrow Neck Beach and Devonport Beach. This stretch of coast includes North Head, and Cheltenham Beach, which are both used as recreation areas by the public. The ultimate receiving environment of the stormwater that drains from the North Head catchment is the Rangitoto Channel and the greater Hauraki Gulf.

The Stormwater Liaison Group has prioritised the North Head catchment based on the receiving environment, areas of new development and public use. A summary of the principles underlying their assessment is included in Appendix D. Based on their study, ARC have assigned the priority levels of C and D (on a scale of A being highest and D the lowest) to the catchment. However, the NSCC have assigned the priority levels of A and D to the North Head catchment reflecting local

concerns. Both sets of priority ratings are presented in the North Shore City Stormwater Strategy report.

The land use in a catchment determines the amount of runoff that is produced and the range of typical contaminants generated within a catchment. Typical contaminants that could arise are summarised in Table 6.1.

***Table 6.1: Typical Contaminants Resulting from Specific Land Use***

| ***Contaminant:*** | ***Land Use:*** | | | |
|---|---|---|---|---|
| | ***Residential*** | ***Commercial*** | ***Special Purpose*** | ***Roads*** |
| Sediment | * | * | * | * |
| Litter | * | ** | * | * |
| Food wastes | ** | * | * | - |
| Garden wastes | ** | - | * | - |
| Nutrients | ** | * | * | - |
| Detergents | * | * | * | - |
| Trace organics (e.g. solvents, herbicides, Pesticides) | * | * | * | - |
| Hydrocarbons (e.g.: oils) | * | ** | - | * |
| Fats, grease | * | * | - | - |
| Heavy metals | - | ** | - | ** |

- None

* Minor

** Significant

Contaminants specific to this catchment are sediment, litter, hydrocarbons, detergents and nutrients.

Sources of sediment are likely to be earthworks (this includes road works) occurring within the catchment. Construction sites often have open stockpiles of soil and little or no erosion and sediment control structures. This leads to sedimentation of the receiving environment.

The North Head catchment contains very small commercial areas and a number of public beaches. Litter does not appear to be a major problem within the North Head catchment. This is supported by the questionnaire response in which none of the residents commented about litter. However, it can accumulate at the catchpits and outlets, destroying the aesthetic quality of the eastern beaches.

Some hydrocarbons and heavy metals will be mixed with the stormwater from overland flow over roads, parking areas and particularly the runoff from the forecourt at the petrol station situated along Vauxhall Road. Therefore hydrocarbons are more than likely a contaminant that affect the receiving environment.

Detergent and nutrient sources are associated with residential activities, which include washing cars, fertilising gardens and composting garden and kitchen wastes. These contaminants enter the stormwater system via runoff from residential properties within the catchment.

In summary, stormwater quality issues derived from the questionnaire response and the catchment inspection are:

- Sediment deposition
- Hydrocarbons and heavy metal contamination of the local beach environment
- Detergents and nutrients derived from residential activities
- Foulwater overflows contaminating the beaches.

## 6.3 Stormwater Quality Options

There are four general options available to Council with respect to stormwater quality within the North Head catchment:

- Do nothing.
- Source Control.
- Stormwater Quality Management Techniques.
- Catchment-wide treatment devices.

### *6.3.1 Do Nothing*

To do nothing would be to accept the consequences of a continued deterioration of the North Head receiving environment. This is inconsistent with ARC Policy Statement and District Plan. It is unlikely to be a favourable solution for the residents given the currently high profile of water quality related issues.

### *6.3.2 Source Control*

This is applicable for both existing and future development or subdivision. Council should particularly recommend and encourage the establishment of source control in all new developments through:

- On-site stormwater treatment systems
- Controls on the type of development allowed
- Reduction in the amount of silt bearing and impervious / paved areas
- Retention of open watercourses.

### *6.3.3 Stormwater Quality Management Techniques:*

Methods for improving stormwater quality through the use of management techniques are listed below. Appendix E provides a more detailed summary of options available.

- Public education on stormwater quality
- Conditions placed on resource / building consent approval.
- Regular cleaning of roads, catchpits and manholes

- Foulwater audits
- Enforcement of policies.

### *6.3.4 Catchment-wide Treatment Devices:*

Ultimately, the preferred option in stormwater management is the implementation of source controls and stormwater quality management techniques. Treatment devices do, however, have an important role in improving stormwater quality. This is achieved by decreasing the reliance upon individuals to implement site specific controls or stormwater quality management techniques.

Some catchment-wide treatment mechanisms are:

- Pond systems
- Vegetated systems (for example, swales, riparian zones)
- Filtration Systems
- Oil Separators.

### *6.3.5 Experimental Techniques*

There is a large body of literature held by the ARC and contained within the conference proceedings of the 'Comprehensive Stormwater and Aquatic Ecosystems Management' conference (Auckland, February 1999) outlining alternative methods of stormwater management. These include;

- Bypassing peak flows past sensitive receiving environments,
- Low-impact subdivision design aimed at minimising impervious areas and maximising source control of pollutants and,
- Collection and recycling of roof water.

Low-impact design could be applied to some of the existing roads and any new development within the North Head catchment, alongside collection and reuse of roof water for purposes such as gardening and washing cars.

## 6.4 Recommended Stormwater Quality Improvements

### *6.4.1 Source Control*

On-site stormwater treatment places the responsibility of stormwater management on the developer and has the advantage of treating any potential problem before it enters the rest of the catchment.

On-site stormwater treatment systems would be of most benefit targeting specific areas such as the Petrol Station on the corner of Vauxhall and Tainui Roads. A filtration device at this location would collect the runoff from the forecourt area and partially treat it, decreasing the amount of

hydrocarbons transported to the receiving environment (refer Figure 6.1 for an illustration of the concept).

Planning controls that require a reduction in the amount of impervious and silt-bearing areas will decrease the amount of runoff and sediment entering the catchment. Future controls on the types of development allowed in the catchment will impact most directly on the type and amounts of contaminants to enter stormwater as well as the amount of runoff produced.

***It is recommended that:***

- ***A filtration device is put in place to collect runoff from the forecourt area of the Petrol Station on Vauxhall Road (refer Project 9.0).***

### *6.4.2 Stormwater Quality Management Techniques*

In reflection of catchment land use, these techniques would generally be implemented by NSCC. They would be applicable mainly for future development, but some of the techniques, such as education of the public and road sweeping, could commence immediately. Council maintenance, such as road cleaning, can immediately reduce the amount of litter and some of the sediments that enter the stormwater system.

Public education on stormwater quality would be valuable in light of the amount of coverage water quality issues are getting in the media at present. Improvement of stormwater quality could occur through better 'housekeeping' practices by individuals. This should include keeping compost heaps out of the way of floodplains and overland flowpaths, and to avoid tipping contaminants such as paint down the stormwater system. Education of residents with respect to the role they play in stormwater quality brings about a greater awareness of their role in maintaining and improving the quality of the catchment stormwater system. The ARC should undertake any public education, but NSCC involvement would be appropriate.

Introducing additional conditions on building consents would enable a tighter control on the impact of development on the catchment. As mentioned in Section 5, it is now practice for developers to fill out site stormwater management plans as part of building consent applications. This should include plans for the prevention of soil loss for the site. For example, stockpiles of topsoil or areas of land where topsoil is exposed for a long time could be covered in hay to prevent transportation into the stormwater system. If these sorts of controls are combined with enforcement of Council policies, extra conditions could result in decreasing short-term effects of sediment deposition, and in the amount of stormwater mitigation required.

Additional conditions could also be introduced on consents for road works, such as the placement of temporary catchpit filters to prevent sediment being transported to the receiving environment during road works.

***It is recommended that:***

- ***Residents within the North Head catchment are educated as to how they can prevent contaminants from their properties entering the stormwater system***
- ***It becomes Council policy to address erosion control as part of the building consent application process.***

- ***It becomes Council policy to address sediment control as part of the consent application for road works.***

### *6.4.3 Catchment-wide Treatment Devices*

Pond-type devices are often the first to be considered. Treatment of the stormwater is by settling of the sediments in the pond. Ponds are often land intensive and require maintenance to remove deposited sediment, however they can provide a potential wildlife habitat. There are limited opportunities within the catchment to site a pond, as the catchment is small and relatively well developed.

Vegetated systems include swales and riparian zones. Swales are essentially grassed trenches that require considerable care and thought in the initial planning / design stages. Maintenance of swales generally involves mowing or harvesting of the vegetation to ensure that growth is controlled and does not intrude into other areas. Dead plant matter needs to be either removed to reduce the potential for it to enter the stormwater system and the potential for odour. Deposited sediment also needs to be removed so as to not restrict plant growth or reduce efficiency. Swales could be implemented along some of the streets that run towards the coast. This would provide some treatment and attenuation of the stormwater before it enters the coastal environment. However this would require further investigation as to the suitability of particular streets within the catchment.

Filtration systems are more complex and require more frequent and expensive maintenance than a vegetated system or a pond-type device. They also require a reasonable amount of land. Treatment is through filtration of stormwater and removal of pollutants greater than a specified size. They would be of use for removal of litter and the sediment in the existing stormwater, but do not provide any stormwater retention. Maintenance involves regular removal of sediments from within the filter.

Oil separation is probably not suitable for treatment of the majority of the contaminants in the stormwater at present. These devices would be more appropriate for use at specific sites where oils, grease and fats are the primary contaminant of concern. They are not to be used for removal of sediments or litter and would need to be used with another device to achieve the level of treatment required. Oil separators do not provide any flood water retention and should be installed off-line so flood flows are bypassed. Possible areas for installation of these devices could be at specific locations as a means of source control.

The concerns of residents regarding foulwater overflows both within as well as outside the catchment, appears to dominate the issue of stormwater quality. As this issue is not included in the scope of this study, it has not been addressed in depth. However, it is recommended that NSCC investigate the incidence of foulwater overflows into the North Head stormwater system. Removal of overflows will involve liaison with Water Services, and / or temporary treatment of target areas (e.g. using screens) to improve stormwater quality.

It is recommended that:

- ***Provision is made for screens at known regular overflow points (Project Care).***

# 7 Erosion Control

## 7.1 Streambank and Coastal Erosion

Erosion and scouring of streambanks and coastal areas is a particularly sensitive issue. The naturally occurring process of erosion is accelerated by human activities such as clearance of vegetation and land development. Foreshore retreat due to wave and wind action is also a natural process of erosion. It usually reflects the natural variation in existing formations and protection from wave actions in specific areas, due to offshore rock shelf platforms. For the North Head catchment, coastal erosion is the predominant concern as there are no reaches of open channel.

## 7.2 Coastal Stability

Coastal stability is a complex issue and requires an in-depth understanding of the geological setting, historical coastal changes, the wave climate, the beach type and sediment transport regime. In the context of this CMP, it only addresses local erosion. Stormwater discharges on beaches can contribute to a wider range of erosion issues (e.g. beach retreat), but this is not addressed in this report. This applies to both beach and cliff stability.

Properties with existing coastal erosion conditions identified in the North Shore City Council Hazard Mapping Report (May 1999) are given in Table 7.1. The extent of the erosion at the site has been assessed in the table below.

***Table 7.1 Existing Instability Hazards***

| *Hazard Ref. No.* | *Address* | *Site Descr.* | *Source* | *Date Reported* | *File Ref* | *Assessment* | *Action* |
|---|---|---|---|---|---|---|---|
| B119 | 12 Rata Road | R | SAC | 3-Mar-96 | N / A | Coastal erosion at culvert outlet. | Leave on hazard register. |

R = Residential
SAC = Action Line

The foreshore area of the North Head catchment has approximately 38 stormwater outlets. Wave action and tidal forces around outfalls contributes to localised accelerated erosion and undermining. Increased development generally results in greater peak flows and velocities at stormwater outlets and associated scouring and sediment deposition. During a site visit a number of outfalls were inspected. A number of pipes have eroded at the outlets and require maintenance to prevent cliff erosion and scour at point of discharge. Extending the pipes down the cliff to high water mark could reduce erosion at these outlets or placing energy dissipation structures where necessary.

***It is recommended that:***

- ***Council conducts a survey of all coastal outfalls to assess the level of erosion and to decide on the appropriate management of each site (refer Table 8.1).***

# 8 Catchment Management Strategy

## 8.1 Recommended Works

Figure 8.1 identifies specific areas requiring water quality, flood and erosion alleviation works. The projects described below in Table 8.1 have been assigned indicative rankings as shown in Appendix F (refer project sheets). It must be noted that project numbers are not related to rankings. An assessment of the impact of the works on the environment is included in Table 8.2.

