Memo

To:	Gordon Mockford	From:	Bevan Pratt
Cc:	David Harford	Date:	14 December 2010
Subject:	Outram Water Supply Model		

Introduction

Two Note Ltd are proposing to construct a 36-lot residential subdivision in Outram, located just west of Formby St. In an attempt quantify the effects the subdivision may have on Outram's water supply network, we have constructed a simple model, incorporating the reservoir and all water mains (100mm and above). The model has not been calibrated so the results should be considered with prudence, however we believe it is still a useful tool to indicate how changes (increased demand, possible upgrades) may affect the water supply network.

Outram Water Supply

The Outram water supply is based around a 2000m³ reservoir sited on the hills above Outram with a single gravity main to town feeding into a network of mostly 100mm water mains (there is a 150mm main running through town along Hoylake St). The peak demand recorded over the last few years was 49 m³/hr.

The water source is an infiltration gallery next to the Taieri River, from where it is pumped up to the treatment plant and reservoir. It is currently treated with lime dosing (pH correction) and chlorination. We understand that UV disinfection is also proposed. The treatment plant capacity is understood to be 720 m³/day, and the raw water pump maximum flow rate is 28.3 m³/hr (679 m³/day)[1].

DCC have also commented that the existing raw water pumps cannot meet peak day demands, as the reservoir level does not recover fully each day during periods of high demand, falling steadily over several days, with the lowest recorded level in the last few years being 67%, and the longest continuous running time for the raw water pumps being over 9 days. Under normal circumstances during a dry spell, peak demands will be driven by Indoor domestic water use, domestic lawn watering, market garden irrigation, contractors filling water tankers from hydrants plus undetected background leakage.

Model Construction

The layout of the model has been based on information provided from the DCC GIS system. This has also included pipe sizes, material and age. The level of all nodes within the township has been assumed at 10m MSL (based on contour information). The top and bottom operating levels for the reservoir (50.17m and 44.50m MSL) were obtained from DCC.

We have assumed an average day demand of 273 m³/day (from DCC website), which we have assumed is based on domestic demand of 1000L per lot per day and equivalent to 273 domestic connections. This has been spread over the nodes within the town, based on the number of lots near each node. Peak day demand is assumed to be 3 times average day demand. The daily demand was modelled using a diurnal pattern, with the peak at 6pm assumed to be 1.6 times the daily average (modelled

[1] Email from DCC 17/11/2010

peak hour demand was therefore 54 m³/hr). Fire fighting demand is assumed to be 25 L/s (FW2 classification).

We have assumed the following Hazen-Williams roughness values for pipework:

PVC	140	(excellent condition, smooth flow)
Asbestos Cement	135	(good condition, slight roughness to pipe walls)
Cast Iron	85	(poor condition, extensive tuberculation)

The reason such a low roughness value was chosen for cast iron water mains is that is appears from the GIS that any cast iron mains in the network were installed around 60-80 years ago, and we have found this value to be typical for old iron/steel water mains from our previous experience modelling water supply networks.

Scenarios

A total of 6 scenarios were run in the model, consisting of the existing pipe network and two upgrade scenarios, which were modelled for both the existing demand and the additional demand created from the proposed 36-lot subdivision. The two upgrade scenarios were:

1. Upgrade Cast Iron (C.I.) pipe along Holyhead St. There is a 240m long section of old 125mm cast iron pipe located in Holyhead St between Hoylake and Bidston Sts. The falling main from the reservoir connects into this section pipe, then feeds both ways into the town network. Even if this pipe is in good condition, it will restrict flows into the town water supply network. If it is in poor condition (a reasonable assumption, given that the likely ages of cast iron mains in this network would be 60-80 years), then the pressure losses over this section of pipe during high demand would be quite substantial. The upgrading of this length of pipe has already been recommended in a DCC memo (from Manager, Water and Waste Services dated 19 April 2010) to address low water pressures during high demand.

2. Additional to the upgrade mentioned above, a further upgrade option that we believe could be considered to reduce pressure fluctuations during periods of high demand would be to increase the capacity of the falling main from the reservoir to the town. Therefore we have modelled a scenario where a second 150mm main is constructed from the reservoir to the edge of the residential area, a distance of approximately 420m, so see what effect this might have on pressures in the town network.

Results

The following results show the pressure in the model at the intersection of Lynas and Formby Sts. We have assumed a level of 10m MSL for this location. This point was chosen as it will be affected the greatest by the additional demand from the proposed 36-lot subdivision at 39A Formby St.

