Frenchs Creek
Flood Study

Final Report

Warringah Council

Final Report
April 2010

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1 FOREWORD

The NSW Government's Flood Prone Land Policy provides for the development of sustainable strategies for managing the occupation and use of floodplains from a risk management hierarchy perspective. The policy has the primary objective *'to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible.'* NSW Government (2005)

Under the adopted policy, management of flood prone land falls to the responsibility of Local Government. The NSW Government subsidies support works to reduce potential flood damage and personal danger in existing developed areas. The Government also provides specialist technical support to assist Councils to ensure that the management of flood prone land is consistent with flood risk, with a view to ensuring that development does not cause an increase in potential liability to all parties.

The Policy provides for technical and financial support by the NSW Government through the following sequential stages:

1. Flood Study – Determines the nature and extent of the flood problem.
2. Floodplain Management Study – Evaluates management options for the floodplain with respect to both existing and future development.
3. Floodplain Management Plan – Involves formal adoption by Council of a plan of management for the floodplain.
4. Implementation of the Plan – Involves construction of flood mitigation works, where viable, to protect existing development.
   – Uses planning controls to ensure that future development is compatible with flood hazards.

The Frenchs Creek Flood Study encompasses stage one of this management process. This study has been prepared by DHI Water and Environment Pty Ltd for Warringah Council to describe and quantify flood behaviour under present catchment conditions.

2 EXECUTIVE SUMMARY

The Frenchs Creek Flood Study covers the catchment area draining to Middle Harbour via Frenchs Creek, Corridor Creek and Haigh Avenue Tributary. The catchment that is the subject of this study is the area bounded by Forest Way to the east, Garigal National Park to the west, Wyatt Avenue to the north, and Blackbutts Road to the south. While the total catchment area of Frenchs Creek is some 550 hectares, the area addressed by this flood study covers the 210 hectare portion of the catchment shown in Figure 1.

In line with normal engineering practice, urban pipe systems are generally designed to carry flows from the more frequent and smaller flood events, for example 50% AEP to 20% AEP events. Excess flows from the more extreme flood events, such as a 1% AEP event, normally travel overland. This is the case with the Frenchs Creek catchment where it leads to flooding of the area.

Overland flooding of Frenchs Creek catchment has historically resulted in inundation of private and commercial property and has affected road and property access. Overland flooding has been reported to have been caused by a range of mechanisms including the accumulation of overland flows in the upper catchment, overland flows exceeding the inlet capacity of the pit and pipe drainage system, surcharging of the pit and pipe stormwater system, flows exceeding the capacity of open channels in the catchment and blockage of the stormwater system inlets.

A flood study of the Frenchs Creek catchment has been undertaken to determine the existing flood behaviour of flood prone areas for a range of flood risk levels from the 20% Annual Exceedance Probability (AEP) event through to the Probable Maximum Flood (PMF). The impacts of climate change will be investigated in the floodplain risk management study and will be reported in the Floodplain Risk Management Study Report.

Flood behaviour was determined for flood prone areas using mathematical modelling tools developed specifically for the study. Catchment runoff and overland flows were calculated using the MIKE Storm modelling software. MIKE Storm is a hybrid model that combines the features of a fully dynamic pipe network model, including the stormwater pit and pipe network and a two dimensional, physically based hydrological catchment model for surface flow modelling into a system modified specifically for urban storm water applications.

The MIKE Storm model allows for a distributed, physically based approach to rainfall runoff, with rainfall time series applied directly to a two dimensional grid representation of the catchment surface. Overland flow routing of the rainfall excess is via the two dimensional grid. The sub surface pipe network and overland flow components of the modelling system are linked through dynamic coupling of the model domains via storm water pit linkages. Linkages are automatically configured for appropriate inlet capacity and head loss conditions.

Allowance for the impact of fences was made by increasing local roughness. Allowance for the impact of blockage in pits and pipes was made by reducing flow

capacity into the inlets and the culverts. Both these allowances were incorporated into the modelling scenarios.

The model was calibrated to two historical storm events: April 1998 and March 2003. The calibrated model was also validated against regional design flow rate estimates. Historical flood information for model calibration was obtained from Council records and the local community.

Design rainfall intensities and temporal patterns for the required range of design flood events were obtained from *'Australian Rainfall and Runoff*' (Reference /4/) and *'The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method*' Bureau of Meteorology (Reference /5/).

Plans showing the approximate extent of overland flooding for the 1% AEP, 2% AEP, 5% AEP, 20% AEP and the PMF events are included in Figures 17 to 21. Indicative flow depth maps for the 1% AEP and PMF flood events are presented as Figures 22 and 23. Figures 24 and 25 present the likely impact to flood behaviour from blockage of the pit and pipe storm water system for 1% AEP and Figure 26 for PMF events. Provisional flood hazard classification of the catchment is presented in Figures 27 and 28 with a Floodplain Hydraulic Classification for overland flow paths provided in Figures 29 and 30. Figure 31 presents the flood extents determined for the flood planning level and the 1%AEP and PMF flood events.

The developed flood modelling tools and reported flood behaviour for existing catchment conditions can now be used as the basis for developing a Floodplain Risk Management Study and Plan for flood prone land in the catchment. The hydraulic model developed for this Flood Study may generally be used to assess the hydraulic impact of any proposed structural flood mitigation works on flood behaviour.

3 GLOSSARY OF TERMS

This glossary is based on the glossary of terms published in the New South Wales Government Floodplain Development Manual (2005).

Annual exceedance probability (AEP)

The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. For example, if a peak flood of discharge 500 m^3/s has an AEP of 5%, it means that there is a 5% chance of (that is one-in-20 chance) of a peak flood discharge of 500m^3/s or larger occurring in any one year (see average recurrence interval).

Australian height datum (AHD)

A common national plane of level corresponding approximately to mean sea level.

Average recurrence interval (ARI)

The long term average number of years between the occurrence of a flood as big, as or larger than, the selected event. For example, floods with a discharge as great as, or greater than, the 20 year ARI flood event will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event.

Cadastre, cadastral base

Information in map or digital form showing the extent and usage of land, including streets, lot boundaries, water courses etc.

Catchment

The land area draining through the main stream, as well as tributary streams to a particular site. It always relates to an area above a particular location.

Discharge

The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second (m^3/s). Discharge is different from the speed or velocity of flow, which is a measure of how fast the water is moving for example, metres per second (m/s).

Flash flooding

Flooding which is sudden and unexpected. It is often caused by sudden local heavy rainfall. Often defined as flooding which peaks within 6 hours of the causative rain.

Flood

Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, lake or dam and/or overland flooding associated with major drainage before entering a watercourse and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.

Flood fringe areas

The remaining area of flood prone land after floodway and flood storage areas have been defined.

Flood liable land

Is synonymous with flood prone land (i.e.) land susceptible to flooding by the probable maximum flood (PMF) event. Note that the term flood liable land now covers the whole of the floodplain not just that part below the flood planning level as indicated in the 1986 Floodplain Development Manual (see flood planning area).