***Table 8.1 Recommended Works***

| ***Project No.*** | ***Works Description*** | ***Rough Order Cost*** |
|---|---|---|
| 1.0 | The 300mm pipe downstream of Node 2 is upgraded to a 525mm pipe for a length of 120m. | $36,000 |
| 2.0 | The pipe downstream of Node 4 is upgraded to a 375mm pipe for a length of 80m. | $17,000 |
| 3.0 | The pipe downstream of Node 6 is an existing project which needs to be prioritised and review Hazard 'status' once completed | |
| 4.0 | The pipe downstream of Node 7 is upgraded to a 375mm pipe for a length of 120m and splaypits are installed | $36,000 |
| 5.0 | The 450mm pipe downstream of Nodes 8 & 9 is upgraded to a 975mm pipe for a length of 450m. | $260,000 |
| 6.0 | The 450mm pipe downstream of Node 11 is upgraded to a 675mm pipe for a length of 130m. | $50,000 |
| 7.0 | The 300mm pipe downstream of Nodes 14 and 15 is upgraded to a675mm pipe for a length of 280m. | $110,000 |
| 8.0 | Unserviced properties are reticulated:<br>a) Subcatchment 6 (Beaconsfield Street and Vauxhall Road).<br>b) Cheltenham Road.<br>c) Remaining unserviced properties within the catchment. | <br>$110,000<br>$210,000<br>$3,000,000 |
| 9.0 | Implementation of a filtration device at the petrol station | (Not estimated-private issue) |

| ***Table 8.1 Recommended Works*** | | |
|---|---|---|
| ***Project No.*** | ***Works Description*** | ***Rough Order Cost*** |
| | ***Investigations and Maintenance*** | |
| - | It is recommended that Council investigate the option of shortening beach outfalls back to the headwall. | - |
| - | Soak holes in reserve bordering Church Road are maintained on a regular basis. | - |
| - | Council conducts a survey of all coastal outfalls to assess the level of erosion and to decide on the appropriate management of each site. | - |

| ***Table 8.2 Environmental Impact Assessment of Works*** | | | | | |
|---|---|---|---|---|---|
| ***Project No.*** | ***Assessment of Effects*** | | | | |
| | ***Impact on Community*** | ***Effect on Development Layout*** | ***Effects During Construction*** | ***Effects on d/s Receiving Enviroment*** | ***Comments*** |
| 1.0 | Limited as devices underground | Limited as highly modified environment already. | Some dust, noise and traffic issues, but of short duration. | No change | Same land use |
| Mitigation Measures | Council to specify construction requirements / controls in Contract Conditions. Contractors to carry out work during low flow periods to minimise sediment transport. | | | | |
| 2.0 | Limited as devices underground | Limited as highly modified environment already. | Some dust, noise and traffic issues, but of short duration. | No change | Same land use |
| Mitigation Measures | Council to specify construction requirements / controls in Contract Conditions. Contractors to carry out work during low flow periods to minimise sediment transport. | | | | |
| 3.0 | Limited as devices underground | Limited as highly modified environment already. | Some dust, noise and traffic issues, but of short duration. | No change | Same land use |
| Mitigation Measures | Council to specify construction requirements / controls in Contract Conditions. Contractors to carry out work during low flow periods to minimise sediment transport. | | | | |
| 4.0 | Limited as devices underground | Limited as highly modified environment already. | Some dust, noise and traffic issues, but of short duration. | No change | Same land use |
| Mitigation Measures | Council to specify construction requirements / controls in Contract Conditions. Contractors to carry out work during low flow periods to minimise sediment transport. | | | | |
| 5.0 | Limited as devices underground | Limited as highly modified environment already. | Some dust, noise and traffic issues, but of short duration. | No change | Same land use |
| Mitigation Measures | Council to specify construction requirements / controls in Contract Conditions. Contractors to carry out work during low flow periods to minimise sediment transport. | | | | |
| 6.0 | Limited as devices underground | Limited as highly modified environment already. | Some dust, noise and traffic issues, but of short duration. | No change | Same land use |
| Mitigation Measures | Council to specify construction requirements / controls in Contract Conditions. Contractors to carry out work during low flow periods to minimise sediment transport. | | | | |

| ***Table 8.2 Environmental Impact Assessment of Works*** | | | | | |
|---|---|---|---|---|---|
| ***Project No.*** | ***Assessment of Effects*** | | | | |
| | ***Impact on Community*** | ***Effect on Development Layout*** | ***Effects During Construction*** | ***Effects on d/s Receiving Enviroment*** | ***Comments*** |
| 7.0 | Limited as devices underground | Limited as highly modified environment already. | Some dust, noise and traffic issues, but of short duration. | No change | Same land use |
| Mitigation Measures | Council to specify construction requirements / controls in Contract Conditions. Contractors to carry out work during low flow periods to minimise sediment transport. | | | | |
| 8.0 | Limited as devices underground | Limited as highly modified environment already. | Some dust, noise and traffic issues. | No change. | Signage to inform public about the works. |
| Mitigation Measures | Council to specify construction requirements / controls in Contract Conditions. Contractors to carry out work during low flow periods to minimise sediment transport. | | | | |
| 9.0 | Limited as devices underground | Limited as highly modified environment already. | Some dust, noise and traffic issues. | Positive benefits for local catchment and harbour water quality. | Ongoing maintenance issue. |
| Mitigation Measures | Council to specify construction requirements / controls in Contract Conditions. Contractors to carry out work during low flow periods to minimise sediment transport. | | | | |

## 8.2 Strategies

### 8.2.1 Public Education

In conjunction with ARC, NSCC should engage in a programme of public education. The programme should be designed to

- Encourage public participation.
- Develop public awareness of stormwater related issues.

### 8.2.2 Health and Safety

NSCC to adopt health and safety issues as discussed in Section 2.8.

### 8.2.3 Flood Control

The following policies should be applied to all development within the catchment:

- Habitable floor levels should be a minimum of 500mm above the 1% AEP flood level, or above any secondary flowpath.
- No habitable buildings should be permitted within the 1% AEP floodplain.
- No building, structure or dense planting which will impede flood flows should be permitted in the floodplain or secondary flowpath areas.
- Source controls (including reduced impervious areas and / or detention) should be implemented to mitigate downstream flooding.

### 8.2.4 Stormwater Quality

The following policies should be applied to all development within the catchment:

- Site usage involving risk of contaminants (e.g. hydrocarbons or hazardous substances) should have on-site treatment of runoff.
- High-use roads and carpark areas should use on-site treatment devices such as swales, sand filters, catchpit filters, or equivalent to reduce discharge of sediment (and attached contaminants) and litter.
- New developments should mitigate the effects of site erosion and sedimentation and typical site contaminants through use of source controls and low-impact design techniques.

### 8.2.5 Erosion Control

The following strategies can assist in minimising catchment erosion:

- Source controls for new developments (including reduced impervious areas and / or detention) should be implemented to mitigate downstream erosion.

- Provide rock and concrete outfall structures for energy dissipation to pipe outlets.
- Provide appropriate planting and (in severe cases) flume lining or piping on steep open drains in soil prone to scouring.
- Require the retention of bush on steep slopes where possible.
- All earthworks and construction within the catchment must be carried out in accordance with ARC TP90.

### *8.2.6 Maintenance Considerations*

The following items require special maintenance consideration:

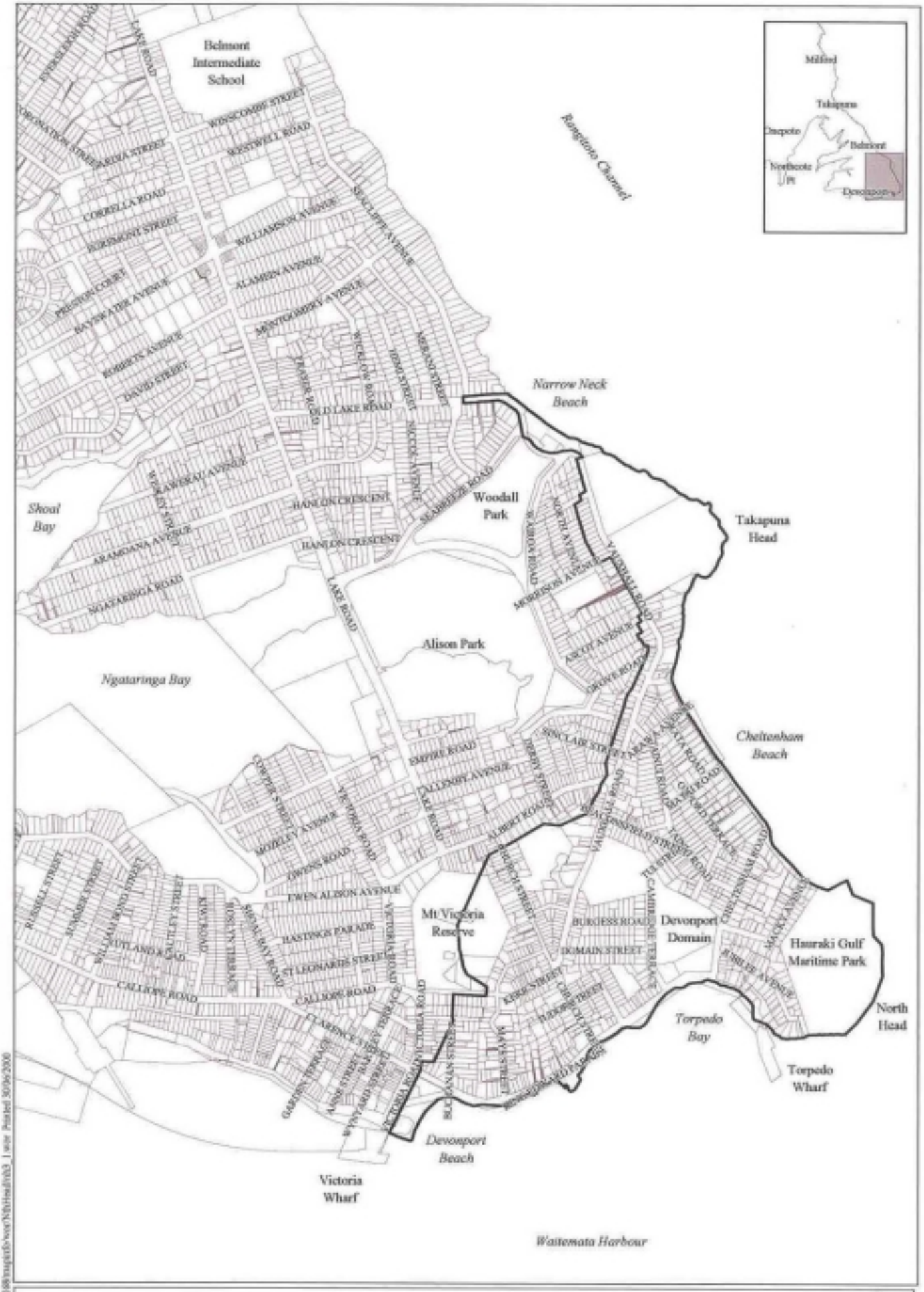
- As development progresses, the primary flowpath, whether a stormwater pipe or natural channel, must be maintained to prevent flooding of nearby properties. Grilles over stormwater inlets and culverts must be cleaned to prevent blockages and the risk of flooding. Major culverts should be checked for blockages every 1-3 months or following significant storm events as required.
- Bank slumping or excessive vegetation growth should be checked at least twice a year. Any such problems should be remedied as soon as possible.

### *8.2.7 Habitat Enhancement*

In the management of stormwater, NSCC should endeavour where possible to enhance existing stream habitats including:

- Provision for fish passage.
- A programme of riparian planting.
- The preservation and where practicable restoration of natural streams.

# Figures




Scale: 1: 15,000 at A4

0m 200m 400m

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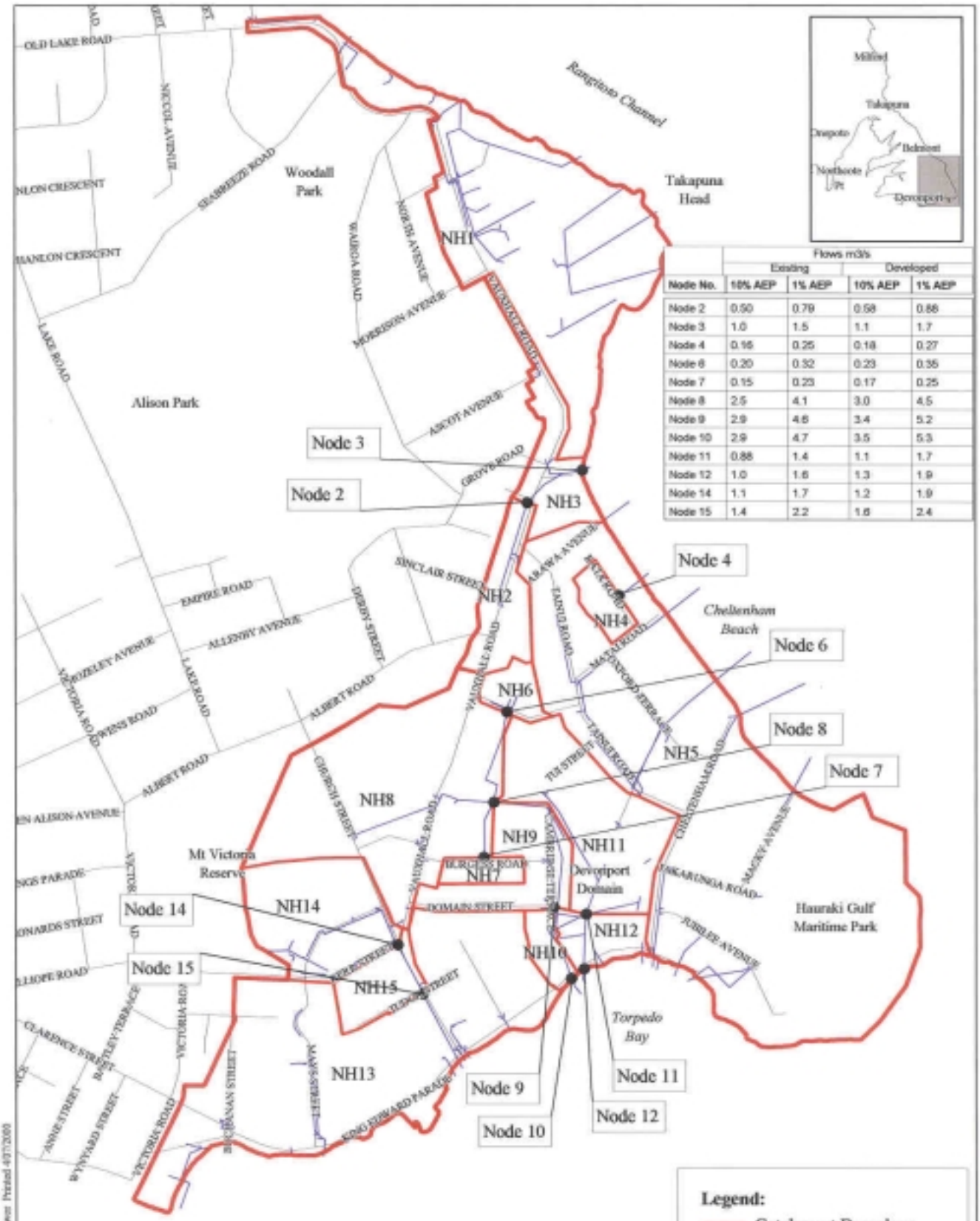
**North Head**
**Catchment Management Plan**

