

# **REPORT**

SH20 Mount Roskill

Storm Water Management  
System

Project Review

*Prepared for*

**Transit New Zealand**

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Wellington

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- A. Stormwater Management System - Location Plan

## Section 1

## Catchment Characteristics

### 1.1 Introduction

The SH20 Mount Roskill Extension traverses two catchments as detailed below, the highway works themselves measure some 46 hectares in total. The portion of the project to the east of the Hillsborough ridge is contained within the Royal Oak catchment, and drains eastward to the Manukau Harbour. The portion of the project to the west of the Hillsborough ridge is contained within the Oakley catchment, and drains westward to tributaries of the Oakley Creek.

The terrain and other factors of relevance to stormwater management differ in each of these catchments, and hence each is dealt with separately within this report.

### 1.2 Description of Catchments

#### 1.2.1 Royal Oak Catchment

##### ***Terrain***

The catchment falls generally from west to east, with the high point located at the Hillsborough ridge east of Hillsborough Road, the land falls to Queenstown Road and thence into the Manukau Harbour.

##### ***Area***

The Royal Oak catchment area is approximately 50 hectares.

##### ***Topography***

The catchment is typically of moderate contour (5% - 10%) and contains mixed use land comprising of residential, open and vegetated green space.

##### ***Drainage features***

Two tributaries occur within the catchment, a smaller one to the south is ephemeral and crosses under the existing motorway where it is culverted, the larger north of this is a perennial stream (the Bel Air Stream), which drains a bush reserve. The larger tributary consists of approximately 750m of open channel, comprised of rocky chutes, small pools, grassy lined channel and geotextile-reinforced channel. This watercourse is piped from adjacent to the Queenstown Road bridge through to Onehunga Bay, a distance of some 900 metres.

##### ***Geotechnical Conditions and Soils***

Miocene age Waitemata Group rocks are well consolidated marine mudstones and sandstones. These are considered as the basement rocks, which underlie the Auckland isthmus area and generally extend to hundreds of metres in depth. The Waitemata Group rocks are overlain in localised areas by relatively thin layers of Pleistocene age Tauranga Group materials.

The geological and hydrogeological soils within this catchment are chiefly comprised of Tauranga Group alluvium and weathered Waitemata Group. The Tauranga Group deposits are Holocene and Pleistocene peats, alluvium and swamp deposits, ranging from silty clays to silty sands, that occur mainly in the Carr Road area to the North of the catchment. The Waitemata Group materials are

Miocene interbedded very weak to weak sandstone and mudstone. These materials can be deeply weathered.



## Section 1

## Catchment Characteristics

### ***Erosion potential***

The soils within the Royal Oak catchment, being in weathered Waitemata Series soil are highly susceptible to erosion.

### ***Flooding***

Flooding does not generally occur within the catchment although there are flooding issues within the adjacent Oakley Creek catchment discussed later.

### ***Design storm event***

The storm event for the proposed drainage strategy was a 100 year return period (1% AEP).

### ***Vehicle kilometres travelled at time of opening***

As at May 2008, measured traffic volumes on this section of SH20 are approximately 35,000 to 41,000 vehicles per day (week day) and 24,000 to 31,000 vehicles per day (weekend). Once the Mount Roskill extension opens, modelled volumes are expected to increase to 69,000 vehicles per day (2011 forecast). The project length within the Royal Oak catchment is 0.9km – corresponding to a forecast traffic flow of approximately 62,000 vehicle kilometres per day in 2011.

### ***Discharge points***

The catchment drains via existing reticulation and overland flow to the watercourses discussed above which then discharge to the Manakau Harbour within the vicinity of Orpheus Drive and the Onehunga Bay reserve. Runoff from the motorway is treated in the Beachcroft Avenue water quality pond prior to discharge. The ultimate discharge area consists of intertidal mud flats typical of the inner Manukau Harbour. The area in the vicinity of the discharge is not identified on any ARC plans as having high ecological value.

### ***Catchment classification***

Urban (from NSHS 2007).

### ***Sensitivity of Receiving Environment***

Attribute scores:	Attributes
Sensitivity	20
Ecological value	10
Human use value	5
Overall sensitivity rating (sum)	35

**Section 1****Catchment Characteristics****1.2.2 Oakley Creek Catchment*****Terrain***

The catchment is generally flat to rolling except at the location of the Mount Roskill cone. It drains generally from south-east to north-west, ultimately discharging into the Waitemata Harbour at Waterview.