Flood mitigation standard	The average recurrence interval of the flood, selected as part of the floodplain risk management process that forms the basis for physical works to modify the impacts of flooding.
Floodplain	Area of land, which is subject to inundation by floods up to, and including the probable maximum flood event, that is, flood prone land.
Floodplain risk management options	The measures that might be feasible for the management of a particular area of the floodplain. Preparation of a floodplain risk management plan requires a detailed evaluation of floodplain risk management options.
Floodplain risk management plan	A management plan developed in accordance with the principles and guidelines of the NSW Government Floodplain Development Manual 2005. Usually includes both written and diagrammatic information describing how particular areas of flood prone land are to be used and managed to achieve defined objectives.
Flood plan (local)	A sub-plan of a disaster plan that deals specifically with flooding. They can exist at State, Division and local levels. Local flood plans are prepared under the leadership of the NSW Emergency Service.
Flood planning area	The area of land below the flood planning level and thus subject to flood related development controls. The concept of flood planning area generally supersedes the "flood liable land" concept of the 1986 Floodplain Development Manual.
Flood planning levels (FPLs)	Are the combinations of flood levels and freeboards selected for the planning purposes, as determined in floodplain risk management studies and incorporated in floodplain risk management plans. The concept of flood planning levels supersedes the "standard flood event" of the 1986 Floodplain Development Manual.
Flood prone land	Is land susceptible to flooding by the probable maximum flood (PMF) event. Flood prone land is synonymous with flood liable land.
Flood risk	Potential danger to personal safety and potential damage to property resulting from flooding. The degree of risk varies with circumstances across the full range of floods. Flood risk is divided into 3 types, existing, future and continuing risks. They are described below. **Existing flood risk:** the risk a community is exposed to as a result of its location on the floodplain. **Future flood risk:** the risk a community may be exposed to as a result of new development on the floodplain. **Continuing flood risk:** the risk a community is exposed to after flood risk management measures have been implemented. For a town protected by levees, the continuing flood risk is the consequences of the levees being overtopped. For an area without any floodplain risk management measures, the continuing risk is simply the existence of flood exposure.

Flood storage areas	Those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood. The extent and behaviour of flood storage areas may change with flood severity and loss of flood storage can increase the severity of flood impacts by reducing the natural flood attenuation. Hence it is necessary to investigate a range of flood sizes before defining flood storage areas.
Floodway areas	Those areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or significant increase in flood levels.
Freeboard	A factor of safety typically used in relation to the setting of floor levels, levee crest levels etc. It is usually expressed as the difference in height between the adopted flood planning level and the flood used to determine the flood planning level. Freeboard provides a factor of safety to compensate for uncertainties in the estimation of flood levels across the floodplain, such as wave action, localised hydraulic behaviour and impacts that are specific event related, such as levee and embankment settlement and other effects such as "greenhouse" and climate change. Freeboard is included in the flood planning level.
Geographical information systems (GIS)	A system of software and procedures designed to support the management, manipulation, analysis and display of spatially referenced data.
Hazard	A source of potential harm or a situation with a potential to cause loss. In relation to the NSW Floodplain Development Manual 2005 the hazard is flooding which has the potential to cause damage to the community.
Hydraulics	The term given to the study of water flow in waterways, in particular, the evaluation of flow parameters such as water level and velocity.
Hydrograph	A graph that shows how the discharge or stage/flood level at any particular location changes with time during a flood.
Hydrology	The term given to the study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods.
Local overland flooding	Inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam.
Mainstream flooding	Inundation of normally dry land occurring when water overflows the natural or artificial banks of a stream, river, estuary, lake or dam.

Major drainage

Councils have the discretion in determining whether urban drainage problems are associated with major or local drainage. For the purposes of the NSW Floodplain Development Manual, major drainage involves:

- The floodplains of original watercourses (which may now be piped, channelised or diverted), or sloping areas where overland flows develop along alternative paths once the system capacity is exceeded; and/or
- Water depths generally in excess of 0.3m (in the major system design storm as defined in the current version of Australian Rainfall and Runoff). These conditions may result in danger to personal safety and property damage to both premises and vehicles; and/or
- Major overland flow paths through developed areas outside of defined drainage reserves; and/or
- The potential to affect a number of buildings along the major flow path.

Mathematical/computer models

The mathematical representation of the physical processes involved in runoff and stream flow. These models are often run on computers due to the complexity of the mathematical relationships between runoff, stream flow and the distribution of flows across the floodplain.

Minor, moderate and major flooding

Both the NSW Emergency Service and the Bureau of Meteorology use the following definitions in flood warnings to give a general indication of the types of problems expected with a flood.

Minor flooding: causes inconvenience such as closing of minor roads and the submergence of low level bridges. The lower limit of this class of flooding on the reference gauge is the initial flood level at which landholders and townspeople begin to flood.

Moderate flooding: low-lying areas are inundated requiring the removal of stock and or the evacuation of some houses. Main traffic routes may be covered.

Major flooding: appreciable urban areas are flooded and/or extensive rural areas are flooded. Properties, villages and towns can be isolated.

Modification measures

Measures that modify either the flood, the property or the response to flooding.

Peak discharge

The maximum discharge occurring during a flood event.

Probable maximum flood (PMF)

The largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation. Generally, it is not physically or economically possible to provide complete protection against this event. The PMF defines the extent of flood prone land, that is, the floodplain. The extent, nature and potential consequences of flooding associated with the PMF should be addressed in a floodplain risk management study.

Probable maximum precipitation (PMP)	The greatest depth of precipitation for a given duration meteorologically possible over a given size of storm area at a particular location at a particular time of the year, with no allowance made for long term climatic trends (World Meteorological Organisation, 1986). It is the primary input to the estimation of the probable maximum flood.
Probability	A statistical measure of the expected chance of flooding. (see annual exceedance probability).
Runoff	The amount of rainfall that actually ends up as stream flow, also known as rainfall excess.
Stage	Equivalent to 'water level'. Both are measured with reference to a specified datum.
Stage hydrograph	A graph that shows how the water level at a particular location changes with time during a flood. It must be referenced to a particular datum.
Survey plan	A plan prepared by a registered surveyor.
Topography	A surface which defines the ground level of a chosen area.
Water surface profile	A graph showing the flood stage at any given location along a water course at a particular time

* This glossary has been developed in consultation with the NSW Floodplain Development Manual (2005).

4 INTRODUCTION

The Frenchs Creek Flood Study covers a portion of the total 550 hectare Frenchs Creek catchment draining to Middle Harbour via Frenchs Creek, Corridor Creek and Haigh Avenue Tributary. The catchment that is the subject of this study is the area bounded by Forest Way to the east, Garigal National Park to the west, Wyatt Avenue to the north, and Blackbutts Road to the south. The study catchment covers a total area of 210 hectares and is indicated in Figure 1.

Overland flooding of the Frenchs Creek catchment has historically resulted in inundation of private and commercial property and has affected road and property access. Overland flooding has historically been caused by a range of mechanisms including the accumulation of overland flows in the upper catchment, overland flows exceeding the inlet capacity of the pit and pipe drainage system, surcharging of the pit and pipe stormwater system, flows exceeding the capacity of open channels in the catchment and blockage of the stormwater system inlets.

In line with normal engineering practice, urban pipe systems are generally designed to carry flows from the more frequent and smaller flood events, for example 50% AEP to 20% AEP events. Excess flows from the more extreme flood events, such as a 1% AEP event, normally travel overland. This is the case with the Frenchs Creek catchment where it leads to flooding of the area.

The recognition of these issues has prompted Warringah Council to prepare a detailed flood study review to identify properties affected by overland flooding in the Frenchs Creek catchments.

Warringah Council has commissioned the Frenchs Creek Flood Study to determine the flood behaviour for the 1%, 2%, 5%, 20% AEP and PMF design flood events for present catchment conditions. The impacts of climate change on flooding will be assessed and reported as part of the floodplain risk management study. Overland flood behaviour will be described by the nature and extent of flooding through the estimation of design flows, levels and velocities.

The study was completed in three stages. Firstly, data collection was undertaken to collate historical flood information including historical rainfall and flood level data and also to collect relevant information to describe the physical size and nature of the catchment and the stormwater asset. Secondly, a combined hydrologic/hydraulic modelling tool of the Frenchs Creek catchment was developed and validated using the historical storm data.

Finally the validated hydraulic model was used in conjunction with design rainfall conditions to estimate design overland flooding behaviour in the catchment for a range of risk levels for existing catchment conditions. The developed model will be used to investigate various management options to assist in determining sustainable flood risk management strategies for the catchment floodplain in the Floodplain Risk Management Study.