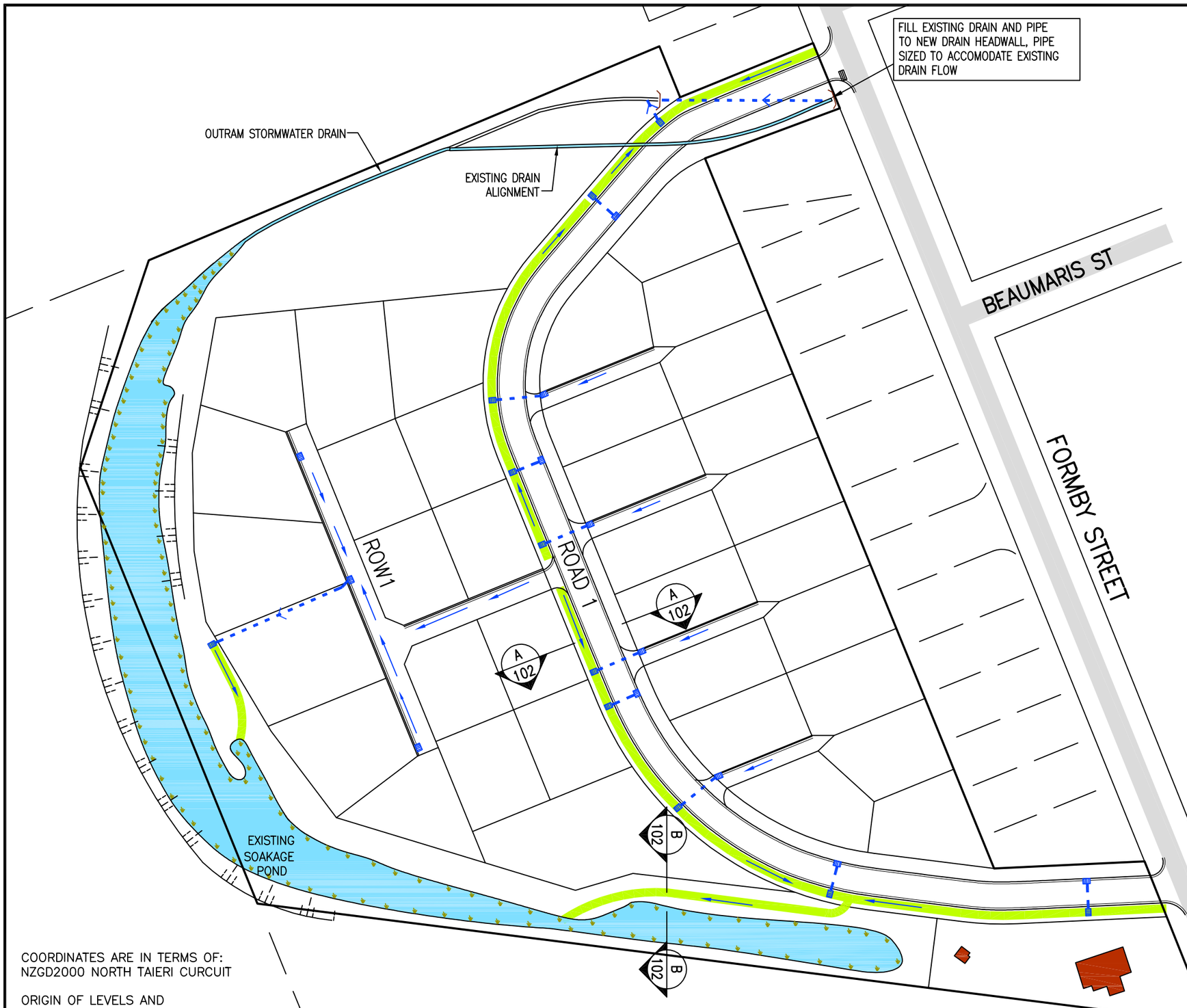
Pre-development				
	Average Day Demand (3.2 L/s)	**Plus fire flow (28.2 L/s)**	**Peak Day Demand (9.5 L/s)**	**Plus fire flow (34.5 L/s)**
Existing network	380kPa	180kPa	370kPa	100kPa
Upgrade C.I. pipe	380kPa	220kPa	370kPa	160kPa
Second 150mm falling main	380kPa	250kPa	380kPa	240kPa
Post-development (extra 36 lots)				
	Average Day Demand (3.6 L/s)	**Plus fire flow (28.6 L/s)**	**Peak Day Demand (10.7 L/s)**	**Plus fire flow (35.7 L/s)**
Existing network	380kPa	150kPa	360kPa	90kPa
Upgrade C.I. pipe	380kPa	200kPa	370kPa	150kPa
Second 150mm falling main	380kPa	270kPa	380kPa	230kPa

Conclusions

It appears that the demand from an additional 36 lots will have little effect on the pressure within the network during periods of high demand, especially once the section of cast iron pipe in Holyhead St has been replaced (if our assumptions on the roughness of the section of cast iron pipe are correct).