***Area***

The Oakley Creek catchment area is approximately 1400 hectares.

***Topography***

The catchment is typically of gentle contour (<5%) and contains mixed use land comprising of residential, commercial, light industrial, open and vegetated green space.

***Drainage features.***

Oakley Creek is a significant watercourse approximately 12km long. SH20 crosses the main channel at Keith Hay Park by way of a bridge. Immediately upstream of the motorway, the channel has been concrete lined, downstream it is culverted under the Mount Roskill Grammar playing fields.

Several other perennial tributaries to the Oakley Creek are present within the catchment described as follows:

The first tributary originates near Hillsborough Road and extends down the designation to join the main channel of the Oakley Creek at Keith Hay Park. This watercourse drains the uppermost reaches of a small sub-catchment predominantly serving industrial and urban developments. Previous channelling and piping has extensively modified the natural channel although it does still have grassy banks. As part of the SH20 Mount Roskill project scope, a 650m length of this watercourse will be piped with a 3050mm diameter concrete pipe.

The second tributary is a small watercourse draining Keith Hay Park and Akarana Golf Course. The channel is similar to the other watercourses in the area, being highly modified, straight and uniform with grassy banks.

The third tributary is located in the vicinity of Roma Road and NZ Foodstuffs, and drains an existing area of modified ephemeral wetland surrounded by willows. The watercourse downstream of the wetland meanders through grassed pasture. In its upstream area due to various industrial and residential developments the stream has been replaced by a network of culverts. As part of the SH20 Mount Roskill project scope, a 250m length of this watercourse will be piped with a 3050mm diameter concrete pipe.



## Section 1

## Catchment Characteristics

A number of other smaller ephemeral stream environments are located within the catchment.

### ***Geotechnical Conditions and Soils***

The nature of the Waitemata Group Rocks was discussed previously. The Mount Roskill volcanic centre initially consisted of a tuff cone upon which a small scoria cone was built. The distribution of the basalt flows from Mount Roskill volcanic centre was controlled by the pre-existing topography of the underlying Waitemata Group rocks. Basalts flowed over the surface of the Waitemata Group rocks and generally filled in a valley in the rock north-west toward Mount Albert.

Waitemata Group materials are as described previously. Around the Mount Roskill area this is overlain with deposits of volcanic tuff ash, basalt lava and scoria. The tuff and ash range from clayey silt to thinly bedded hard clayey silt, dense sand and dense gravel. The basalt and scoria ranges from loose unwelded scoria to dense, fractured basalt rock.

### ***Erosion potential***

The soils within the Oakley catchment, being in weathered Waitemata Series soil are susceptible to high erosion.

### ***Flooding***

Flooding is known to occur within the Oakley catchment during storm events. In particular, Keith Hay Park is located within a flood plain, and has a flood detention function during significant storm events. The function has not been adversely affected by the SH20 project.

### ***Design storm event***

The storm event for the proposed drainage strategy was a 100 year return period (1% AEP)

### ***Vehicle kilometres travelled at time of opening***

Once the Mount Roskill extension opens, modelled volumes are expected to be to 60,000 vehicles per day (2011 forecast) between the Hillsborough and Dominion Road interchanges, reducing to 46,000 vehicles per day (2011 forecast) between the Dominion Road interchange and the western termination. The project length within each of these two sections of the Oakley catchment is 1.9km – corresponding to a forecast traffic flow of approximately 200,000 vehicle kilometres per day.

### ***Discharge points***

The catchment discharges via existing reticulation and overland flow to the watercourses as described above then into the Waitemata Harbour at Waterview.

Discharges from the SH20 Mount Roskill project within the catchment occur to the main channel at Keith Hay Park and to a tributary channel at the western termination.

### ***Catchment classification***

Urban (from NSHS – 2007).

**Section 1****Catchment Characteristics*****Sensitivity of Receiving Environment***

Attribute scores:	Attributes
Sensitivity	20
Ecological value	10
Human use value	5
Overall sensitivity rating (sum)	35



## Section 2

## Design Philosophy

### 2.1 Design Philosophy

#### 2.1.1 Objectives

The objectives for stormwater management within the SH20 Mount Roskill project were essentially to:

- proactively collect and manage runoff from the project works;
- attenuate this runoff in such a manner as to not result in increased peak discharges to the receiving environment as a consequence of the project being constructed; and
- provide treatment to this runoff prior to discharge to achieve compliance with Auckland Regional Council TP10 Guideline criteria and conditions of designation and resource consent relating to the project works.