5 CATCHMENT DESCRIPTION

The Frenchs Creek Flood Study area comprises approximately 210 hectares in the Upper Middle Harbour catchment. The catchment covers parts of the urban residential areas of Belrose and Frenchs Forest in the Warringah Council local government area. The study area comprises the areas of Belrose and Frenchs Forest draining to Frenchs Creek, Corridor Creek and Haigh Avenue Tributary. This catchment area is roughly bounded by Forest Way to the east, Garigal National Park to the west, Wyatt Avenue to the north, and Blackbutts Road to the south. An overview of the study area is provided in Figure 1.

The Frenchs Creek catchment is a moderately steep, urbanised catchment. It is characterised by predominantly low-medium density urban development. Most of the catchment is serviced by formalised kerb and gutter connecting to a sub-surface piped stormwater system. In the lower parts of the study area, the sub-surface piped system drains to the open channels of Frenchs Creek and Corridor Creek. In the southwest of the catchment there are a number of formal overland flow paths that exist and form the Haigh Avenue Tributary. Many reaches of these two channels have been altered from their natural state by concrete or block lining. The open channels run through narrow drainage easements which are restricted by the close proximity of residential properties whose boundary fences restrict flows in some instances.

Frenchs Creek Arm Sub-catchment

In the north of the study area, the Frenchs Creek arm originates in the vicinity of Wyatt Avenue. The natural swales and gullies that would once have collected rainfall in this area have been replaced by a piped stormwater system and formal overland flow paths. The system is presently an enclosed system until it reaches Pringle Avenue, in the geographical centre of the catchment. The piped system upstream of Pringle Avenue generally follows the natural creek line, down Neridah Avenue, through Curragundi Avenue, through Lyndale Place (the former Dairy Farmers Site), St Anne's Close, Knightsbridge Avenue and the back of properties in Pringle Avenue until the Pringle Avenue intersection with Hews Parade where the open channel begins. In storm conditions the overland flows are likely to have a tendency to follow the original creek line, causing road and property flooding.

Corridor Creek Tributary Sub-catchment

Corridor Creek runs through the former Belrose – St Ives Road corridor. The creek channel has been moved from its assumed natural alignment where it ran down what is now Kapunda Place. During storm flow conditions, overland flows are likely to follow this original creek line, causing flooding to properties in Kapunda Place.

Lower Catchment

Corridor Creek merges with Frenchs Creek in the reserve area to the east of Kew Close. From here Frenchs Creek flows to Elm Avenue, where it passes through the Elm Avenue culverts and along the northern side of Calool Crescent. This area has experienced flooding problems in the past and has been the focus of a number of former studies.

Haigh Avenue Tributary Sub-Catchment

A third watercourse, known as the Haigh Avenue tributary, joins Frenchs Creek just downstream of Calool Crescent immediately upstream of the study boundary. This tributary has formal overland flow paths that discharge overland flows from Lionel Watts Park, Frenchs Forest Showground and Glenrose Shopping Centre.

6 STUDY APPROACH

The objectives of the Flood Study were to:

a) Compile all available flood related data for the study area by searching relevant data sources;
b) Undertake a community survey of residents in the catchment to collect historical information describing overland flows and community opinion regarding drainage in the catchment;
c) Determine the likely extent and behaviour of historical overland flows by reviewing the compiled data and feedback from the resident survey;
d) Define existing flood behaviour for the Frenchs Creek catchment by calibration/verification to historical flood data;
e) Describe existing flood risk in the study area by documenting flood levels, velocities and flow distributions for the Frenchs Creek catchment for a range of flood risk levels; and to
f) Map the extent of flooding for a range of flood risk levels for the Frenchs Creek catchment.

A combined hydrologic/hydraulic modelling tool was developed in order to meet the objectives of defining existing flood behaviour for various risk levels. The modelling system comprised of a two-dimensional representation of the catchment surface dynamically linked to a pipe network model of the sub-surface stormwater system. Section 9 discusses the development of the modelling system utilised for the study.

Topographical and flood record data compiled from existing reports and files relevant to the Study are discussed in Section 8 of this report. Where possible the data have been registered in MapInfo Geographic Information System (GIS) format for ease of presentation and analysis.

Results from the models describing the existing overland flow behaviour of the catchment are presented in Section 10, with plots of approximate flood extents presented in the figures attached to the report.

Additional important historical data, community survey responses and model result data are presented in the appendices of the report. The appendices are included to provide the reader with an overview of flood behaviour in the catchment and additional background information collected by the Flood Study.

7 COMMUNITY CONSULTATION

Community and stakeholder consultation is an important and integral part of the floodplain management process for the Frenchs Creek catchment. Initial consultation for the Frenchs Creek Flood Study involved announcing the study to the wider community via Council's regular column in Saturday's Manly Daily. A press release appeared in the column in November 2004.

Accompanying the press release in November 2004, Council distributed a newsletter and questionnaire by letterbox drop to residents identified as living in areas known to be and predicted to be, subject to overland flooding. The purpose of the newsletter and questionnaire was to inform the community of the Flood Study and also to access community knowledge of historical overland flooding in the study area. The questionnaire sought advice as to whether residents have experienced overland flooding, the nature and depths of flows and the timing of such flows. It also provided an opportunity for the residents to express their support for various types of flood management measures across a range of available alternatives.

Approximately 1350 copies of the community newsletter and flood questionnaire were circulated through the community. A total of 186 replies were returned via the reply-paid envelope from the total circulation of 1350 questionnaires. This is a return rate of 13.7% on questionnaires circulated.

Community members identified as potentially having more detailed information on past flood events were contacted by DHI for follow up interviews. A total of 84 property owners were interviewed either by phone or face to face for their recollections and views on flooding in the catchment. Many photographs and video footage of recent flooding in the catchment were provided by the community for reference.

The Belrose Open Space Corridor Association (BOSCA) is a key community group in the catchment. BOSCA was approached initially by letter in September 2004. Meetings were held on site with BOSCA representatives in October on two occasions where firsthand knowledge of historical flooding and BOSCA's views on potential flood management measures were discussed.

As well as the local community, the NSW Department of Natural Resources (formally Department of Infrastructure, Planning and Natural Resources – DIPNR and now incorporated in DECCW), NSW Roads and Traffic Authority and the local representatives of the NSW Emergency Service were contacted to inform them of the study and request flooding information. No flood information was provided by these departments.

Information collected from the community questionnaires, and resident and stakeholder interviews is presented as Appendix A of this report, along with a copy of the Manly Daily Press Release, Community Newsletter and Questionnaire.

A draft of this Flood Study report was exhibited for public comment from the 28th of November 2005 until the 10th of February 2006. The exhibition was announced in Council's regular column in the Manly Daily. As well, all residents whose property

was identified as being within the flood planning zone were notified of the exhibition directly by mail. The report was placed on display at Council's Customer Service Centre in Dee Why and at Belrose Library. An open day to discuss the report was held on Saturday 10th of December 2005 at Glenrose Shopping Centre from 10am to 3pm. Subsequent to the first public exhibition, the flood extents were changed to reflect the effect of blockages of the pits and pipes in the catchment. As a result of this change in flood extents, the amended final draft was exhibited for public comment for a second time from 1 June 2009 until 29 June 2009.

One written submission was received during the first public exhibition period. This submission describes historical flooding in St Annes Close, and suggests solutions to mitigate flooding in this area. Following the second public exhibition, 16 submissions were received.