The installation of a second falling main (or replacement of the existing main with a larger capacity pipe) would further significantly reduce pressure fluctuations.

No matter what else is done, the raw water pumps and treatment plant will probably need to be upgraded to increase the daily capacity in order to meet any increased demand, though this will depend on what DCC consider to be an acceptable minimum reservoir volume for fire fighting and emergency storage.



NOTE:

1) ALL LOTS TO DISCHARGE TO ROW DIRECTLY TO KERB & CHANNEL OR VIA SUMPS EXCEPT WHERE SHOWN ON ROAD
2) ROW 1 RUNOFF IN KERB & CHANNEL

LEGEND

- EXISTING BUILDING TO REMAIN
- EXISTING DRAIN
- PROPOSED DRAIN ALIGNMENT
- EXISTING WATERWAY
- BUBBLE–UP SUMP
- EXISTING SUMP
- PROPOSED PIPE
- FLOW DIRECTION
- SWALE
- KERB & CHANNEL

DRAFT
DRAWINGS ARE CONCEPT ONLY AND SUBJECT TO FINAL DESIGN

20 10 0 10 20 30 40 50 60 70 80 90 100
Scale 1:1500

COORDINATES ARE IN TERMS OF:
NZGD2000 NORTH TAIERI CURCUIT

ORIGIN OF LEVELS AND COORDINATES IS LINZ GEODETIC MARK A4H4.

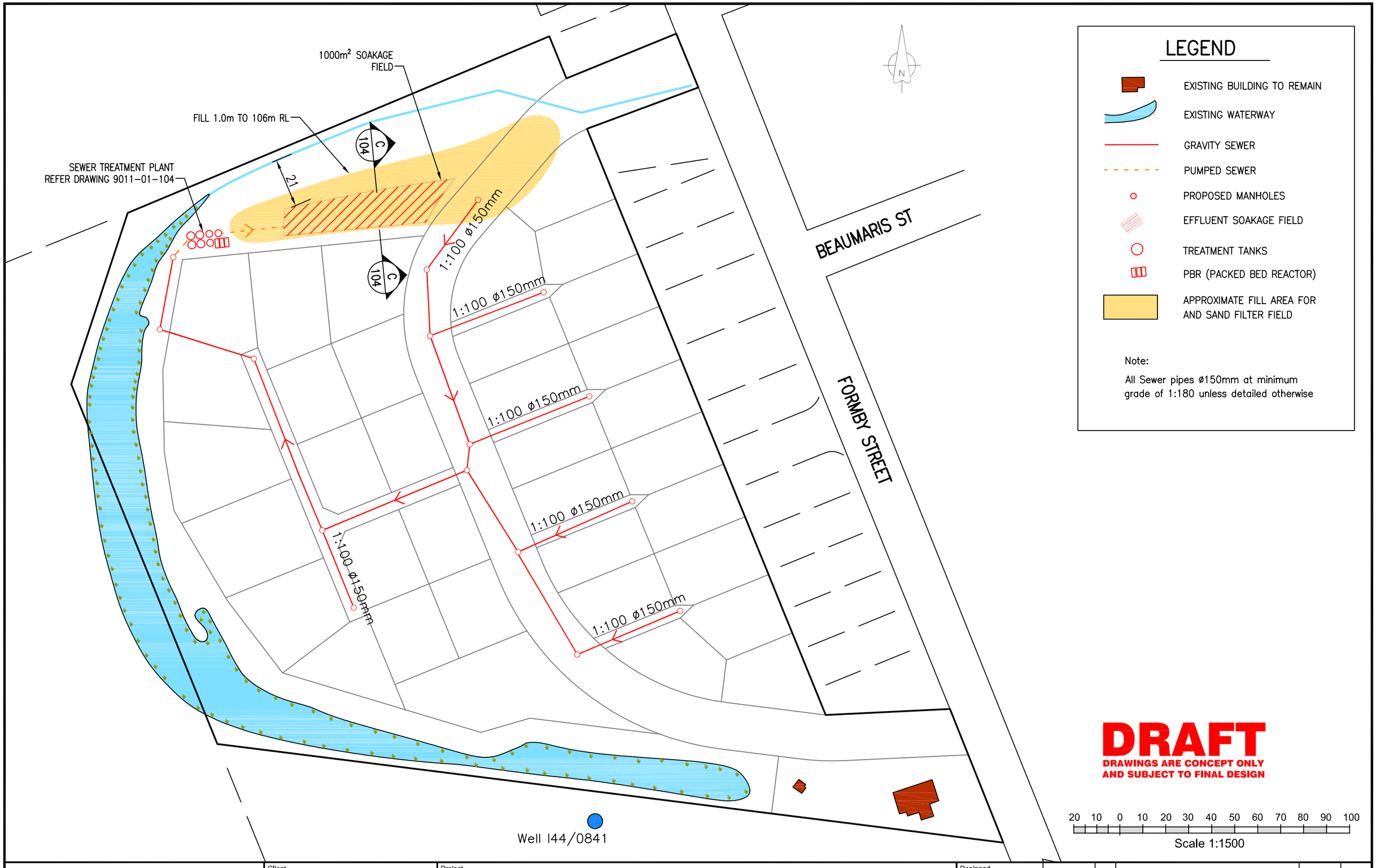
e2environmental CONSULTING ENGINEERS
Level 1, 136 Worcester Street, PO Box 31159, Christchurch
P 64 3 358 4955 www.e2environmental.co.nz