**Figure 3.1**
**Catchment Location**


Rangitoto Channel
Woodall Park
Takapuna Head
Alison Park
Mt Victoria Reserve
Devonport Domain
Hauraki Gulf Maritime Park
Torpedo Bay
Devonport Beach
Victoria Wharf
OLD LAKE ROAD
NICOLL AVENUE
HANLON CRESCENT
SEABREEZE ROAD
LAKE ROAD
MORRISON AVENUE
ASCOT AVENUE
GROVE ROAD
VAUXHALL ROAD
EMPIRE ROAD
ALLENDY AVENUE
MOZELEY AVENUE
VICTORIA ROAD
OWENS ROAD
ALBERT ROAD
ALISON AVENUE
HASTINGS PARADE
LEONARDS STREET
CALLIOPE ROAD
CLARENDON STREET
WYNYARD STREET
ANNE STREET
SINCLAIR STREET
MOANA AVENUE
ROTA ROAD
TAINUI ROAD
MATAI ROAD
OXFORD TERRACE
TAMAKI ROAD
CHURCHILL ROAD
BURGESS ROAD
DOMAIN STREET
CUMBERLAND ROAD
CHELTENHAM ROAD
TAKARUNGA ROAD
MACKAY AVENUE
RUBICON AVENUE
KYLE STREET
TUDOR STREET
MAIN STREET
BUCHANAN STREET
KITCHENER PARADE
Legend
Business
Recreation
Residential
Scale 1:10,000 at A4
0 125 250
Metres
BECA
2508168/10
North Head
Catchment Management Plan
Figure 3.2
Land Use Zoning




| | Flows m3/s | | | |
|---|---|---|---|---|
| | Existing | | Developed | |
| Node No. | 10% AEP | 1% AEP | 10% AEP | 1% AEP |
| Node 2 | 0.50 | 0.79 | 0.58 | 0.88 |
| Node 3 | 1.0 | 1.5 | 1.1 | 1.7 |
| Node 4 | 0.16 | 0.25 | 0.18 | 0.27 |
| Node 6 | 0.20 | 0.32 | 0.23 | 0.35 |
| Node 7 | 0.15 | 0.23 | 0.17 | 0.25 |
| Node 8 | 2.5 | 4.1 | 3.0 | 4.5 |
| Node 9 | 2.9 | 4.6 | 3.4 | 5.2 |
| Node 10 | 2.9 | 4.7 | 3.5 | 5.3 |
| Node 11 | 0.88 | 1.4 | 1.1 | 1.7 |
| Node 12 | 1.0 | 1.6 | 1.3 | 1.9 |
| Node 14 | 1.1 | 1.7 | 1.2 | 1.9 |
| Node 15 | 1.4 | 2.2 | 1.6 | 2.4 |

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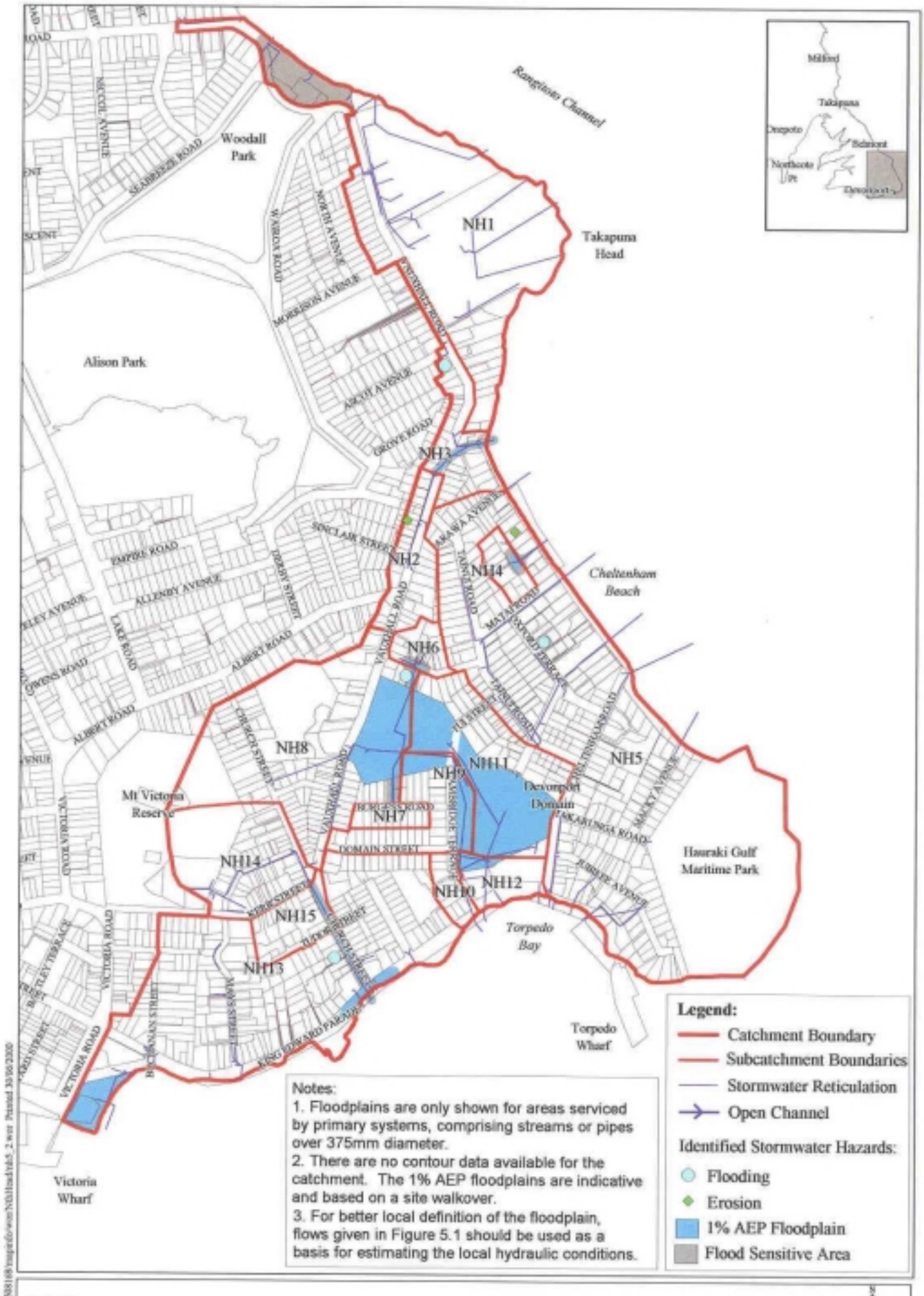
Scale 1:10,000 at A4
0 125 250
Metres

**North Head**
**Catchment Management Plan**

**Figure 5.1**
**Stormwater Drainage System**

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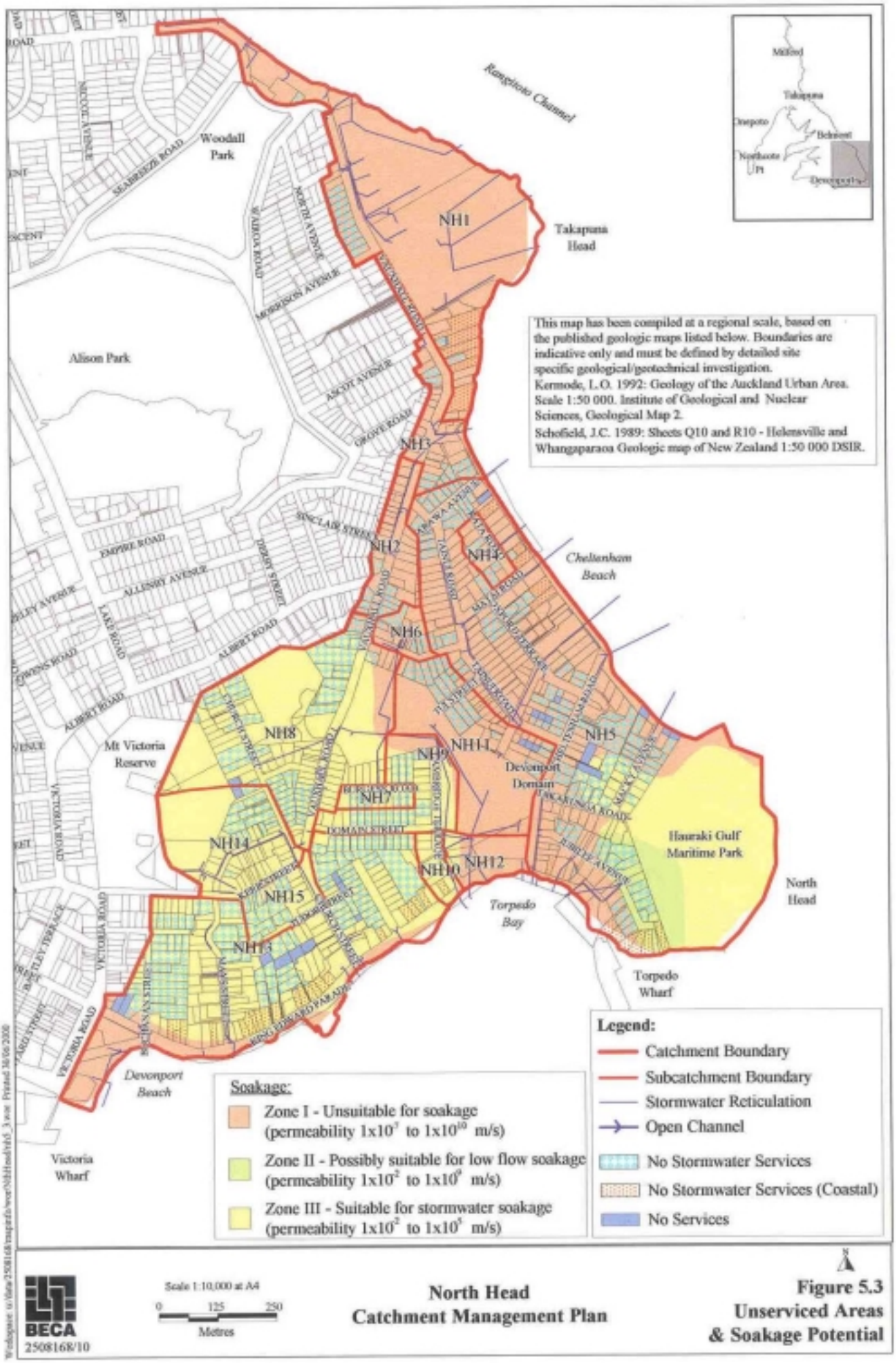
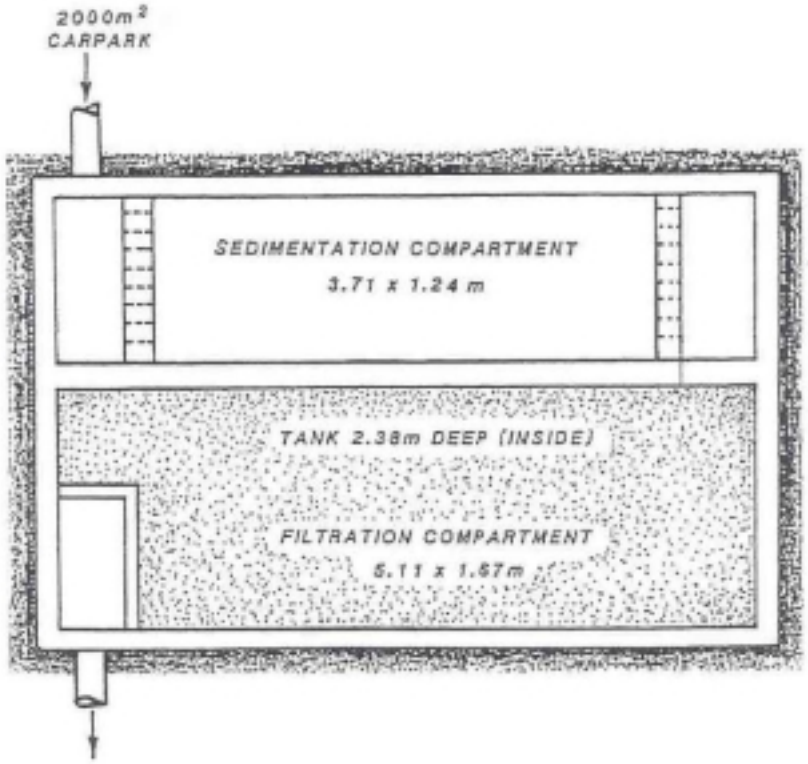
Metres