8 DATA

Data has been collated for the Flood Study from a variety of sources. The data includes information describing historical overland flow behaviour that has occurred in the catchment and data essential for the development and validation of the modelling tools. Information and feedback relevant to the flood study has been obtained from a range of sources. Data presented in this report has been sourced from:

- Warringah Council files and records;
- Previous studies and reports;
- Sydney Water Corporation;
- Dept of Commerce, Manly Hydraulics Laboratory;
- Residents of the Belrose/Frenchs Forest area;
- Belrose Open Space Corridor Association (BOSCA);
- Local newspapers;
- Roads and Traffic Authority; and
- Department of Natural Resources (formally DIPNR).

8.1 Previous Relevant Studies

A number of previous studies have been undertaken in the Frenchs Creek catchment area.

The *'Warringah Council Creek Management Strategy'*, MWH (2004), was developed to provide a sound basis for the protection and repair of all the creeks in the Warringah local government area, including Frenchs Creek. Development control was identified as being of high priority for Frenchs Creek, while weed control, catchment planning control and the development of a creek management plan were identified as being of medium priority.

The report entitled *'Flood Information for the Flood Event of March 10 2003'* by Webb McKeown (2003) represents a photographic survey of the catchment during and after the storm event of the 10th March 2003. Water is observed flowing through properties and residences and across roads in the vicinity Lyndale Close/St Annes Close, Calool Crescent/Elm Avenue and Knightsbridge Close. Damage and debris around Kapunda Place and Winani Close indicate the floodwater levels in those areas during the event.

The *'Frenchs Creek, Belrose, Investigation of Flood Problem – Elm Avenue to Calool Crescent'* and the associated *'Compendium of Flood and Drainage Information'*, Webb McKeown (2001), focuses on the flooding issues in the lower part of the Frenchs Creek catchment, specifically the area immediately up and downstream of the Elm Avenue culverts. Extensive data collection was undertaken, including the distribution of a questionnaire to residents. Hydrologic and hydraulic models of the catchment were built and calibrated to the April 1998 event. A range of flood mitigation options were investigated. It was concluded that while improvements to flood risk could be achieved for frequent storm events, events in excess of 10% AEP would experience no appreciable improvements.

The *'Stormwater Drainage Investigation Report'*, Warringah Council (1999), details Council's investigation into the impact of the storm events of April and August 1998.

The *'Report on Flooding Impact/Damage from the storm of 10th April 1998'*, Flood Impacted Residents of Belrose Association (1998), documents the impact of the storm event of the 10th April 1998 on residents west of Pringle Avenue and discusses their observations and concerns regarding drainage and the proposed corridor development.

The '*Belrose Corridor Drainage Study'*, Webb McKeown (1997), examines the proposed Belrose Corridor development and the impact this would have on local stormwater drainage. A hydrological model was built to assess current and future rainfall runoff volumes and the flood impact for various risk levels on known flood affected areas around Pringle Avenue, Elm Avenue and Calool Crescent. This report proposes a drainage layout for the corridor development to ensure the current drainage situation in Frenchs Creek catchment is not exacerbated by the proposed development.

The '*Submission to Council re Flooding of Residential Properties in Curragundi Avenue, Belrose'*, Ian Gillespie (1989), was prepared by residents of Curragundi Avenue after the storm event of 6th January 1989. It includes observations, photographs and a questionnaire prepared and completed by the residents. These observations note that flooding has been observed to worsen in past 10 years as development north of Wyatt Avenue progressed and that many of the pits in Curragundi Avenue surcharge on events less intense than that of the 6th January 1989.

Other studies include a number of drainage investigations performed by Warringah Councils on the following locations:

- Elm Avenue and Calool Crescent
- Curragundi Avenue
- Lyndale Place and St Anne's Close
- Knightsbridge Avenue
- Kapunda Place

A number of other studies have been undertaken in the area, and while these do not apply directly to the Frenchs Creek catchment they are relevant to the understanding the catchment's contribution to flooding in the wider area.

The '*Northern Beaches Stormwater Management Plan*', Patterson Britton and Partners (1999) represents the fifth stage in the stormwater management process for the Northern Beaches catchment, defining the nature of the flood hazard, identifying and assessing the potential measures aimed at reducing the impact of flooding on both existing and future development within the catchment. The Northern Beaches catchment comprises areas draining to the Pacific Ocean north of Sydney Harbour and south of Narrabeen Lagoon, including parts of Warringah and Pittwater, and all of the Manly local government areas. The Frenchs Creek catchment lies to the west of the Northern Beaches catchment.

8.2 Cadastral and Topographic Data

Warringah Council provided cadastral base information and Land and Property Information (LPI) and NSW 2 metre ground surface contour files in GIS digital format for use during the Flood Study. The MapInfo GIS database has been used as a spatial reference for storing and presenting the various data collated for the Study.

Photogrammetric remote sensing techniques were used to develop 0.5m contours of the Frenchs Creek study area. The photogrammetry was developed using low-level colour aerial photography. Ground control was developed using well-defined feature points visible in the photography. The manhole cover levels for the stormwater system were also obtained using this photogrammetry technique.

8.3 Ground Survey

In the first instance, a detailed inspection of the Frenchs Creek catchment was undertaken with Council's representatives, who identified known overland flow paths and the topographical and man-made features believed to influence overland flows in the catchment.

The photogrammetric and supplementary ground survey gathered detailed information describing the catchment terrain were focussed on the areas most likely to be subject to overland flows. Photogrammetric survey was developed using low level (1:4000 scale date of photography 16/12/02) colour aerial photography for mapping purposes. All photography was exposed with 60% forward overlap and 25% side lap using a Cessna 402 twin engine aircraft and Leica high-resolution aerial survey camera. Ground control was developed using well-defined feature points which was located in areas which are visible in the photography. 15 ground control points were used over the study area. Ground control was used to reduce the survey data to MGA (zone 56) coordinates and AHD datum for mapping and triangulation purposes. Ground survey was provided as 0.5m contours. The accuracy of the ground survey was confirmed as:

- Vertical approx +/- 0.10m
- Horizontal approx +/- 0.12m

The supplementary survey taken using traditional ground survey techniques was used to accurately define the capacity of the open creek channels.

Some ground survey data were available from previous studies in the area, including cross sections of lower Frenchs Creek channel, downstream on Elm Avenue. These cross sections along with other ground survey taken by traditional methods were used to supplement the 0.5m contours derived from photogrammetry. Figure 2 shows the location of both the existing sections from recent past studies and the cross sections measured for this study.

Survey was also undertaken to establish calibration levels for peak flood elevation for historical floods in the catchment. These levels were identified by residents of the Frenchs Creek catchment during the community consultation.

ALS data were collected in 2007, after the Frenchs Creek MIKE Storm model was set up and the modelling completed. Following analysis of the overland flow paths produced by the model and the ground terrain from the ALS, Council considered that it was not necessary to enter the ALS into the existing model. It should be noted that the ALS has an estimated +/- 0.2m vertical accuracy.

8.4 Storm Water Network

Pit and pipe data for the storm water network for the Frenchs Creek Flood Study area were supplied by Warringah Council. This network data was imported to the MIKE Storm model using direct database links. The storm water system for the Frenchs Creek Flood Study is shown in Figure 3.

Councils stormwater infrastructure details were indicative only and were the best available to Council at the time it was provided to DHI. Where works as executed drawings were available, these were incorporated in Council's stormwater infrastructure. A significant effort has been made to ground truth the location and size of the pit and pipe network to ensure that the underground system is correctly represented in the hydraulic model.

8.5 Flooding History

In order to establish the existing behaviour of overland flooding in the catchment it is important to first establish the history of overland flooding in the study area. Some information describing historical flooding was available from Warringah Council records and previous studies and further information of historical flooding was forthcoming from the community through the consultation process.

Council's records and the community consultation process provided a range of information on historical overland flows in the catchment. Much of the information is however descriptive rather than quantitative (i.e. surveyable). Many residents can recall different properties flooding and describe the approximate flow paths and duration of flows, but accurate recollection of the time and date of flows and measurable peak flow heights was found to be sparse.