Client: TWO NOTE LTD

Project: PROPOSED SUBDIVISION, 39A FORMBY ST, OUTRAM

Title: CONCEPT STORMWATER DESIGN LAYOUT PLAN

Designed	LB				
Drawn	AF				
Checked		REV	COMMENTS	DATE	APR
Approved		Scale	1:1500 (A3)	Drawing No	9011-01-100
Date	26 AUGUST 2010	Sheet	1 OF 1	Revision	A



LEGEND

- EXISTING BUILDING TO REMAIN
- EXISTING WATERWAY
- GRAVITY SEWER
- PUMPED SEWER
- PROPOSED MANHOLES
- EFFLUENT SOAKAGE FIELD
- TREATMENT TANKS
- PBR (PACKED BED REACTOR)
- APPROXIMATE FILL AREA FOR AND SAND FILTER FIELD

Note:

All Sewer pipes ø150mm at minimum grade of 1:180 unless detailed otherwise

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20 10 0 10 20 30 40 50 60 70 80 90 100

Scale 1:1500

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Client: TWO NOTE LTD

Project: PROPOSED SUBDIVISION, 39A FORMBY ST, OUTRAM

Title: CONCEPT WASTEWATER DESIGN LAYOUT PLAN

Designed	LB				
Drawn	AF				
Checked		REV	COMMENTS	DATE	APR
Approved		Scale	1:1500 (A3)	Drawing No	9011-01-103
Date	22 JUNE 2010	Sheet	1 OF 1	Revision	A

LEVELS ARE IN TERMS OF: DUNEDIN VERTICAL DATUM 1958

COORDINATES ARE IN TERMS OF: NZGD2000 NORTH TAIERI CURCUIT

ORIGIN OF LEVELS AND COORDINATES IS LINZ GEODETIC MARK A4H4.

SEE DRAWING 9011–01–106 FOR TEST PIT LOGS

BEAUMARIS ST

FORMBY STREET

LEGEND

- Existing Building
- 108 Major Contour
- Minor Contour
- 1 Test pit
- Fenceline
- Edge of seal
- Waterway

20 10 0 10 20 30 40 50 60 70 80 90 100

Scale 1:1500

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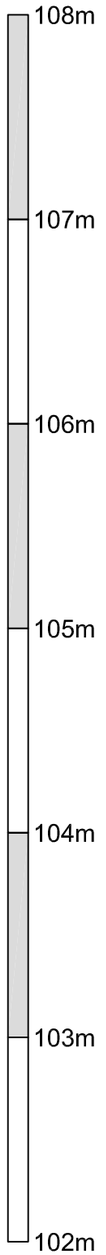
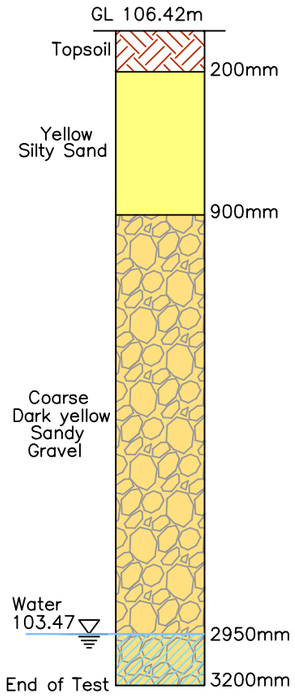
Client: TWO NOTE LTD