#### 2.1.2 Criteria

##### *Water Quality*

The SH20 Mount Roskill project manages runoff from approximately 180,000m<sup>2</sup> of paved surfaces and 72,000m<sup>2</sup> of cut batter surfaces. It provides treatment to Auckland Regional Council TP10 Guideline criteria, which target 75% sediment removal, prior to discharge to the receiving environment.

It is worth noting that prior to construction of the Mount Roskill extension, runoff from the existing SH20 was discharged without any treatment at all.

##### *Water Quantity*

The SH20 Mount Roskill project incorporates flood attenuation provisions that target no increase in peak rate of runoff discharge to the receiving environment as a consequence of project construction.

There are existing flooding issues within the Oakley catchment that have been addressed within the comprehensive discharge consent that Auckland City Council holds for this catchment, and the SH20 Mount Roskill project respects the flood mitigation measures provided for under that consent. In particular, it preserves the capacity of Keith Hay Park to provide flood detention under severe rainfall events.

##### *Transit Standards*

Transit criteria adopted for stormwater management relate essentially to:

- provision for runoff from the 100 year return period (1% AEP) design storm event within channels, culverts, pipe reticulation and overland flow paths; and
- maintenance of appropriate freeboard above floodplain levels to pavement surfaces; and
- use of appropriate materials.

These criteria are entirely consistent with consenting criteria relating to water quality and flood attenuation.

## Section 2

## Design Philosophy

### ***References***

The following documentation has been used in this design:

- ARC Guidelines for Stormwater Treatment Devices 1992, Technical Publication No. 10 (ARC TP10)
- ARC Guidelines for Stormwater Runoff Modelling in the Auckland Region 1999, Technical Publication No. 108 (ARC TP108)
- Highway Surface Drainage Design Guide 1977
- The comprehensive discharge consent held by Auckland City Council for the Oakley catchment, together with supporting reports and modelling data.



## Section 3

## Stormwater Management Devices

### 3.1 Stormwater Management Devices, Methods of Design, Positioning and Construction

#### 3.1.1 Erosion and Sediment Control

Erosion and sediment control measures employed during the construction phase of the project comply with Auckland Regional Council TP90 Guidelines and the relevant conditions of resource consent granted.

#### 3.1.2 Operational Stormwater Management

The stormwater management proposals incorporate:-

- Modifications to the existing reticulation network as necessary to accommodate the motorway extension;
- Piped diversions of two sections of a tributary to the Oakley Creek, namely:
  - a 650m length of watercourse from Melrose Road to Keith Hay Park; and
  - a 250m length of watercourse adjacent to the western termination.
- Various culverts beneath the motorway
- New reticulation serving the motorway extension; and
- Five permanent dual purpose ponds for water quality and flood attenuation purposes, namely:
  - the Beachcroft Avenue pond (wet pond) (Royal Oak catchment)
  - the Melrose Road pond (planted wetland) (Oakley catchment)
  - the Keith Hay Park pond (planted wetland) (Oakley catchment)
  - the Roseman Avenue pond (vegetated sand filter) (Oakley catchment)
  - the Roma Road pond (vegetated sand filter) (Oakley catchment)

The proposal to attenuate peak runoff by incorporating detention ponds at strategic locations throughout the corridor is considered the best practicable option insofar as ponds provided for detention purposes will also be available to serve as treatment devices. These ponds enable the peak rate of runoff during storm events under maximum probable catchment development conditions to be no greater with the motorway constructed than would be the case without it.

In two locations where the underlying strata is suitable the treated, stormwater is also discharged to ground. This occurs at the Roseman Avenue and Roma Road ponds to the extent that the underlying volcanic soils will accommodate this.

Three methods for the treatment of the stormwater have been adopted as follows:

**Wet Pond** - This provides the benefits of: adsorption of organic material; bacterial decomposition; temperature benefits; volatilisation; settling/burial of contaminants in sediments; limited infiltration to groundwater. A wet pond will also provide a habitat for the fish and bird species present in the Onehunga catchment.