A number of historical storms that caused flooding in the catchment have been identified from available information and are listed in Table 1.

Table 1: List of Identified Storm Events

Year	Month	Date
1989	January	6
1990	August	1
1995	February	10
1996	August	31
1998	April	10
1998	August	7-8
2003	March	10

Several properties have already been identified as being affected by overland flows in these past floods. The properties are generally within the vicinity of:

- Calool Crescent
- Elm Avenue
- Curragundi Avenue
- Kapunda Place
- Lyndale Place
- Knightsbridge Avenue
- Trentbridge Avenue
- Pringle Avenue

8.6 Historical Flow Levels and Discharges

Many community members provided information identifying overland flow paths that have been active in the past. Information on the flows includes qualitative information on flow direction, approximate flow depth and speed, and duration of flows. A number of community members were also able to provide reliable information on measurable peak flood levels for specific storm events. These locations are detailed in Table 2 below. These flood marks were surveyed and the reduced elevation levels are also presented in Table 2. Water levels observed from the April 1998 storm event were also identified in a previous resident questionnaire survey and were topographically surveyed as part of a previous study by Webb McKeown and Associates in the Elm Avenue / Calool Creek area (Reference /12/). The 1998 flood levels surveyed by Webb McKeown are also included in Table 2. The water level locations are presented in Figure 4.

No flow gauging exists for the catchment.

Table 2: Historical Flood Levels

No	Street Name	Description	Year	Month	Date	Level mAHD
81	Pringle Avenue	Peak water level 40mm above property floor level.	1998	04	10	133.77
	Winani Close	* WMA report – road crest at end of cul-de-sac (house owner was not present during flood event).	1998	04	10	130.0
	Elm Avenue	* WMA report – road crest at culverts.	1998	04	10	125.7
8a	Elm Avenue	* WMA report – at front of property.	1998	04	10	126.9
3	Calool Crescent	* WMA report – at front boundary with road.	1998	04	10	124.1
15	Calool Crescent	* WMA report – at front of property.	1998	04	10	122.9
19	Calool Crescent	* WMA report – at front of house.	1998	04	10	121.7
13	Calool Crescent	Centreline of driveway.	2003	03	10	122.71
19	Calool Crescent	High water mark on brick fence in front garden.	2003	03	10	121.53
21	Calool Crescent	Peak water level reached patio by front door.	2003	03	10	122.48
6	Kapunda Place	Peak water level just below property floor level.	2003	03	10	147.91
43	Knightsbridge Avenue	Peak water level 100mm above floor level of property.	2003	03	10	146.89
12-13	Lyndale Place	High water mark on log fence in easement between properties.	2003	03	10	151.02
20	Pembroke Place	Peak water level 150mm above property floor level.	2003	03	10	146.56
136	Pringle Avenue	Peak water level 450mm above property floor level.	2003	03	10	142.60
3	St Annes Close	Peak water level 100mm above property floor level.	2003	03	10	150.07
4	St Annes Close	Peak water level 75mm above property floor level.	2003	03	10	150.66

Note: * The location of the surveyed water level was obtained from the YSCO Geomatics survey drawing 'Plan Showing Water Level Information and Survey Detail at Elm Evenue & Calool Crescent, Belrose', dated 12 November 2001 in Appendix B of the Webb McKeown report 'Investigation of Flood Problem – Elm Avenue to Calool Crescent (Reference /12/). Exact locations of surveyed water levels were not provided in the report.

8.7 Historical and Design Rainfall Data

A number of storm events for the Frenchs Creek catchment were identified from both the Councils own records and the responses received during the residential survey and community consultation.

Rainfall records for the April 1998 and March 2003 storm events were obtained from Sydney Water Corporation and Manly Hydraulics Laboratory for rainfall pluviograph stations in the area around the catchment. The Belrose West rain gauge was installed in 2001 and the Allambie rain gauge in 1999, so no data were available at these locations for the 1998 storm events. No local rain gauges were installed prior to 1990, so only rainfall events after this date were considered for calibration. A summary of rainfall depth information for rainfall stations in the Frenchs Creek area is presented in Table 3 with rainfall pluviograph traces for the events represented in Figures 5 and 6 and rainfall isohyets presented in Figures 7 and 8.

Table 3: Calibration Event Rainfall Depths

Rainfall Depths (mm) - April 1998 Storm Event					
Date	**Belrose Bowling Club**	**Belrose West**	**Belrose Squash Centre**	**Allambie**	**Cromer**
08/04/1998	-	-	0.0	-	0.0
09/04/1998	26.5	-	28.0	-	30.5
10/04/1998	207.0	-	210.0	-	136.0
11/04/1998	14.5	-	13.5	-	24.5
12/04/1998	-	-	0.0	-	0.0
Total	**248.0**	**-**	**251.5**	**-**	**191.0**
Rainfall Depths (mm) - March 2003 Storm Event					
09/03/2003	-	-	0.0	0.5	0.5
10/03/2003	142.5	158.0	96.5	53.5	41.5
11/03/2003	29.0	20.0	31.0	6.5	17.0
12/03/2003	56.5	73.5	50.0	17.5	64.0
13/03/2003	0.5	0.0	0.0	0.0	0.0
14/03/2003	-	-	0.0	0.0	0.0
Total	**228.5**	**251.5**	**177.5**	**77.5**	**123.0**

Design storm rainfall depths for the study area were estimated using ARR (2001) are presented in Table 4 below. The PMF events were determined using the Bureau of Meteorology's "The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method" Bulletin 53 Bureau of Meteorology (2003).

Table 4: Design Rainfall Intensities (mm/hr)

Frequency (AEP) / Duration	**20%**	**10%**	**5%**	**2%**	**1%**	**PMF**
10 min	128.83	144.93	166.30	194.13	215.23	*
15 min	108.87	122.91	141.45	165.68	184.10	640.00
20 min	95.67	108.31	124.93	146.71	163.30	*
30 min	78.75	89.52	103.62	122.15	136.31	480.00
45 min	64.00	73.09	84.90	100.50	112.46	400.00
1 hr	54.91	62.91	73.27	87.00	97.55	350.00
1.5 hr	43.55	50.00	58.34	69.41	77.93	266.67
2 hr	36.82	42.34	49.46	58.93	66.23	220.00
3 hr	28.98	33.40	39.10	46.68	52.53	166.67
6 hr	19.22	22.23	26.11	31.28	35.29	103.33
12 hr	12.77	14.83	17.46	21.00	23.75	*
24 hr	8.47	9.86	11.65	14.06	15.93	*
48 hr	5.48	6.41	7.60	9.20	10.45	*
72 hr	4.15	4.86	5.77	7.00	7.96	*

Note: *Rainfalls not calculated.

9 MODELLING

9.1 Model Development

Overland flows, levels and velocities describing the flood behaviour in the study area were simulated using DHI's hydraulic computer-based modelling software package, MIKE Storm, DHI (2004 SP3). MIKE Storm is a hybrid model that combines the features of DHI's MOUSE computational engine for the pit and pipe network and the MIKE-SHE two dimensional, physically based hydrological catchment model for surface flow modelling into a system modified specifically for urban stormwater applications.

The MIKE Storm hydrodynamic pipe network module solves the complete, fully dynamic Saint Venant equations. Both supercritical and subcritical flows are accommodated in the solution method. Head losses at pit junctions are automatically calculated by the model, taking into account pipe direction changes, offset pipes and pipe drops across pits.