Project: PROPOSED SUBDIVISION, 39A FORMBY ST, OUTRAM

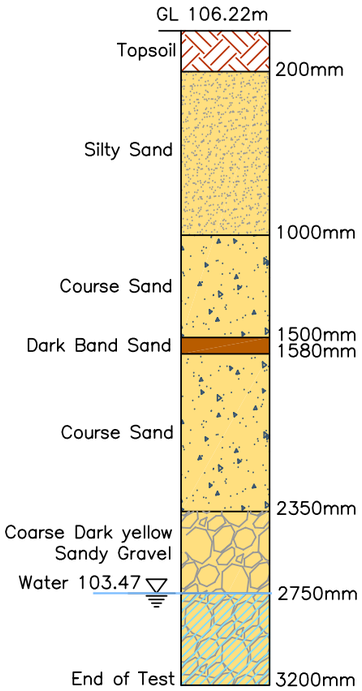
Title: TOPOGRAPHICAL SURVEY AND TEST PIT LOCATIONS

Designed	LB				
Drawn	AF				
Checked		REV	COMMENTS	DATE	APR
Approved		Scale	1:1500 (A3)	Drawing No	9011-01-105
Date	22 JUNE 2010	Sheet	1 OF 1	Revision	A

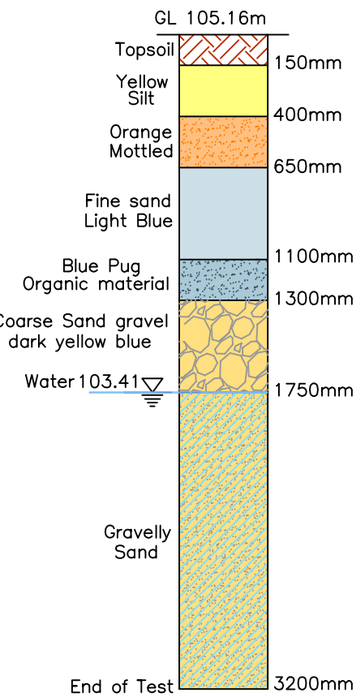




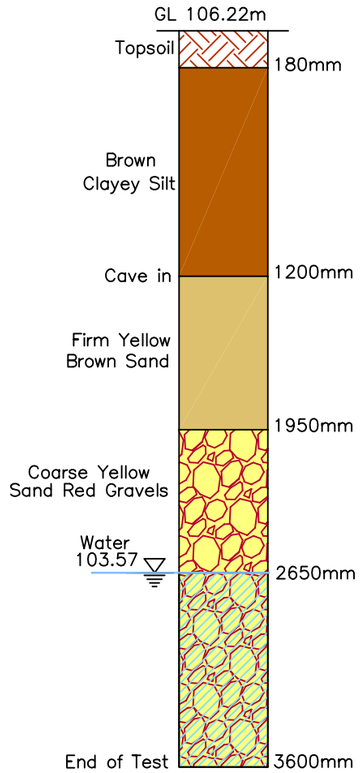
Test Pit 1



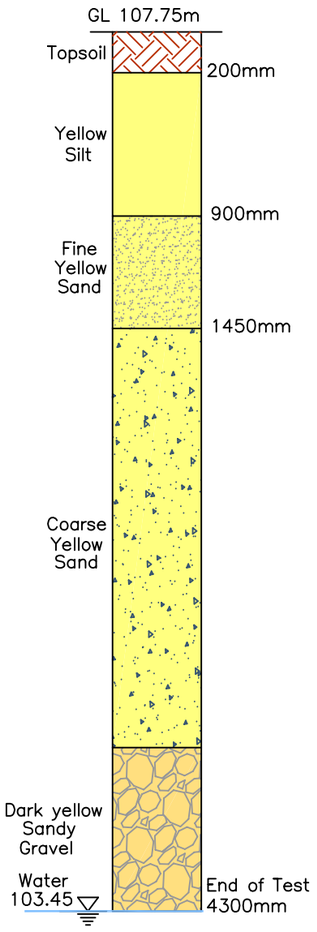
Test Pit 2



Test Pit 3



Test Pit 4



Test Pit 5

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Title: TEST PIT LOGS

Designed LB						
Drawn AF						
Checked		REV	COMMENTS		DATE	APR
Approved		Scale As Shown	Drawing No 9011-01-106			Revision A
Date 22 JUNE 2010		Sheet 1 OF 1				