**North Head**
**Catchment Management Plan**

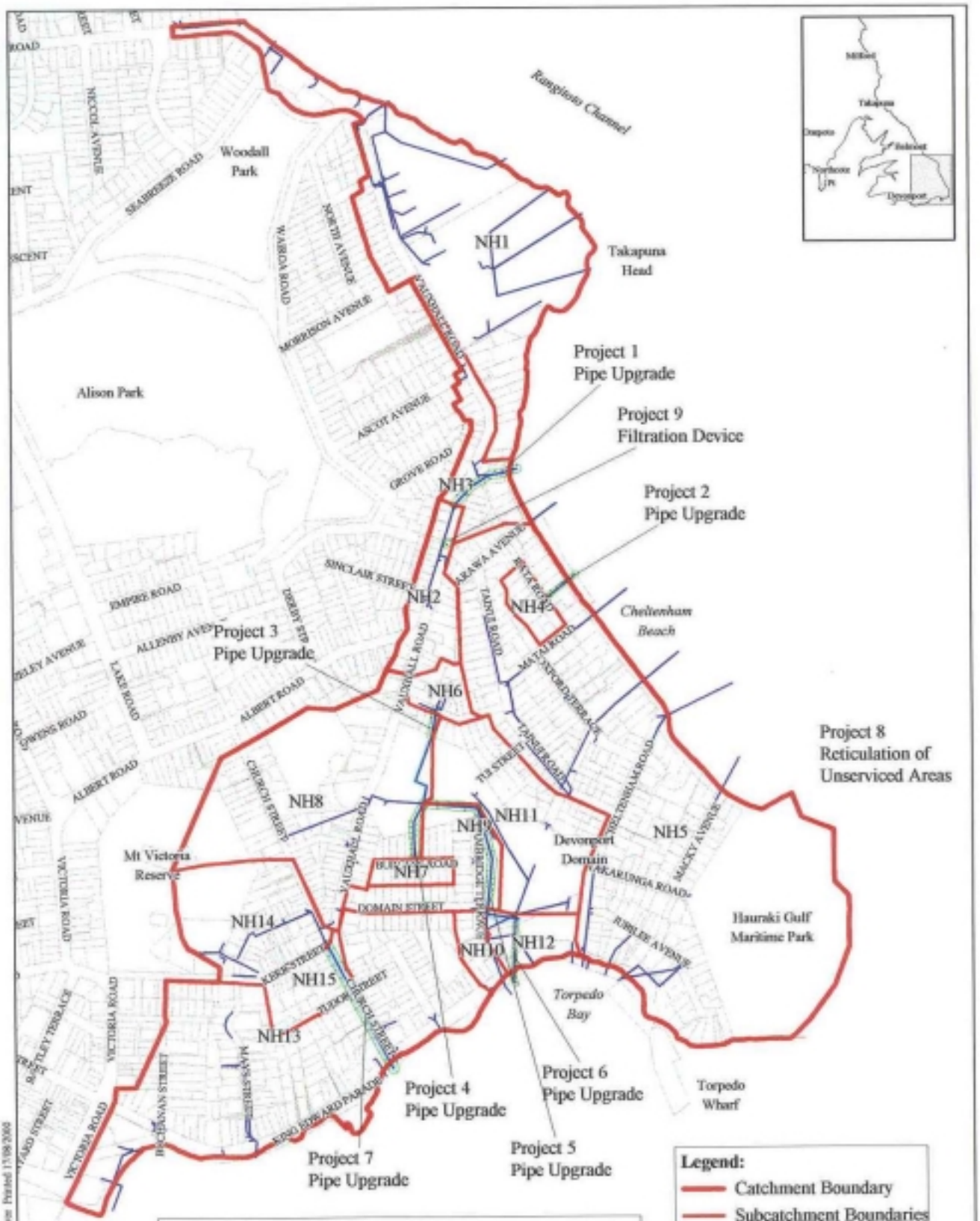
**Figure 5.2**
**Indicative 1% AEP Floodplain & Indentified Hazards**


Rangitoto Channel
Woodall Park
Takapuna Head
Alison Park
Cheltenham Beach
Mt Victoria Reserve
Devonport Domain
Hauraki Gulf Maritime Park
North Head
Torpedo Bay
Torpedo Wharf
Devonport Beach
Victoria Wharf
NH1
NH2
NH3
NH4
NH5
NH6
NH7
NH8
NH9
NH10
NH11
NH12
NH13
NH14
NH15
This map has been compiled at a regional scale, based on the published geologic maps listed below. Boundaries are indicative only and must be defined by detailed site specific geological/geotechnical investigation.
Kermode, L.O. 1992: Geology of the Auckland Urban Area. Scale 1:50 000. Institute of Geological and Nuclear Sciences, Geological Map 2.
Schofield, J.C. 1989: Sheets Q10 and R10 - Helensville and Whangaparaoa Geologic map of New Zealand 1:50 000 DSIR.
Soakage:
Zone I - Unsuitable for soakage (permeability 1x10⁻⁷ to 1x10⁻¹⁰ m/s)
Zone II - Possibly suitable for low flow soakage (permeability 1x10⁻² to 1x10⁻⁹ m/s)
Zone III - Suitable for stormwater soakage (permeability 1x10⁻² to 1x10⁻⁵ m/s)
Legend:
Catchment Boundary
Subcatchment Boundary
Stormwater Reticulation
Open Channel
No Stormwater Services
No Stormwater Services (Coastal)
No Services
Scale 1:10,000 at A4
0 125 250
Metres
BECA
2508168/10
North Head
Catchment Management Plan
Figure 5.3
Unserviced Areas
& Soakage Potential




BECA STEVEN

Figure 6.1 Concept Plan of a Filtration Device

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Scale 1:10,000 at A4
0 125 250
Metres

**North Head**
**Catchment Management Plan**

**Figure 8.1**
**Secondary Flowpaths**
**& Recommended Works**

# Appendix A

## NSCC Policy Regarding Open Water Courses and Piped Drains

# *NORTH SHORE CITY COUNCIL*

***Open Watercourses Policy***

**(Adopted 28 June 1998)**

1. (a) That the maintenance of private stormwater discharges to a beach, cliff or reserve is the responsibility of the owner of the drain.

1. (b) That the maintenance of the public stormwater discharges to a beach, cliff or reserve is the responsibility of the Council.

1. (c) That the stormwater services manager prepare suitable criteria for the consideration of Council to be incorporated into maintenance standards for these discharges.

2. That responsibility for the maintenance of open drains and natural watercourses be:

Private Responsibility

- Clearance of obstructions under the property owner's control.
- Problems contributed towards by the property owner's activities within the 1 in 10 AEP flow path.
- Problems caused by the property owner's method of maintenance of the drain.
- Minor erosion of the drain floor and banks.

Public Responsibility

- Maintenance of lined drains where the lining was approved or constructed by the Council.
- Serious erosion due to upstream development approved or carried out by the Council that can be mitigated by maintenance works.

## NORTH SHORE CITY COUNCIL

### *Piped Drains Policy*

### (Adopted May 1998)

1. That Council only maintain drains which serve more than one freehold lot.

2. That Council maintain any other drain which can be demonstrated to have been under the control of the Council for a period of not less than twenty years, or which has been declared as a public drain.

3. That any other drain remains the responsibility of the owner/s of the lot which it serves, through to the point of its connection on the public drain or through to the boundary of the legal road reserve, whichever is encountered first.

4. That the following guidelines be used to assist in interpreting the policy as outlined in recommendations 1, 2 and 3:

    - Owners are responsible for all maintenance of the drain serving a freehold lot, through to its connection point on the public sewer or through to the boundary of the legal road, whichever is encountered first. Usually 100 mm diameter for wastewater and 100 mm or 150 mm diameter for stormwater.

    - Any drain which serves more than one freehold lot will be taken over by the Council and maintained as a public drain. This parallels the policy relating to common private drains.

    - A drain serving more than one dwelling on a single lot is regarded as a private drain through to the road reserve. A single lot is taken to not only include the traditional freehold lot but also the situation where two or more dwellings are on a cross-lease or unit titles type subdivision. The parent lot for this purpose is taken to be one lot even though it may contain more than one flat or unit, provided that they are served by a common drain (usually 100 mm diameter for wastewater and 100 mm or 150 mm diameter for stormwater).

    - In some parts of the reticulation (which tend to be on more recent subdivisions), a 150 mm diameter pipe has been provided up to and near to the boundary. Because such pipes have been constructed to a public drain standard, they are considered to be public drains and are maintained by Council.

# Appendix B

## Questionnaire Responses and Other Consultation

1. **Please state your street address.**

a) _____ Street Number _____ Street Name (please write the address to which this questionnaire was delivered, not a post office box nor your home address if it is different from above)

b) _____ Name (optional) _____ Contact phone number (optional)

c) How long have you lived / worked at this address?

please specify number of years _____

2. **Stormwater flooding on section.**

a) Have you experienced any stormwater flooding on this section due to a major rainfall event, during the last 10 years?

☐ Yes, if so please specify month and year _____ ☐ No (please go to 4.) ☐ Don't know (go to 4.)

b) Please indicate where you believe stormwater overflowed from:

☐ a manhole ☐ a roadway ☐ a creek or stream ☐ a neighbouring property ☐ don't know

c) What part of your property has flooded over the last 10 years?

☐ living area ☐ garage ☐ other, please specify _____

d) How often has stormwater flooded/ponded on this section over the last 10 years?

☐ 1 - 2 times ☐ 3 - 5 times ☐ 6 - 10 times ☐ more than 10 times

e) To what extent has stormwater affected the main dwelling on this section over the past 10 yrs?

☐ not affected ☐ under dwelling ☐ inside dwelling

How often in the past 10 years?

☐ 1 - 2 times ☐ 3 - 5 times ☐ 6 - 10 times ☐ more than 10 times

f) Please estimate the greatest depth of water on the section, under or inside the main dwelling? (please tick one box only for the most severe effect; note that 10cm = 4 inches)

☐ less than 5 cm ☐ 5 cm to 10 cm ☐ 10 cm to 50 cm ☐ greater than 50 cm

g) Please rate how inconvenient you regard the stormwater flooding of your property.

☐ not inconvenient ☐ slightly ☐ moderately ☐ seriously

3. In remedying the flooding in the catchment and on your property what do you perceive as the most desirable solution?

☐ do nothing ☐ upgrade open drains ☐ provide designated ponding areas

☐ upgrade pipework ☐ raise houses above floodplain ☐ other _____

4. If your property borders a stream, has there been any erosion of your property along the stream?

(a) ☐ Yes ☐ No (please go to 5.) ☐ Don't know (please go to 5.)

if yes, please specify _____

5. **Stormwater Quality**

a) In your opinion how much of an issue is quality (cleanliness) of the water in the stream in this catchment or in the Harbour? *(Rainwater falling on our streets, roofs and industrial areas washes contaminants into our streams and eventually into our harbours. These contaminants include sediment, sewage overflows, animal waste, leaves, heavy metals, garden sprays all of which can affect the health of plants and small marine animals in the natural environment. There are a number of possible options to reduce the effect of these contaminants, most of which are very costly to the city and its ratepayers.)*

We believe reducing stormwater contaminants is:

☐ not an issue ☐ low importance ☐ moderate importance ☐ high importance

b) This is because we are most concerned about:

☐ effects on health ☐ protection of property ☐ protection of harbour and environment ☐ penalising people who pollute

6. If you have any comments, please add them to this form, or you can attach a separate piece of paper to this questionnaire.

_____

# *TO THE PROPERTY OWNER / OCCUPIER:*

## THIS IS NOT A CIRCULAR - YOUR HELP IS NEEDED

Over the next few months North Shore City Council (NSCC) and its consultant, Beca Steven, will be investigating how well the present stormwater systems in the Takapuna/Devonport areas are working and how they might be improved. The information is primarily required for long term planning and stormwater management in the catchment. For serious flooding problems that require urgent investigation, residents should contact Action Line on Ph 486-8600.

Your response to this questionnaire will help us to identify flooding within the study areas. It will also help us to assess the management of the stormwater system, and to identify any remaining problems. So we need you to tell us what is happening around your house, business and yard.

**Do you have photographs which you would be prepared to lend us showing flooding and flood damage? If so please put your name and address on the back of the photograph so that we can return them to you. The more information you can provide the better.**

***Please complete the questionnaire on the other side of this sheet, refold it again (with the return address on the outside), seal with sellotape and drop it in the post before 15 February 1999***

**THERE IS NO POSTAGE REQUIRED. IT HAS BEEN PRE-PAID.**

**For further information please phone:**

Maree Watson or Graham Levy at Beca Stevens 300 9000

Thank you very much for your cooperation.