The MIKE Storm surface model allows a distributed, physically based approach to rainfall runoff, with rainfall time series applied directly to a two dimensional grid representation of the catchment surface. Rainfall losses can be accounted for automatically on a grid basis by a range of techniques from a simple initial loss / proportional loss or continuing loss approach, to a comprehensive approach that accounts for saturated/unsaturated pervious soil profiles and groundwater flow. In this study the initial loss / continuing loss approach was adopted. Overland flow routing of the rainfall excess is via two dimensional diffusive wave approximation of the St Venant Equations of conservation of mass and momentum. This solution scheme is very stable and appropriate for use in steep catchments such as where super critical flows may be encountered. Validation of the MIKE Storm approximation of catchment runoff was made by comparison to the Kinematic Wave Method is described in Section 9.2.3.

The sub surface pipe network and overland flow components of the modelling system are linked through dynamic coupling of the model domains via stormwater pit linkages. The dynamic linkages allow feedback between the surface model and the pipe network model during model simulation which ensures that the interaction between above ground and below ground storages and flow paths is accurately represented. Figure 9 demonstrates the range of inflow and surcharge modes that the links can operate in. Linkages are automatically configured for appropriate inlet capacity and head loss conditions. Additional information describing the MIKE Storm system is included in Appendix E.

9.1.1 Pit and Pipe Drainage System

The sub-surface, pit and pipe drainage system model was developed from Council's stormwater asset database using automated techniques. MIKE Storm can be automatically linked to asset databases containing the appropriate size, level and topology (linkage) data. The pit and pipe data provided by Warringah Council was used as the basis of the storm water model. It was necessary to edit these data in order to

ensure pits were located correctly at the road kerb and gutter by cross checking the data locations in the study GIS using ground-truthing. Following this ground-truthing of the data, the MIKE Storm model was simply configured by linking to the GIS data through a database link (ODBC). Once this link was made, the pit and pipe network was automatically configured within the MIKE Storm system. The stormwater pit and pipe model is presented in Figure 3.

Pits were identified as being either "on grade" or "sag" type. The inlet capacity of the pits was automatically configured based on the pit size and type. MIKE Storm was simply linked to the GIS data through a database link. Once this link was made, the pit and pipe network was automatically configured within the MIKE Storm system.

Two versions of the pit and pipe MIKE Storm model were required for the calibration of the model to ensure that the model structure matched the state of the stormwater asset at the time of the historical storm events. Changes to the model were made primarily in the vicinity of Lyndale Place. The April 1998 storm event occurred before the development of the subdivision in Lyndale Place (previously known as the Dairy Farmers site). The subdivision included the development of 16 residential dwellings, an access road and significant changes to the local drainage network including the addition of four underground stormwater detention tanks.

9.1.2 Digital Elevation Model

The MIKE Storm model was configured to operate with overland flows represented in full 2D. The whole of the catchment was included in the 2D model surface.

A digital elevation model (DEM) was created using the 0.5m photogrammetric contours and the supplementary ground survey data, with the survey data taking precedence over the contours. The surface DEM was developed to a 3m grid resolution, using an automated, GIS based technique to collate and manipulate the available ground survey data into 2D surfaces quickly and efficiently. A grid on this resolution covering the Frenchs Creek catchment has approximately 250,000 computational grid points. Polygons representing building footprints were digitised using the available digital aerial photography. A representation of the buildings was then extruded in the DEM based on these polygons.

Surcharges, pit inlet capacities and pit bypasses were estimated automatically by the linked 2D system and overland flow paths are developed without the prior assumptions of the direction and size of the flow path as would be required in a 1D overland flow approach. The 2D surface modelling approach also eliminates issues with additional overland flows paths that may occur for more extreme events that can potentially be underestimated or missed entirely using a 1D approach.

Two DEMs were developed for the calibration of the MIKE Storm model because of the subdivision works in Lyndale Place, as described in Section 9.1.1 above. The shape of the ground surface in this area circa 1998 was approximated using the available 2m LPI contours provided by Council. The ground surface from the DEM derived from the 0.5m photogrammetric contours, which was taken as representative of existing conditions in the area was adjusted using the 2m LPI contours so as to match the pre-development condition. The final DEM for existing catchment conditions is presented in both 2D and 3D form in Figures 10 and 11.

The digitised road and roof polygons were combined to produce a map of pervious and impervious areas for use in the estimation of runoff in the model (see Section 9.1). A plan showing the developed impervious area map is shown in Figure 12.

9.2 Model Calibration

9.2.1 General Approach

Calibration of the model was an iterative process, which followed the steps listed below:

1. Develop rainfall hyetographs for calibration event.
2. Apply rainfall to the hydraulic (MIKE Storm) model and compare modelled peak water levels to historical peak water levels.
3. Adjust model parameters and return to step 2 (depending on the rate of convergence to historical values).

The model parameters were fine-tuned until a reasonable fit with the recorded flood level data was reached for the two calibration events.

The calibration was undertaken for the combined hydrologic and hydraulic model against historic flood level data. It was not possible to calibrate the separate hydrology component because no flow data were available.

The results of the model calibration were then validated by comparison to regional estimates of design catchment flow, as described in Section 9.2.3.

9.2.2 Calibration Events

Data from the storm events of April 1998 and March 2003 were used to calibrate the model. These events were selected for several reasons. First there are no local rainfall records prior to 1990 that could be used to calibrate the model. Secondly, the April 1998 and March 2003 storm events represented the largest floods in the area since 1990. The April 1998 flood event was the largest event since records began in 1990 and was considered the largest since the 1970's by local residents (Reference /12/). The March 2003 storm was not as large as the 1998 storm, but had very intense rainfall over a much shorter duration and so was noteworthy for the resulting depth of flooding, as shown in Figures 5 and 6.

The MIKE Storm model was run for the April 1998 and March 2003 storm events numerous times, adjusting hydrologic and hydraulic model parameters until the modelled levels approximated the magnitude of the peak water levels recorded.

The rainfall depths and temporal patterns for the two calibration storm event were taken from the recorded rainfall data available from the rainfall gauges located in the vicinity of the catchment. Spatially varying rainfall maps, based on the isohyets developed for the study (see Figures 7 and 8) were developed and applied to the model.

Model roughness coefficient maps were developed within the GIS using available aerial photography as a basis. Initial roughness estimates were based on values applied in previous studies. Fine-tuning of the roughness map formed part of the calibration

exercise. The final roughness values adopted for use in the MIKE Storm model are presented in Table 5.

Table 5 Adopted Roughness Values

Description	Adopted Manning's 'n'
Road/Roof surfaces	0.035
Grassed Surfaces	0.070
Heavy Vegetation	0.080
Rock lined channel	0.040

A comparison of the modelled and recorded peak water levels for the April 1998 and March 2003 events are presented in Tables 6 and 7. In the absence of gauging data, it was not possible to calibrate the models against discharge, either in terms of magnitude or timing.

The 1998 calibration run started at 14:45 am on April 10, 1998. Prior to this start time 62mm of rainfall had fallen, wetting the catchment considerably. Based on the antecedent conditions being wet, no initial losses were applied for the event. Continuing losses of 2mm/hour for pervious areas and 1mm/hour for impervious areas were applied to the rainfall.

Table 6 Comparison of Modelled and Recorded Peak Water Levels for April 1998 Storm Event

Location	Recorded Level (mAHD)	Modelled Level (mAHD)	Difference (m)
81 Pringle Ave	133.8	133.81	0.04
Winani Close	130.0	129.84	-0.16
Elm Avenue	125.7	125.75	0.05
8a Elm Avenue	126.9	126.80	-0.10
3 Calool Cres	124.1	124.10	0.00
15 Calool Cres	122.9	122.75	-0.15
19 Calool Cres	121.7	121.67	-0.03

The comparison of modelled and recorded peak water levels for the April 1998 storm event presented in Table 6 shows that a close match of the observed peak water levels has been obtained at all observed data locations for this event and so the parameter values were deemed reasonable for this calibration.