## Section 3

## Stormwater Management Devices

**Planted Wetland** - Provides the benefits of: uptake of contaminants in plant biomass; filtration through vegetation; adsorption of organic material; bacterial decomposition; temperature benefits; volatilisation; settling/burial of contaminants in sediments; limited-infiltration to groundwater.

**Vegetated Sand Filter** - Combined with wetland type planting provides the benefits of: infiltration to groundwater; filtration of contaminants and sediments; adsorption of organic material; bacterial decomposition; settling/burial of contaminants in sediments; volatilisation; filtration through vegetation; and uptake of contaminants in plant biomass.

Discharge of treated stormwater occurs in three locations. These are:-

- To Onehunga Bay from the Royal Oak catchment;
- To the main channel of the Oakley Creek at Keith Hay Park; and
- To a tributary of the Oakley Creek at the western termination.

## Section 4

## Cost and Time

### 4.1 Cost

The following cost indications are approximate only, and have been derived from tender price information. A degree of pro-rata adjustment has been necessary in some instances to “break down” costs into the categories listed.

#### ***Resource consents***

Stormwater related resource consents were the subject of a notified hearing by the Auckland Regional Council, and subsequent appeal to the Environment Court. The estimated cost of input by a stormwater specialist to preparation of the assessment of effects on the environment (AEE) that supported the consent applications, and of presenting evidence on the subject at both hearings is approximately \$40,000.

#### ***Building and other consents***

Stormwater management works within this project did not require building consent, but were subject to an engineering approval process by Auckland City Council. This process incurred an estimated cost of approximately \$30,000.

#### ***Final Design***

Design fees for stormwater related works for this project amounted to approximately \$390,000 (rounded).

#### ***Construction***

Construction costs are as follows:

- |    |             |                        |
|----|-------------|------------------------|
| 1. | collection  | \$625,000 (rounded)    |
| 2. | conveyance  | \$11,940,000 (rounded) |
| 3. | attenuation | \$425,000 (rounded)    |
| 4. | treatment   | \$425,000 (rounded)    |

Construction costs indicated are derived from the tender of the successful contractor – actual costs will doubtless have evolved from this position throughout the construction period. URS does not have access to this information.

The project works incorporate five ponds that provide both the attenuation and treatment function. For the purposes of this report, the costs of those ponds have been apportioned equally to those two functions.

#### ***Monitoring Costs***

Construction monitoring has been undertaken by Opus International Consultants Limited, and URS does not have information on these costs.

#### ***Operation and Maintenance Estimated Annual Costs***

Operation and maintenance costs are unknown at this time.



## Section 4

## Cost and Time

### 4.2 Time

#### ***Resource consents***

The AEE that supported the Notice of Requirement for designation and resource consent applications was completed in November 2000.

The Auckland Regional Council hearing for resource consents was held in March 2002.

The Environment Court hearing of appeals occurred in June 2002, and the final determination was released in January 2003.

Accordingly, the resource consent process extended over a period of some 26 months.

#### ***Building and other Consents***

Building consents and engineering approvals were applied for and gained over a 6 month period within the project design phase.

#### ***Final Design Time***

The timeframe for design of this project at award of the professional services contract for the D&PD phase was 12 months.

Subsequent revisions to design criteria by Transit through value engineering, coupled with resolution of Auckland Volcanic Cones Society concerns associated with the impacts of the project works on the Mount Roskill volcanic cone added approximately 6 months to this timeframe.

#### ***Construction***

Construction of the Mount Roskill Extension commenced mid 2005 and is expected to be complete by the end of 2008, or early 2009 – a construction period of approximately 42 months.

*Collection* - Stormwater collection works were constructed progressively throughout the overall construction timeframe of 42 months.

*Conveyance* - Stormwater conveyance works were constructed progressively throughout the overall construction timeframe of 42 months.

*Attenuation* - The Beachcroft Avenue pond in the Royal Oak catchment was constructed over a 7 month period as enabling works ahead of the main contract works commencing. Other stormwater attenuation works were constructed progressively throughout the overall construction timeframe of 42 months.

#### ***Operation and maintenance***

*Life expectancy prior to major works* - The life expectancy of the major works is likely to be of the order of 50 years with minor maintenance works.

*Life expectancy for renewal* - The life expectancy for renewal is likely to be of the order of 50 years.



**Appendix A**

**Stormwater Management System - Location  
Plan**