NORTH SHORE CITY

*Private Bag 93500 Takapuna*
*Telephone 4868400*

# North Shore City Council

## Stormwater Questionnaire

### City Services Contract No.300

*in partnership with*

BECA STEVEN

*P O Box 6345*
*Wellesley St, Auckland*
*Telephone 300 9000*

# Beca Steven

**a division of**
**Beca Carter Hollings & Ferner Ltd**
**Consulting Engineers**

Postage paid if posted
in New Zealand

Authority No. 92786 North Shore NZ
Takapuna/Devonport Catchments

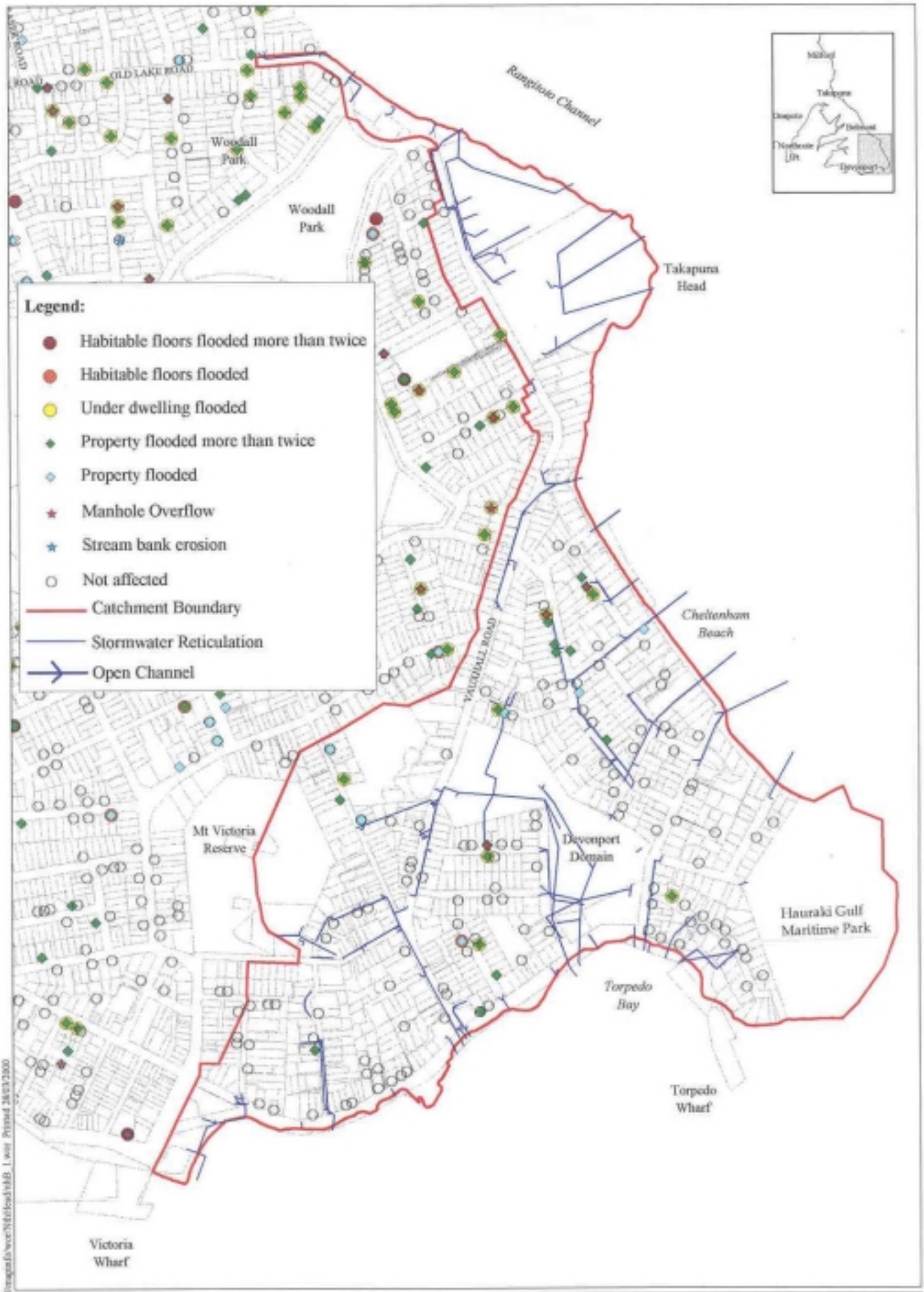
North Shore City Council
Private Bag 6345
**Auckland**

Takapuna/Devonport Stormwater Questionnaire

| WHOLE PROPERTY | | | | | | | | | | | | | | | | | | OUTDOOR | | | | | | | MAIN DWELLING | | | | | | | | | EROSION | | | | SUMMARY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Qu. No. | No. | Street | No. of Years Occupied by Respond-ant | Flooding in last 10 years? | | Stormwater overflowed from | | | | | | Flooded location | | | | | | Frequency of outdoor flooding over last 10 yrs | | | | Main dwelling area affected | | | Frequency of main dwelling flooding over last 10 yrs | | | | Depth under or inside main dwelling | | | | Erosion of property along stream? | | | | Habitable Floors Flooded More Than Twice | Habitable Floors Flooded | Under Dwelling Flooded | Property Flooded More Than Twice | Property Flooded | Not affected | Manhole Overflow | Stream Bank Erosion | Problem likely to be attributed to: |
| | | | | Yes | No | Manhole | Roadway | Stream | Neighbouring property | Unknown | | living | garage | Other | Comment | 1-2 times | 3-5 times | 6-10 times | >10 times | not affected | under dwelling | inside dwelling | 1-2 times | 3-5 times | 6-10 times | >10 times | <5cm | 5cm - 10cm | 10cm - 50cm | >50cm | yes | no | comment | | | | | | | | | | | |
| 527 | 15 | Beaconsfield St | 29 | 1 | | | 1 | | | | | | | 1 | driveway and backyard | 1 | | | | 1 | | | | | | | | | 1 | | | | | | | | | | 1 | | | | | Existing Project 623 |
| 896 | 17 | Beaconsfield St | 16 | 1 | | | 1 | | | | | | | 1 | back lawn, under house | | 1 | | | | 1 | | 1 | | | | | | 1 | | | | | | | | | 1 | 1 | 1 | | | Existing Project 623 |
| 433 | 13A | Burgess Rd | 15 | 1 | | 1 | | | | | | | | 1 | backyard by football fields | | 1 | | | 1 | | | | | | | 1 | | | | | | | | | | 1 | 1 | | 1 | | Addressed through Project 4.0 |
| 494 | 14 | Burgess Rd | 41 | 1 | | | 1 | | | | | | | 1 | under house and front lawn | | | 1 | | | 1 | | | | 1 | | | 1 | | | | | | | | | 1 | 1 | 1 | | | Addressed through Project 4.0 |
| 1697 | 2 | Cheltenham Rd | 15 | 1 | | | | | 1 | | | | | 1 | access to garage | | | | 1 | 1 | | | | | 1 | | | 1 | | | 1 | | | | | | | 1 | 1 | | | | Overland flow from properties uphill. |
| 1278 | 2/57 | Church St | 24 | 1 | | | 1 | | | | | | | 1 | driveway | | | | 1 | 1 | | | | | | | | | | | | | | | | | | 1 | 1 | | | | Lack of maintenance of soakholes in reserve |
| 1694 | 2 | Cracroft st | 15 | 1 | | | | | 1 | | | | | 1 | general, no flooding | 1 | | | | 1 | | | | | | | | 1 | | | 1 | | | | | | | | 1 | | | | No stream on property therefore erosion not a result of stormwater. |
| 607 | 12 | Duders Ave | 1 | 1 | | | | | | 1 | | | 1 | | | | 1 | | | | 1 | | | 1 | | | | 1 | | | | | | | | | 1 | 1 | 1 | | | Drive slopes towards garage (refer Section 5.4.5). |
| 252 | 15 | Duders Ave | 5 | 1 | | | | | | 1 | | | | 1 | Bedroom | 1 | | | | | | 1 | 1 | | | | 1 | | | | | | | | | | 1 | | | | Problem fixed. |

| WHOLE PROPERTY | | | | | | | | | | | | | | | | | OUTDOOR | | | | MAIN DWELLING | | | | | | | | | | EROSION | | | SUMMARY | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Qu. No. | No. | Street | No. of Years Occupied by Respond-ent | Flooding in last 10 years? | | Stormwater overflowed from | | | | | Flooded location | | | | | Frequency of outdoor flooding over last 10 yrs | | | | Main dwelling area affected | | | Frequency of main dwelling flooding over last 10 yrs | | | | Depth under or inside main dwelling | | | | Erosion of property along stream? | | | Habitable Floors Flooded More Than Twice | Habitable Floors Flooded | Under Dwelling Flooded | Property Flooded More Than Twice | Property Flooded | Not affected | Manhole Overflow | Stream Bank Erosion | Problem likely to be attributed to: |
| | | | | Yes | No | Manhole | Roadway | Stream | Neighbouring property | Unknown | living | garage | Other | Comment | 1-2 times | 3-5 times | 6-10 times | >10 times | not affected | under dwelling | inside dwelling | 1-2 times | 3-5 times | 6-10 times | >10 times | <5cm | 5cm - 10cm | 10cm - 50cm | >50cm | yes | no | comment | | | | | | | | | |
| 672 | 2 | Duders Ave | 18 | 1 | | | | | 1 | | | 1 | 1 | rear of section | | | | 1 | 1 | | | | | 1 | | | | | | | | | | 1 | 1 | | | | | Overland flow from unserviced properties (refer Project 8.0). |
| 39 | 1 | Jubilee Ave | 54 | 1 | | | | | | | | | 1 | concreted, dug-out area under house | | | | 1 | | 1 | | | | | 1 | 1 | | | | | | | | 1 | 1 | 1 | | | | Dug out basement. |
| 1584 | 2 | Matai Rd | 4 | 1 | | | 1 | | | | | 1 | 1 | section | 1 | | | | 1 | | | | | | | 1 | | | | | | | water runs down footpath and errodes beach | | | | | 1 | | | | Drive slopes towards garage (refer Section 5.4.5). |
| 1535 | 9 | Mays St | 1 | 1 | | | | | 1 | | | | 1 | lawn | | 1 | | | 1 | | | | | | | 1 | | | | | | | | | | 1 | 1 | | | | Overland flow from neighbours driveway |
| 669 | 5 | Rata Rd | 20 | 1 | | | 1 | | | | | 1 | 1 | front garden/ drive | | | | 1 | | 1 | | 1 | | | | | 1 | | | | | | | | 1 | 1 | 1 | | | | Addressed through Project 4.0 |
| 338 | 7 | Rata Rd | 8 | 1 | | 1 | 1 | | | | | | 1 | front lawn | | 1 | | | 1 | | | | | | | | 1 | | | | | | | | | 1 | 1 | | 1 | | Addressed through Project 4.0 |
| 123 | 9 | Rata Rd | 3 | 1 | | | 1 | | | | | | | front lawn | | | | 1 | 1 | | | | | | 1 | | | 1 | | | | | | | | 1 | 1 | | | | Addressed through Project 4.0 |
| 1669 | 30 | Tainui Rd | 15 | 1 | | | | | | 1 | | | 1 | Grounds | 1 | | | | 1 | | | | | | | | 1 | | | | | | | | | | | 1 | | | | Overland flow from unserviced properties (refer Project 8.0). |

| WHOLE PROPERTY | | | | | | | | | | | | | | | | OUTDOOR | | | | MAIN DWELLING | | | | | | | | | | | EROSION | | | SUMMARY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Qu. No. | No. | Street | No. of Years Occupied by Respond-ant | Flooding in last 10 years? | | Stormwater overflowed from | | | | | Flooded location | | | | | Frequency of outdoor flooding over last 10 yrs | | | | Main dwelling area affected | | | Frequency of main dwelling flooding over last 10 yrs | | | | Depth under or inside main dwelling | | | | Erosion of property along stream? | | | Habitable Floors Flooded More Than Twice | Habitable Floors Flooded | Under Dwelling Flooded | Property Flooded More Than Twice | Property Flooded | Not affected | Manhole Overflow | Stream Bank Erosion | Problem likely to be attributed to: |
| | | | | Yes | No | Manhole | Roadway | Stream | Neighbouring property | Unknown | living | garage | Other | Comment | 1-2 times | 3-5 times | 6-10 times | >10 times | not affected | under dwelling | inside dwelling | 1-2 times | 3-5 times | 6-10 times | >10 times | <5cm | 5cm - 10cm | 10cm - 50cm | >50cm | yes | no | comment | | | | | | | | |
| 136 | 34A | Tainui Rd | 12 | 1 | | | | | | 1 | | | 1 | front section | | | | 1 | 1 | | | | | | 1 | | | 1 | | | | | | | 1 | 1 | | | | Overland flow from unserviced properties (refer Project 8.0). |
| 326 | 41A | Tainui Rd | 11 | 1 | | | | | 1 | | | | 1 | front section | | | 1 | | 1 | | | | | | | | | | | | | | | | 1 | 1 | | | | Overland flow from unserviced properties (refer Project 8.0). |
| 1214 | 43 | Tainui Rd | 5 | 1 | | | | | 1 | | | 1 | | | | 1 | | | 1 | | | | | | | | 1 | | | | | | | | 1 | 1 | | | | Overland flow from unserviced properties (refer Project 8.0). |
| 1219 | 49 | Tainui Rd | 18 | 1 | | | | | | | | | 1 | back yard | | | | 1 | 1 | | | | | | 1 | | | 1 | | | | | | | 1 | 1 | | | | Overland flow from unserviced properties (refer Project 8.0). |
| 1608 | 51 | Tainui Rd | 18 | 1 | | 1 | 1 | | 1 | | | | 1 | back yard | | | | 1 | | 1 | | | | | 1 | | | 1 | | | | | | | 1 | 1 | 1 | | 1 | Overland flow from unserviced properties (refer Project 8.0). |
| 311 | 5-16 | Tainui Rd | 2 | 1 | | | | | | | | 1 | | | | | | 1 | 1 | | | | | | 1 | | | | | | | | | | 1 | 1 | | | | Overland flow from unserviced properties (refer Project 8.0). |




Scale 1:10,000 at A4

0 125 250

Metres

BECA

2508168/10

**North Head**
**Catchment Management Plan**

**Figure B.1**
**Response to Stormwater Questionnaire (Appendix B)**

THE NGATI PAOA
WHANAU
TRUST BOARD

363 DON BUCKS ROAD,
MASSEY, AUCKLAND
TEL/FAX 0-9-832 1860

BECA STEVEN
P O Box 6345
AUCKLAND

**Attention : Graham Levy, Project Manager**

15 November 1999

Tena koe,

**RE : NORTH SHORE CATCHMENT MANAGEMENT PLANS**

Thank you for your correspondence advising that North Shore City Council is updating or preparing new Catchment Management Plans for a number of areas on the North Shore.

In terms of those matters to be assessed within the plans, the Trust wishes to comment on specific items.

1. Environmental Impact Assessment of proposed works.

   No new piping, culverts or fill from subdivisions and earthworks be permitted in natural waterways or wetlands as the environmental impact on the flora and fauna on the surface and in the waterways, extinguishes the inherent features of the natural landforms and landscapes.

2. Water Quality.

   Ensuring water quality in the various catchments may require constant monitoring, ongoing performance indicators of existing systems and where necessary immediate replacement or closure of substandard water systems.
   Sewage and wastewater outlets into coastal waters should be closed and relocated under strict treatment procedures and processes for disposal to designated high density natural bush areas. Consideration be given to wastewater for irrigation purposes such as sports fields, golf courses and revegetation programmes in public parks and reserves.

3. Erosion Control.

   Where possible sloping walls of packed natural rock be built (not cemented), two or three metres cut from the effected area and backfilled with a preferred base of sand or heavy clay fill, topped with suitable topsoil for replanting of pohutukawa or similar coastal vegetation.

In some instances where coastal erosion has occurred, it has also been the cause of ancient human remains surfacing as a tradition of the ancestors of Ngati Paoa were to bury the deceased either on the land edge of the coastline and/or on the nearest beaches to a village .