The 2003 calibration event was run from a start time of 14:00 on March 10, 2003. Prior to this start time 2mm of rainfall had fallen in the past 12 hours and the catchment was therefore considered to be dry. Based on the antecedent conditions being dry, a 20mm initial loss was applied to the rainfall. Continuing losses of 2mm/hour for pervious areas and 1mm/hour for impervious areas were adopted for the event.

Modelled and observed peak water surface levels for the March 2003 storm are compared in Table 7. This comparison of peak water surface levels shows that a close match of the observed levels has been obtained in most locations in the model. The differences in modelled and observed levels (to datum) at 4 St Annes Close and 13 Lyndale Place are outside the range generally accepted as satisfactory. These levels were observed at locations in the upper part of the catchment where steeper slopes result

in shallow overland flow paths. The flows in these locations are passing through properties where local flow depths and directions are significantly affected by obstacles such as buildings, retaining walls and fences. While the absolute observed water surface level to datum has not been matched, the model is faithfully reproducing the flow path, depth and speed of the observed overland flow at these locations.

Table 7 Comparison of Modelled and Recorded Peak Water Levels for March 2003 Storm Event

Location	Recorded Level (mAHD)	Modelled Level (mAHD)	Difference (m)
43 Knightsbridge Ave	147.50	147.55	0.05
8 Kapunda Pl	146.40	146.27	-0.13
20 Pembroke Pl	144.07	144.08	0.01
136 Pringle Ave	142.52	142.61	0.09
3 St Annes Close	150.20	150.28	0.08
4 St Annes Close	150.70	150.50	-0.20
6 Kapunda Pl	146.80	146.81	0.01
Between 12 & 13 Lyndale Pl	151.00	151.27	0.27
13 Calool Cres	122.70	122.76	0.06
19 Calool Cres	121.50	121.62	0.12
21 Calool Cres - Patio	122.50	122.30	-0.20

In the lower part of the catchment in the vicinity of Elm Avenue and Calool Crescent, flood flow behaviour is considerably influenced by the performance of the Elm Avenue culvert. The culvert is skewed to the channel and hence skewed to the predominant direction of flows coming down the channel. The culvert inlet capacity is also impeded by the presence of a concrete encased manhole in front of the culvert inlet. Calculations and model testing undertaken as part of the calibration exercise concluded that the capacity of the culvert under Elm Avenue needed to be reduced by between 40% and 50% of its theoretical "in-line" capacity to meet the overland flow rates required to match recorded peak flood levels in Calool Crescent for this event only. Blockage of the Elm Avenue culvert was undertaken only for the 2003 calibration event and was not undertaken in the design events.

The difference between the modelled and recorded flood levels at 21 Calool Crescent is outside the range generally accepted as satisfactory. 21 Calool Crescent is located at the downstream side of the Calool Crescent culvert and the error in modelling this hydraulic structure may have been compounded by the complexities in modelling the upstream Elm Avenue culvert .

Observed water surface levels in the area have generally been well matched in the model and so this approach was deemed reasonable for this calibration.

The model outputs were also verified against reported overland flow paths in other areas to ensure that the flow patterns being generated by the model generally matched those reported in Council's records and during the resident interview process. Figures 13, 14 and 15 show the model generated maximum water surface level map for the two calibration events.

While the model could be further improved by calibration against recorded flows, should they become available, the reproduction of flood patterns and levels by the model was considered satisfactory for the prediction of catchment flow behaviour.

9.2.3 Model Validation against Regional Estimates of Design Catchment Flow

In the absence of more extensive historical storm data and recorded flow data, the model was also validated against a regional estimate of catchment runoff. The model was only compared against the Kinematic Wave Method because other regional methods such as the Probabilistic Rational Method and the Cordery-Webb Method, which are based on data for rural catchments, were considered as inappropriate comparison for the highly urbanised Frenchs Creek catchment.

The Kinematic Wave Method uses physical catchment parameters such as area, catchment length and catchment slope, along with AR&R (Reference 4) prescribed rainfall intensities to produce estimates of peak catchment runoff rate. A comparison of the 1% AEP peak flows from MIKE Storm model and the Kinematic Wave Method is presented in Table 8. The comparison Location "A" is near Haigh Avenue as identified on Figure 16 for a sub-catchment area of 56.7 hectares.

Table 8 Comparison of the 1% AEP Peak Flows (2 hour) from MIKE Storm with Alternative Methods

Model	Peak Catchment Flow (m^3/s)
	Location A
Kinematic Wave Method	21.9
MIKE Storm	20.4

Whilst the model could be further improved by calibration against recorded flows, should they become available, the flow estimate produced by the model was a considered satisfactory validation for the prediction of catchment runoff rates.

9.3 Design Storm Modelling

The calibrated MIKE Storm model was used to simulate overland flood behaviour for a range of design events. In the first instance, a range of storm durations were simulated for the 1% AEP event to determine the storm duration most representative of the critical storm duration for the whole catchment. Once the critical storm duration was determined the remaining design events were simulated for that duration storm (see Section 9.3.1).

Design rainfall temporal patterns derived from Australian Rainfall and Runoff were applied to the DEM (Reference /4/). Spatial variability of the rainfall over the catchment was not considered necessary given the relatively small catchment size. Design rainfall losses of 0mm initial loss and a continuing loss of 2mm/hour on pervious areas and 1mm/hour on impervious areas were adopted. The initial loss of 0mm was considered appropriate on the basis of the 1998 model calibration, which indicated that historical flood events had previously occurred on a saturated catchment (see Section 9.2). This adoption of 0mm initial loss gives a conservative simulation of the design flood behaviour.

Buildings were included in the 2D overland flow model as obstructions to overland flow. Allowances for other potential obstructions to flow such as fences and retaining walls were accounted for in the adopted model roughness coefficients.

Flow exchanges between the catchment surface and the sub-surface stormwater pipe network were automatically calculated by the model. All pit inlets (grates and lintels) were assumed to have no blockage for the base design case. Blockage of pits inlets was considered separately as part of the model sensitivity testing (see Sections 8.4 and 10.2).

Model tail water levels at the model boundary were calculated automatically by the model as the flow passed through critical depth over the waterfall downstream of the Calool Crescent culverts.

9.3.1 Critical Storm Duration

A range of storm durations from 15 minutes through 6 hours were simulated for the 1% AEP flood event in order to determine the critical storm duration for the catchment. Peak flood levels at 26 representative sites were extracted from the model results (see Table 9 and Figure 16).

Table 9 Key Locations for Reporting

Site	Location
1	Calool Crescent
2	Calool Crescent
3	Winani Close
4	Trentbridge Road
5	Pringle Avenue
6	Pringle Avenue
7	Knightsbridge Avenue
8	St Annes Close
9	Lyndale Place
10	Curragundi Avenue
11	Burrswood Close
12	Haigh Avenue
13	Lowanna Street
14	Glenn Street
15	Pringle Avenue
16	Kapunda Place
17	Kapunda Place
18	Willow Tree Crescent
19	Ralston Avenue
20	Lynette Place
21	Pringle Avenue
22	Willow Tree Crescent
23	Creek Confluence
24	Elm Avenue
25	Coora Avenue
26	Wingara Avenue

Peak flood depths for the 1% AEP flood at this range of sites for the various tested storm durations are presented in Table 10. The presented results indicate that while there is a range of storms between 60 minutes and 3 hours that provide the peak water depth in some locations, the difference between the levels across all the simulated storm durations is generally small.