We are aware that these are comments based on Ngati Paoa values and may not be appropriate or may require some modification.

Kia ora,
Ngati Paoa Whanau Trust

Hariata Gordon
Principal

**Meeting at Three Streams (QE Trust Reserve) in Wayside 27/1/00**

**Present**

- Paul Mitchell and Kate Medlicott (Beca Steven)
- Jim Lewis (Forest and Bird)
- John Hogan (Three Streams)

Stormwater Management concerns of Jim Lewis and John Hogan (23 catchments):

- The importance of vegetation control outside of the riparian zones, in particular upper catchment areas. Support community participation in replanting of these areas and streambanks. Follow up needed for educational material developed by Parks and Reserves on streamside planting – "The magic of Streams"
- The high percent impervious allowed for in the District Plan for new development. Some development of residential lots is occurring after maximum impervious areas have been exceeded e.g. paving, carports etc being built after Council have approved maximum impervious areas for lot.
- Streambank erosion, particularly at stormwater outfalls (both existing and new). Design of outfalls from subdivisions adjacent to watercourses, still efficient engineering solutions to collect runoff but not manage it afterwards.
- Question adequacy of sediment removal from detention tanks both roadside and streamside
- Clearfelling of vegetation for new building footprints in bush areas, these are often issued as non-notified consents.
- Utility services are impacting on vegetation e.g. new wastewater sewer lines.
- Not enough attention given to cumulative effects on main streams or coastal degradation from the development of specific sites in tributary catchments.
- Implications of development adjacent to Sites of Special Wildlife Interest (SSWI) and Lake Pupuke, quality of water for aquatic species. Note research by Stormwater Dept. on Life in 6 Streams.
- Runoff in rural catchments – effects of fertilisers, farm animal nutrients and septic tanks
- Agree with TP10 approach and can see benefits from retaining / creating greenfields and wetland ponds, though concerned about location of stormwater management (devices) especially wetlands within esplanade reserves, and acceptance of low efficiency of some designs (50-60%). Retrofit erosion and sediment control ponds to wetland ponds following construction of subdivision.

# Appendix C

## Catchment Modelling and Summary of Results

# Technical Description of Catchment Models

## *Guideline for Stormwater Runoff Modelling in the Auckland Region*

A study has recently been undertaken for the ARC to prepare guidelines for a standard rainfall-runoff model for the Auckland Region. The study included a review of available stormwater modelling packages and analysis methodologies, an evaluation study in which three selected models were calibrated against data from gauged catchments in the Region, and the development of a recommended model for the Region.

The study was driven by the Regional Council's desire for consistency and accuracy in stormwater analysis across the Region. In addition there was a desire to include calculation of storm runoff volume and timing, and the effects of development. Results from the evaluation study highlighted the range of model results (and hence capital works outcomes) that is obtained with the range of available methodologies. On the basis of agreement between modelled and recorded catchment flows and other features of the model, the US Soil Conservation Service model was selected to form the basis of the standard Auckland Region stormwater model.

The outcome of the study will be a set of guidelines produced by the Auckland Regional Council providing a standard methodology for the application of the US Soil Conservation Service (SCS) model to the Region. This will include a standard Auckland design rainfall storm, guidelines for selecting rainfall loss parameters for typical Auckland soils, a regionally calibrated equation for estimating catchment times of concentration, and a standard unit hydrograph.

| *Table C.1: Summary of Catchment Characteristics* | | | | |
|---|---|---|---|---|
| ***Subcatchment Number*** | ***Area (ha)*** | ***Slope[#] (m/m)*** | ***% Impervious*** | |
| | | | ***Existing Use*** | ***Future Use*** |
| NH1 | 16.8 | 0.03 | 70 | 70 |
| NH2 | 3.0 | 0.04 | 42 | 70 |
| NH3 | 5.9 | 0.05 | 42 | 70 |
| NH4 | 0.9 | 0.01 | 42 | 70 |
| NH5 | 23.3 | 0.06 | 42 | 70 |
| NH6 | 1.2 | 0.01 | 42 | 70 |
| NH7 | 0.84 | 0.02 | 42 | 70 |
| NH8 | 15.8 | 0.05 | 40 | 70 |
| NH9 | 19.9 | 0.04 | 41 | 70 |
| NH10 | 20.8 | 0.04 | 41 | 70 |
| NH11 | 6.5 | 0.02 | 30 | 70 |
| NH12 | 7.8 | 0.02 | 30 | 70 |
| NH13 | 16.6 | 0.06 | 42 | 70 |
| NH14 | 6.2 | 0.10 | 42 | 70 |
| NH15 | 8.2 | 0.08 | 42 | 70 |

[#] Indicative

| *Table C2: Summary of Nodal Flows* | | | | | | | |
|---|---|---|---|---|---|---|---|
| ***Node*** | ***D/S Pipe Diameter (mm)*** | ***Pipe Slope * (m/m)*** | ***Existing Pipe Capacity ($m^3/s$)*** | ***Nodal Flows ($m^3/s$)*** | | | |
| | | | | ***Existing Use*** | | ***Future Use*** | |
| | | | | ***10% AEP*** | ***1% AEP*** | ***10% AEP*** | ***1% AEP*** |
| 2 | 300 | 0.03 | 0.2 | 0.50 | 0.79 | 0.58 | 0.88 |
| 3 | Outlet | - | - | 1.0 | 1.5 | 1.1 | 1.7 |
| 4 | <300 | 0.01 | 0.09 | 0.16 | 0.25 | 0.18 | 0.27 |
| 6 | <300 | 0.01 | 0.09 | 0.20 | 0.32 | 0.23 | 0.35 |
| 7 | <300 | 0.02 | 0.13 | 0.15 | 0.23 | 0.17 | 0.25 |
| 8 | 450 | 0.02 | 0.32 | 2.5 | 4.1 | 3.0 | 4.5 |
| 9 | 450 | 0.02 | 0.50 | 2.9 | 4.6 | 3.4 | 5.2 |
| 10 | Outlet | - | - | 2.9 | 4.7 | 3.5 | 5.3 |
| 11 | 450 | 0.02 | 0.32 | 0.88 | 1.4 | 1.1 | 1.7 |
| 12 | Outlet | - | - | 1.0 | 1.6 | 1.3 | 1.9 |
| 14 | 300 | 0.02 | 0.16 | 1.1 | 1.7 | 1.2 | 1.9 |
| 15 | 300 | 0.03 | 0.19 | 1.4 | 2.2 | 1.6 | 2.4 |

*****There are no invert data available for this catchment. Pipe slopes have been estimated from inclinometer readings.

# Appendix D

## Stormwater Liaison Group – Technical Report 3

# *Extract from ARC Technical Report*

## Prioritisation of Receiving Environments and Catchments; (Stormwater LIAISON Group)

- The environmental values of the stormwater receiving environments, both marine and freshwater, along with the magnitude of catchment threats such as flooding and erosion should be the key factors for determining the catchment priorities for stormwater management, and priority being given to high value : high threat catchments.
- Environmental values include ecological and community values, but primary importance should be given to the ecological values of the receiving environments when determining the priorities for stormwater management. A healthy ecology has the additional benefits of enhancing the community's safe enjoyment of natural resources.
- Priority should be given to protecting and preserving highly valued receiving environments. Preserving high receiving environment values generally more cost efficient than remediating degraded environments.
- Priority should be given to stormwater quality management with depositional receiving environments. Contaminants are less likely to persist and accumulate in non-depositional marine environments (and hence present a lower priority), but may result in higher suspended sediment levels reducing aesthetic appeal, and other short to medium term effects.

Where opportunities for the efficient enhancement of stormwater quality or quantity issues exists, such as where development is occurring and can address these issues

# Appendix E
## Stormwater Quality Management Techniques

# *Stormwater Quality Management Techniques*

***Stormwater quality management techniques may be implemented by Council and by individual landowners or occupiers.***

## 1.0 Council Stormwater Quality Management Techniques

Stormwater quality techniques that could be implemented by Council include:

- Pumping station overflow storage / treatment.
- Refining road sweeping and catchpit cleaning programmes.
- Provision of rubbish bins within reserves.
- Provision of 'dog boxes' within reserve areas.
- Education.
- Enforcement of regulations.
- Checks upon drainage connections.
- Review of maintenance procedures.
- Site development controls.

### *Pumping Station Overflow Storage*

Council could investigate the installation of overflow holding tanks adjacent to pumping stations. The size of the tanks will depend on the flows through the pumping station and the duration of the overflows captured (eg 12 hours / 24 hours depending on Council policy).

Another means of limiting contaminants released during pumping station overflows would be to partially treat the discharge by installing a device such as a screen followed by a weir at, and activated by, the discharge. This however is normally not viewed as a long term solution and containment of the overflow would be preferable.

Alarms should be installed on all pumping stations, if they are not already, and the number, frequency and volume of the overflows monitored. This information should be forwarded to the Regional Council as part of the stormwater discharge consent conditions.

### *Road sweeping and catchpit maintenance*

In areas where there are catchpits and curbing, Council could increase the frequency of catchpit cleaning to maximise the potential to intercept sediment:

Increasing the frequency of sump cleaning is likely to improve the efficiency of the sumps to trap sediment.

Council could investigate the time it takes for sumps around the catchment to fill with sediment and adjust the catchment-wide sump cleaning programme accordingly. Some areas of the catchment may require a more intensive cleaning programme to ensure the catchpits maintain optimum efficiency; some a decreased frequency.

### *Provision of Rubbish Bins Within Reserves*

Council could ensure that adequate rubbish bins are provided in reserves within the catchment and that they are regularly emptied. This would help to ensure that litter and debris were retained within the bins and did not enter the stormwater system. The provision of rubbish bins next to stream crossing typically warrants particular attention and priority.

### *Provision of 'Dog Boxes' within reserve areas.*

'Dog boxes' could be placed within reserve areas as have already been done in some North Shore reserves. The boxes encourage dog owners to act responsibly. This would help to control the release of nutrients and improve the amenity value of reserve areas.

### *Education*

Council, in association with the ARC, could develop a community wide education programme. This could involve the production of sector specific information pamphlets, i.e. for industry, commerce, or residents. This could be followed up with public forums to discuss stormwater issues in general.

Another useful mechanism is ongoing education of secondary school pupils from nearby secondary schools. By making the students aware of the significance of contaminants entering the stormwater system, this would have an effect on the community in the short term. This is an activity that could be picked up by the Regional Council.

Helping people visualise where the stormwater system discharges to may also prove beneficial. Symbols of fish either painted or attached on small plates next to stormwater grates may prove a useful preventative tool in areas draining to stormwater; both in public areas and in commercial and industrial areas for staff awareness.

### *Enforcement*

Enforcement of aims and district / regional policies would help to ensure that the sites or areas within the catchment with the potential for individually significant releases of contaminants to stormwater / soakage are regularly checked and are thus accountable.

During licensing inspections under the Dangerous Goods Regulations (now transitional under the Hazardous Substances and New Organisms Act), the inspector should check for potential spillage to the stormwater system. This is, in fact, required in Sections 31 m and 33 d (iii) in that: *"all reasonable precautions shall be taken for ... the prevention of the escape of dangerous goods into any sewer or drain or natural water, ...."*.

Another means of regulating the discharge of contaminants to stormwater is to incorporate into any future Council strategic policies a statement that requires anyone discharging stormwater to the Council stormwater system to be responsible for ensuring that the discharges from their site do not compromise or breach the conditions imposed on Council for the overall discharge consent. This would then encourage Council to enforce the quality of stormwater being discharged into the Council stormwater system.

### *Checks Upon Drainage Connections*

Illegal connections of stormwater into the foulwater system may result in overflow of foulwater during storm events. Conversely, foulwater and tradewaste connections into the stormwater system would result in contaminants being an almost continuous component of the stormwater discharge.

Council could conduct an audit of the existing stormwater system (this includes open watercourses) to identify potential or actual illegal connections. Works to separate any illegal connections should then be prioritised with existing works to separate illegal connections; foulwater connections to the stormwater system should be preferentially separated.

### *Review of Maintenance Procedures*

Maintenance procedures throughout the catchment should be critically examined from the perspective of preventing contaminants from entering the stormwater system. Maintenance of grassed areas, especially road berms could avoid the use of herbicides where practicable.

### *Site Development Controls*

Any development within the catchment has the potential to generate significant quantities of silt over a short term period. Council could ensure all such development, including that which is Council instigated (such as road maintenance), is subject to the appropriate level of silt control. Controls upon site development may include requirements that:

- Painting contractors should not discharge wastes into the stormwater system.
- Concrete pumping contractors should not allow the discharge of waste concrete into gutters or catchpits. Waste concrete should be disposed of on site or as clean fill as appropriate.
- Bricklaying / paving contractors (eg during curbing construction) should not mix mortar in gutters or any other situation which will drain to the stormwater system.
- All earthworks and material stockpiles should be stored appropriately.
- All individual and subdivisional development and / or building applications must be accompanied by a site management plan including stormwater control plans. Controls may include:
  - Silt curtains.
  - Regular catchpit clearance / road sweeping.
  - Use of cut-off drains.
  - Installation of sedimentation tanks.
  - Regular (self and Council) auditing of controls.

  The range of controls / requirements should be appropriate to the development.
- Where sandblasting and paint stripping are proposed, adequate screening should be provided to trap all airborne material. Sweeping and vacuuming should be utilised to collect the waste for disposal in an appropriate manner.
- No materials should be deposited on Council's roadways as a result of vehicles leaving the building site.

- Council could check the site prior to issuing of the occupancy certificate to ensure that all catchpits / treatment devices have been cleaned out, and that the site has been satisfactorily cleaned up to minimise any significant adverse environmental effects.

## 2.0 PRIVATE SECTOR POLLUTION PREVENTION

Individual pollution prevention is largely either enforced by Council or is reliant upon the individual to be proactive and / or informed. Council initiated education and enforcement initiatives would directly affect the effectiveness of contaminant removal and / or containment prior to release into the main stormwater system.

There are a number of ways by which contaminants may be controlled at the source:

### *Installation of Pretreatment Devices*

Pretreatment devices may include oil separators, grit and grease traps. Pretreatment may occur on general drainage, or from wash down areas.

### *Staff Education*

Education of staff would help in avoiding incorrect disposal of liquid wastes down stormwater grates. A fish symbol could also be placed on all stormwater grates as a reminder of the end point of the drain.

### *Spill Contingency Planning*

Companies should be encouraged to develop contingencies for spills of substances into the stormwater system. Adsorbent / containment equipment should be available, and a register of events (together with the response) should be established.

### *Waste Management*

Sites should ensure waste bins are covered and do not include liquid wastes that could drain to ground / stormwater. Waste chemical containers should be stored under cover and in a contained area. Particulate material should be secured so that it does not disperse (such as plastic packing chips).

### *'Chemical' Storage*

Storage of dangerous and hazardous goods oils, paints, and chemicals should be such that runoff / spillage to stormwater is avoided. This should include loading and unloading activities together with transfer of these substances within the operation.

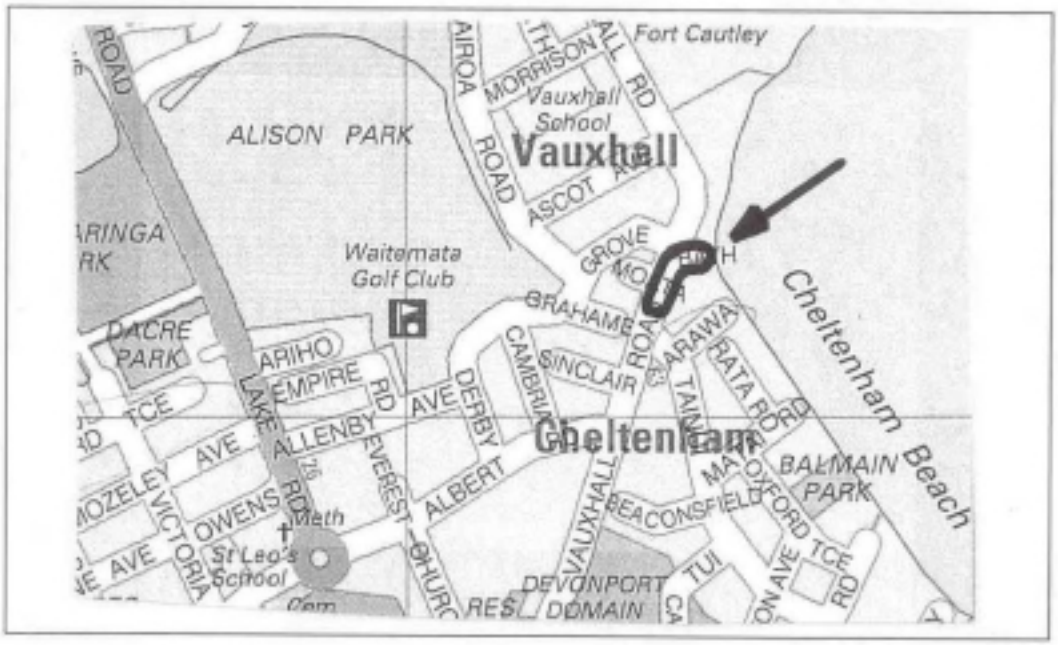
### *Environmental Management Systems*

Establishment of management systems on sites would aid in the prevention of erroneous environmental practices and may provide mitigation against the release of contaminants to stormwater. Other benefits may include cleaner production techniques and increased cost efficiency.

# Appendix F
## Project Sheets

## Project Summary Sheet

| | | | |
|---|---|---|---|
| ***Date: April 2000*** | ***Catchment:*** North Head | ***Ward:*** | Devonport |
| ***Project Address:*** | Vauxhall Road | | |
| ***Project Description:*** | P | | |




***Problem Description:*** Existing pipe has inadequate capacity to pass the 10% AEP design flow.

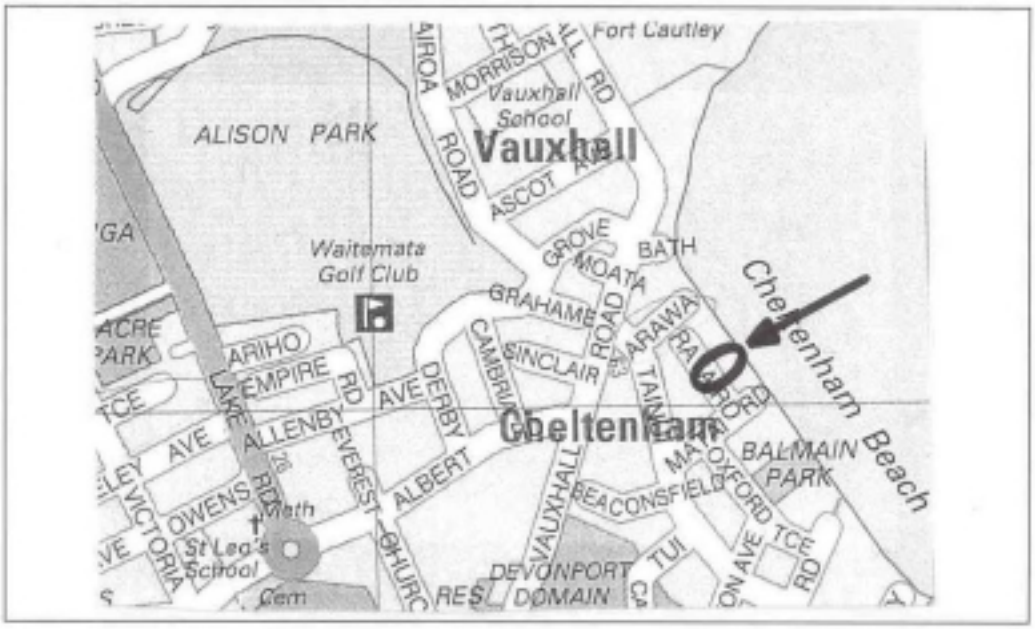
***Solution Required:*** Upgrade pipe to a 525mm diameter for approx. 120m.

| | | | |
|---|---|---|---|
| ***CMP Y/N:*** | Y | ***Budget Category:*** | FP |
| ***CMP Project No:*** | 1.0 | ***Effect / Threat:*** | J |
| ***Capital Estimate*** | $36,000 | ***Frequency:*** | 6 |
| | | ***Other Factors 1:*** | CMP |
| ***Maintenance Estimate*** | | ***Other Factors 2:*** | |
| ***Estimate Accuracy:*** | Conceptual | ***Other Factors 3:*** | |
| ***Project Confidence:*** | Reliable | ***Other Factors 4:*** | |
| ***Solution Confidence:*** | Limited | ***TOTAL RANK:*** | 3.5 |

***Comments:*** Low priority upgrade as no problems have been reported and secondary flow is likely to occur on the road only.

## Project Summary Sheet

| | | | | | |
|---|---|---|---|---|---|
| ***Date: April 2000*** | ***Catchment:*** | North Head | ***Ward:*** | Devonport | |
| ***Project Address:*** | Rata Road | | | | |
| ***Project Description:*** | P | | | | |

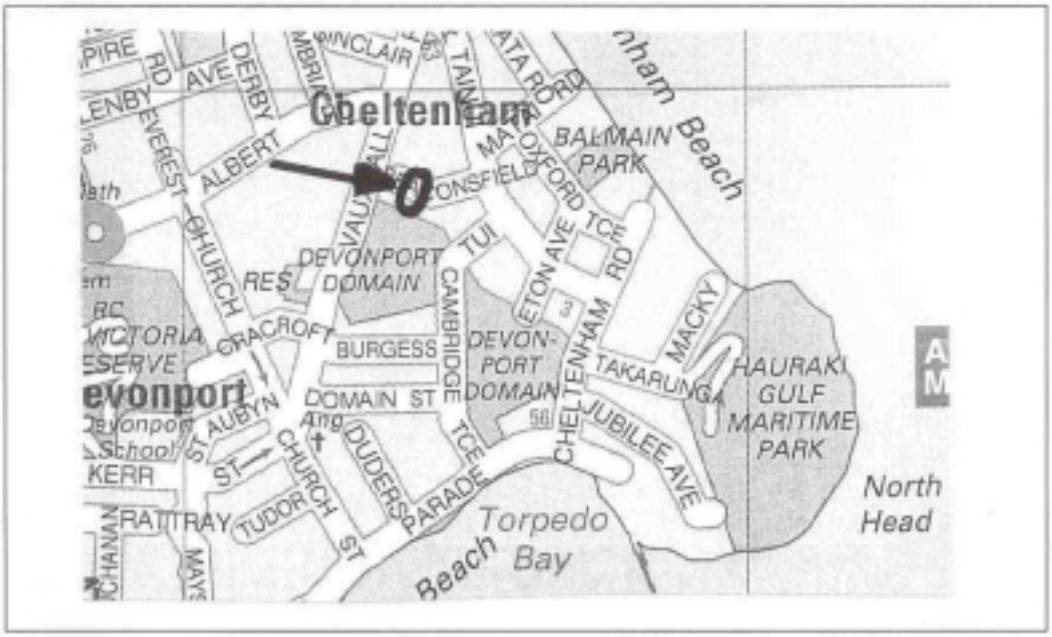



| | |
|---|---|
| ***Problem Description:*** | Existing pipe has inadequate capacity to pass the 10% AEP design flow. |
| ***Solution Required:*** | Upgrade pipe to a 375mm diameter for approx. 80m. |

| | | | |
|---|---|---|---|
| ***CMP Y/N:*** | Y | ***Budget Category:*** | FP |
| ***CMP Project No:*** | 2.0 | ***Effect / Threat:*** | G |
| ***Capital Estimate*** | $17,000 | ***Frequency:*** | 3 |
| | | ***Other Factors 1:*** | CMP |
| ***Maintenance Estimate*** | | ***Other Factors 2:*** | |
| ***Estimate Accuracy:*** | Conceptual | ***Other Factors 3:*** | |
| ***Project Confidence:*** | Reliable | ***Other Factors 4:*** | |
| ***Solution Confidence:*** | Limited | ***TOTAL RANK:*** | 5.0 |
| ***Comments:*** | | | |

## Project Summary Sheet

| | | | |
|---|---|---|---|
| ***Date: April 2000*** | ***Catchment:*** North Head | ***Ward:*** | Devonport |
| ***Project Address:*** | Beaconsfield Street | | |
| ***Project Description:*** | P | | |




| | |
|---|---|
| ***Problem Description:*** | Existing project. |
| ***Solution Required:*** | Increase priority rating, and review hazard 'status' once project complete. |

| | | | |
|---|---|---|---|
| ***CMP Y/N:*** | Y | ***Budget Category:*** | FP |
| ***CMP Project No:*** | 3.0 | ***Effect / Threat:*** | D |
| ***Capital Estimate*** | Existing project | ***Frequency:*** | 3 |
| | | ***Other Factors 1:*** | CMP |
| ***Maintenance Estimate*** | | ***Other Factors 2:*** | |
| ***Estimate Accuracy:*** | Conceptual | ***Other Factors 3:*** | |
| ***Project Confidence:*** | Reliable | ***Other Factors 4:*** | |
| ***Solution Confidence:*** | Limited | ***TOTAL RANK:*** | 5.5 |
| ***Comments:*** | | | |

# Project Summary Sheet

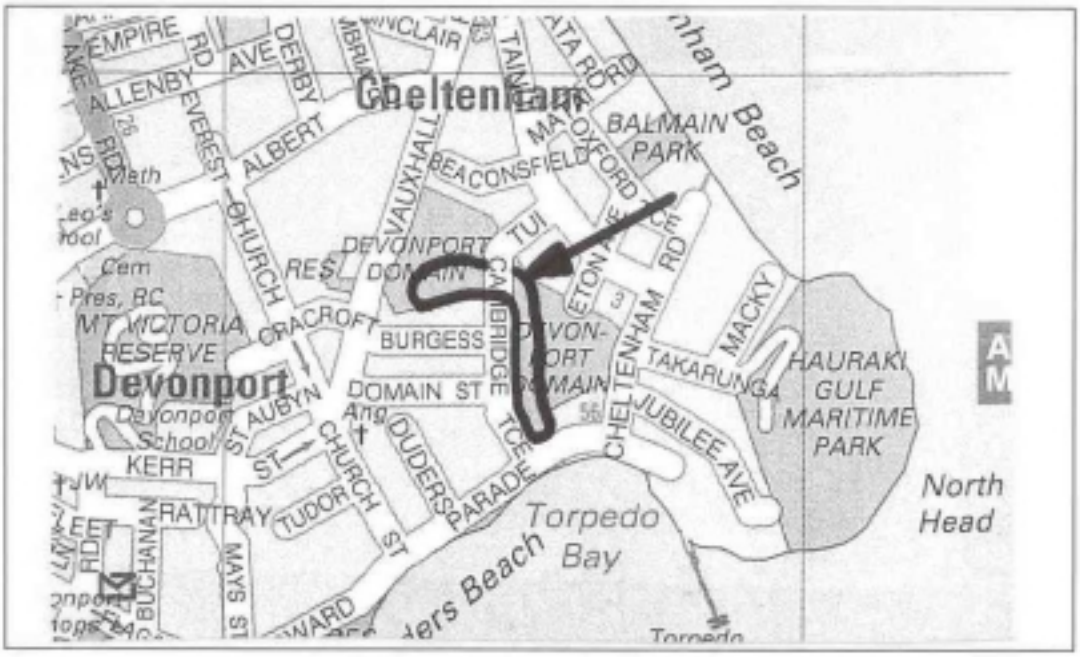
| | | | |
|---|---|---|---|
| **Date: April 2000** | **Catchment:** North Head | **Ward:** | Devonport |
| **Project Address:** | Burgess Road | | |
| **Project Description:** | P, I | | |


| | |
|---|---|
| **Problem Description:** | Existing pipe has inadequate capacity to pass the 10% AEP design flow. |
| **Solution Required:** | Upgrade pipe to 375mm diameter for a length of approx. 120m and install splaypits. |

| | | | |
|---|---|---|---|
| **CMP Y/N:** | Y | **Budget Category:** | FP |
| **CMP Project No:** | 4.0 | **Effect / Threat:** | G |
| **Capital Estimate** | $36,000 | **Frequency:** | 3 |
| | | **Other Factors 1:** | CMP |
| **Maintenance Estimate** | | **Other Factors 2:** | |
| **Estimate Accuracy:** | Conceptual | **Other Factors 3:** | |
| **Project Confidence:** | Reliable | **Other Factors 4:** | |
| **Solution Confidence:** | Limited | **TOTAL RANK:** | 4.9 |
| **Comments:** | | | |

## Project Summary Sheet

| | | | |
|---|---|---|---|
| ***Date: April 2000*** | ***Catchment:*** North Head | ***Ward:*** | Devonport |
| ***Project Address:*** | Devonport Domain | | |
| ***Project Description:*** | P | | |




***Problem Description:*** Existing pipes has inadequate capacity to pass the 10% AEP design flow.

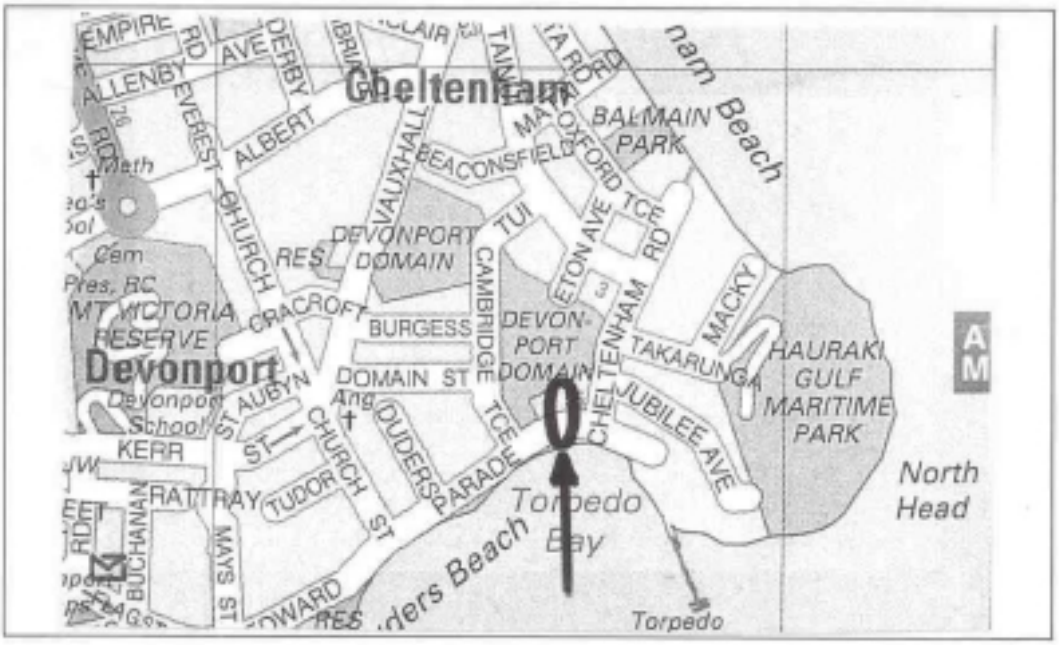
***Solution Required:*** Upgrade pipes to 975mm diameter for a length of approx. 450m.

| | | | |
|---|---|---|---|
| ***CMP Y/N:*** | Y | ***Budget Category:*** | FP |
| ***CMP Project No:*** | 5.0 | ***Effect / Threat:*** | 1 |
| ***Capital Estimate*** | $260,000 | ***Frequency:*** | 3 |
| | | ***Other Factors 1:*** | CMP |
| ***Maintenance Estimate*** | | ***Other Factors 2:*** | |
| ***Estimate Accuracy:*** | Conceptual | ***Other Factors 3:*** | |
| ***Project Confidence:*** | Reliable | ***Other Factors 4:*** | |
| ***Solution Confidence:*** | Limited | ***TOTAL RANK:*** | 4.5 |

***Comments:***

## Project Summary Sheet

| | | | |
|---|---|---|---|
| ***Date: April 2000*** | ***Catchment:*** North Head | ***Ward:*** | Devonport |
| ***Project Address:*** | Devonport Domain | | |
| ***Project Description:*** | P | | |

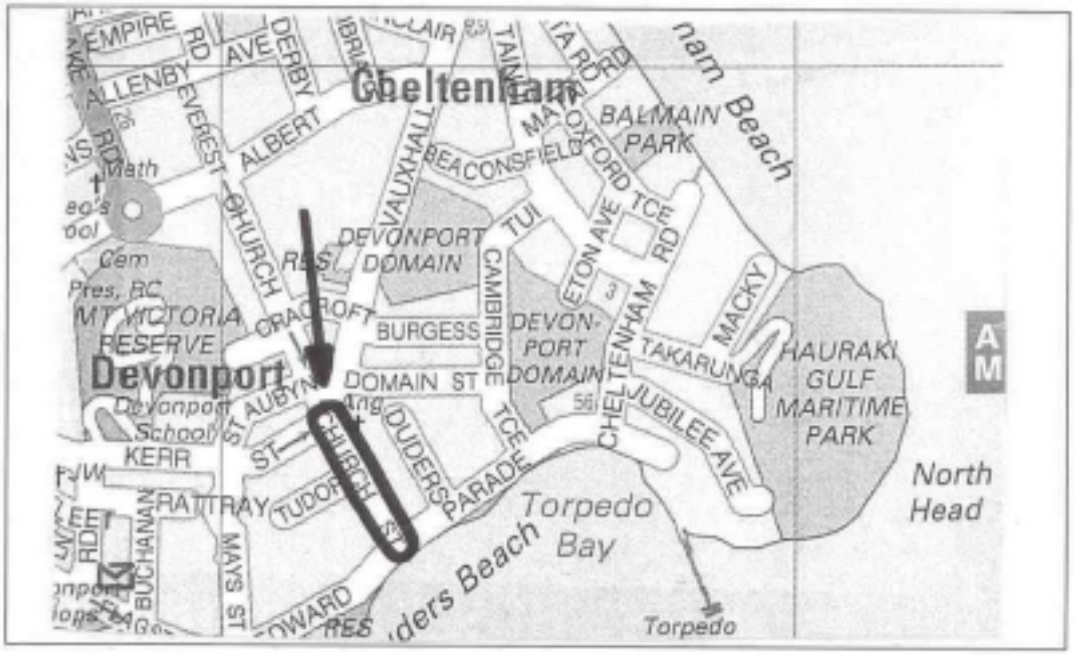



| | |
|---|---|
| ***Problem Description:*** | Existing pipe has inadequate capacity to pass the 10% AEP design flow. |
| ***Solution Required:*** | Upgrade pipe to 675mm diameter for a length of approx. 130m. |

| | | | |
|---|---|---|---|
| ***CMP Y/N:*** | Y | ***Budget Category:*** | FP |
| ***CMP Project No:*** | 6.0 | ***Effect / Threat:*** | I |
| ***Capital Estimate*** | $50,000 | ***Frequency:*** | 3 |
| | | ***Other Factors 1:*** | CMP |
| ***Maintenance Estimate*** | | ***Other Factors 2:*** | |
| ***Estimate Accuracy:*** | Conceptual | ***Other Factors 3:*** | |
| ***Project Confidence:*** | Reliable | ***Other Factors 4:*** | |
| ***Solution Confidence:*** | Limited | ***TOTAL RANK:*** | 4.5 |
| ***Comments:*** | | | |

# Project Summary Sheet

| | | | |
|---|---|---|---|
| ***Date: April 2000*** | ***Catchment:*** North Head | ***Ward:*** | Devonport |
| ***Project Address:*** | Church Street | | |
| ***Project Description:*** | P | | |




***Problem Description:*** Existing pipe has inadequate capacity to pass the 10% AEP design flow.

***Solution Required:*** Upgrade pipe to 675mm diameter for a length of approx. 280m.

| | | | |
|---|---|---|---|
| ***CMP Y/N:*** | Y | ***Budget Category:*** | FP |
| ***CMP Project No:*** | 7.0 | ***Effect / Threat:*** | G |
| ***Capital Estimate*** | $110,000 | ***Frequency:*** | 3 |
| | | ***Other Factors 1:*** | CMP |
| ***Maintenance Estimate*** | | ***Other Factors 2:*** | |
| ***Estimate Accuracy:*** | Conceptual | ***Other Factors 3:*** | |
| ***Project Confidence:*** | Reliable | ***Other Factors 4:*** | |
| ***Solution Confidence:*** | Limited | ***TOTAL RANK:*** | 4.9 |

***Comments:***

# Project Summary Sheet

| | | | |
|---|---|---|---|
| *Date: April 2000* | *Catchment:* North Head | *Ward:* | Devonport |
| *Project Address:* | North Head catchment | | |
| *Project Description:* | E | | |

*Refer Figure 5.3*

*Problem Description:* Overland flow from unserviced properties is causing localised ponding.

*Solution Required:* Unserviced properties are reticulated:

a) Subcatchment 6 (Beaconsfield Street and Vauxhall Road) ($110,000).

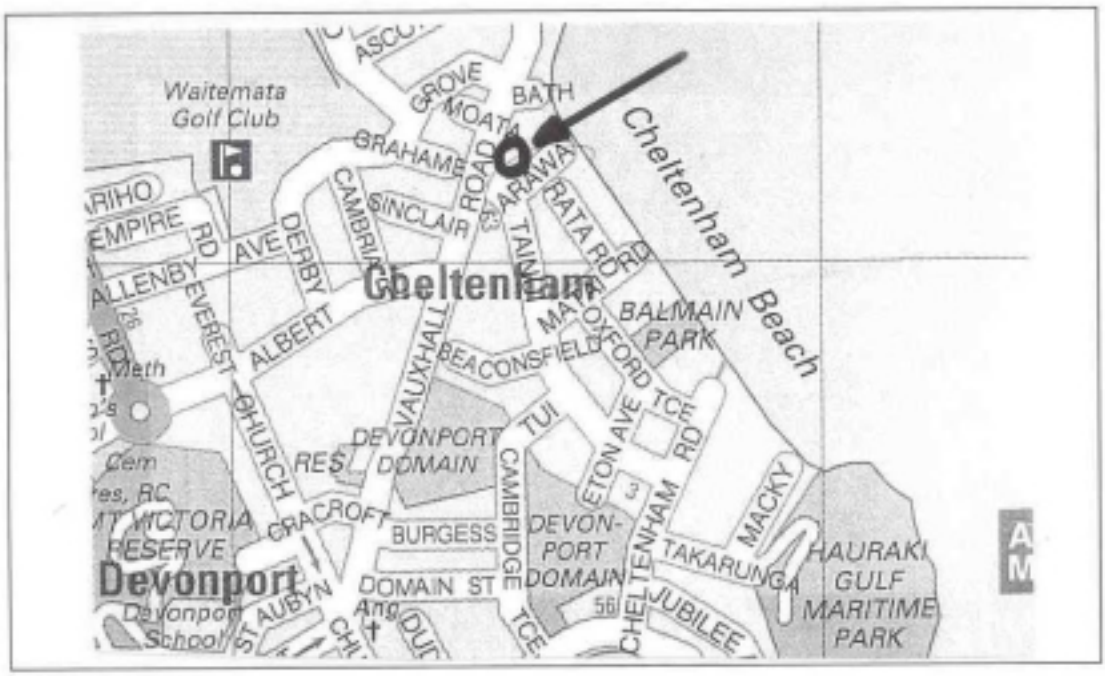
b) Cheltenham Road ($210,000).

c) Remaining unserviced properties within the catchment ($3,000,000).

| | | | |
|---|---|---|---|
| *CMP Y/N:* | Y | *Budget Category:* | FP |
| *CMP Project No:* | 8.0 | *Effect / Threat:* | G |
| *Capital Estimate* | $3,000,000-$3,500,000 | *Frequency:* | 6 |
| | | *Other Factors 1:* | CMP |
| *Maintenance Estimate* | | *Other Factors 2:* | |
| *Estimate Accuracy:* | Conceptual | *Other Factors 3:* | |
| *Project Confidence:* | Reliable | *Other Factors 4:* | |
| *Solution Confidence:* | Limited | *TOTAL RANK:* | 4.4 |
| *Comments:* | | | |

# Project Summary Sheet

| | | | |
|---|---|---|---|
| ***Date: April 2000*** | ***Catchment:*** North Head | ***Ward:*** | Devonport |
| ***Project Address:*** | Petrol Station on the Corner of Vauxhall Road and Tainui Street | | |
| ***Project Description:*** | SQ | | |




| | |
|---|---|
| ***Problem Description:*** | Runoff from the forecourt area of the petrol station contains contaminants such as hydrocarbons. |
| ***Solution Required:*** | Install a filtration device. |

| | | | |
|---|---|---|---|
| ***CMP Y/N:*** | Y | ***Budget Category:*** | SQ |
| ***CMP Project No:*** | 9.0 | ***Effect / Threat:*** | H |
| ***Capital Estimate*** | Private issue | ***Frequency:*** | 7 |
| | | ***Other Factors 1:*** | CMP |
| ***Maintenance Estimate*** | | ***Other Factors 2:*** | |
| ***Estimate Accuracy:*** | Conceptual | ***Other Factors 3:*** | |
| ***Project Confidence:*** | Reliable | ***Other Factors 4:*** | |
| ***Solution Confidence:*** | Limited | ***TOTAL RANK:*** | 4.5 |
| ***Comments:*** | | | |