Table 10 1% AEP Flood Event – Peak Depths

Location	Depth (m)								Critical Duration (min)
	15min	30min	45min	60min	90min	120min	180min	Max	
1	1.44	1.22	1.47	1.45	1.26	1.46	**1.49**	1.49	180
2	0.13	0.24	0.17	0.17	**0.27**	0.18	0.18	0.27	90
3	0.00	0.15	0.10	0.11	**0.16**	0.11	0.10	0.16	90
4	1.65	1.62	1.69	1.71	1.64	**1.74**	1.70	1.74	120
5	1.35	1.87	1.47	1.49	**1.91**	1.56	1.51	1.91	90
6	0.41	0.47	0.53	0.58	0.53	**0.59**	0.50	0.59	120
7	0.92	0.99	1.09	1.16	1.05	**1.17**	1.03	1.17	120
8	0.52	0.48	0.58	0.68	0.51	**0.68**	0.53	0.68	120
9	0.12	0.19	0.19	0.24	0.21	**0.25**	0.16	0.25	120
10	0.26	0.29	0.29	0.30	0.31	**0.31**	0.26	0.31	120
11	0.16	0.13	0.17	0.17	0.16	**0.18**	0.14	0.18	120
12	1.52	1.60	1.58	1.55	1.65	**1.65**	1.57	1.65	120
13	0.00	0.00	0.00	0.00	**0.10**	0.09	0.00	0.10	90
14	0.17	0.20	0.23	0.23	0.22	**0.24**	0.19	0.24	120
15	1.26	1.37	1.29	1.29	**1.39**	1.30	1.29	1.39	90
16	0.78	0.85	0.83	0.86	0.87	**0.88**	0.81	0.88	120
17	0.27	0.28	0.28	0.28	0.27	**0.28**	0.27	0.28	120
18	0.57	0.48	0.57	0.57	0.49	**0.57**	0.57	0.57	120
19	0.16	0.22	0.21	0.23	0.23	**0.24**	0.19	0.24	120
20	0.67	0.76	0.84	0.90	0.86	**0.93**	0.82	0.93	120
21	0.12	0.15	0.17	0.19	0.17	**0.20**	0.17	0.20	120
22	0.19	0.15	0.20	**0.21**	0.18	0.20	0.18	0.21	60
23	0.65	0.73	0.67	0.68	**0.76**	0.71	0.67	0.76	90
24	0.00	0.23	0.12	0.11	**0.23**	0.11	0.12	0.23	90
25	0.13	0.13	0.16	0.17	0.16	**0.18**	0.14	0.18	120
26	0.28	0.00	0.28	0.29	0.27	**0.29**	0.25	0.29	120

At first glance, there appear to be inconsistencies in the 'normal' trend that critical storm durations will increase from the upstream to the downstream ends of the catchment. Examples of the 'normal' trend are: location 22, which is at the upstream end of a subcatchment and has a short critical duration (60 minutes); and location 1, which is at the downstream end of the catchment and has a long critical duration (180 minutes). The results shown in Table 10 indicate that this does not happen at all locations in Frenchs Creek catchment and there are several contributing reasons why this is so. The main reason is that surface topography does not have a constant gradient across the whole catchment. Where the gradient is shallower, overland flow takes longer to reach the floodways and conversely, where the gradient is steeper, flow reaches the floodways more quickly. As described in Section 5, this catchment is only 210 hectares, but is moderately steep and urbanized, which leads to localised quick runoff responses to rainfall, particularly in the steeper sections of the Corridor Creek and Frenchs Creek sub-catchments which have a large impact on the short range of critical durations. In a larger catchment, these impacts would usually be damped by the relatively larger contributions from the upstream sub-catchments. The effect of these localised quick response times may cause combined peak flows and flood levels at an

earlier time in the storm than the upstream sub-catchments. This effect has been noted in a number of locations, but, as described below, the difference in peak flood levels is often small between different duration storms.

In a limited number of locations reported in Table 10, such as Location 5 (Pringle Avenue) and Location 24 (Elm Avenue), the difference between the maximum water level and the 2 hour duration water level at the 1% AEP flood risk level is greater than 0.1m. Review of the model results in Table 10 shows smaller differences in locations reported close by, indicating that the differences at these three places are localised. The effect of flood duration on peak flood level would be smaller for smaller flood events. On this basis, the 2 hour flood event was adopted as representative for floods smaller than the 1% AEP event.

9.3.2 Model Results

Having determined the critical storm duration for the catchment, simulations were run for the 1%, 2%, 5% and 20% AEP and the PMF base case scenarios.

A detailed summary of the performance of the stormwater system is presented in Appendix D. Flood depth maps for design events, colour coded to indicate flood depth are presented in Figures 17 to 21. In the preparation of these maps, overland flooding was assumed to have occurred once the flow depth exceeded 40mm. The depth of 40mm was chosen primarily to show the continuity of overland flow paths through the catchment. Sensitivity testing of flow depths greater than 40mm showed that the routes of the flow paths were lost.

A summary of peak water surface levels and flow velocities for representative locations (see Figure 16) is presented in Table 11.

There are two locations in Table 11, namely 14 (Glenn Street) and 26 (Wingara Avenue), where the water surface level is shown as being higher for the 20% AEP flood event than for the 5% AEP event. The difference ranges from 0.01m to 0.02m and can be attributed to the uncertainties within the modelling setup. These differences are not considered to be significant for these two events.

Flood model results and flood maps presented for the 1% AEP flood, PMF and flood planning level (Figure 31) represent an envelope of maximum water levels based on an analysis of all flood durations.

Table 11 Summary of Peak Water Surface Levels and Velocities for Design Flood Events

Location		PMF		1% AEP		2% AEP		5% AEP		20% AEP	
		Water Level (mAHD)	Velocity (m/s)	Water Level (mAHD)	Velocity (m/s)	Water Level (mAHD)	Velocity (m/s)	Water Level (mAHD)	Velocity (m/s)	Water Level (mAHD)	Velocity (m/s)
1	Calool Crescent	122.72	4.60	121.89	4.20	121.78	4.24	121.72	2.83	121.64	4.39
2	Calool Crescent	123.61	4.52	123.00	3.11	122.88	3.07	122.82	3.08	122.72	2.99
3	Winani Close	128.84	1.27	128.64	0.98	128.63	0.97	128.63	1.16	128.61	0.89
4	Trentbridge Road	128.12	3.98	127.34	2.41	127.12	2.36	127.07	0.95	126.92	2.23
5	Pringle Avenue	134.53	6.72	133.74	4.55	133.64	4.46	133.56	4.01	133.49	4.47
6	Pringle Avenue	143.55	2.74	143.03	1.83	142.90	1.67	142.82	1.34	142.75	1.15
7	Knightsbridge Avenue	148.15	2.28	147.54	1.24	147.36	1.08	147.21	0.80	147.12	0.59
8	St Annes Close	149.88	1.54	149.55	1.29	149.39	1.06	149.25	0.71	149.16	0.40
9	Lyndale Place	155.13	0.98	154.87	0.61	154.78	0.55	154.71	0.39	154.71	0.34
10	Curragundi Avenue	164.73	1.90	164.67	1.49	164.64	1.70	164.63	1.17	164.53	0.30
11	Burrswood Close	157.14	1.84	157.07	1.01	157.04	0.65	157.01	0.60	157.01	0.34
12	Haigh Avenue	129.45	9.09	129.09	8.92	128.96	8.64	128.88	6.09	128.82	7.95
13	Lowanna Street	148.31	1.49	148.07	1.35	148.00	1.32	148.02	0.94	147.98	0.64
14	Glenn Street	158.27	1.95	158.19	1.52	158.15	1.35	158.10	1.00	158.11	0.94
15	Pringle Avenue	133.53	3.05	133.37	2.81	133.36	2.76	133.35	2.63	133.34	2.73
16	Kapunda Place	138.50	1.63	138.39	1.53	138.34	1.49	138.25	1.46	138.14	1.18
17	Kapunda Place	147.16	2.22	147.15	2.13	147.14	2.13	147.11	1.92	147.11	1.91
18	Willow Tree Crescent	166.19	1.77	166.09	1.98	166.08	1.97	166.01	1.85	165.99	1.69
19	Ralston Avenue	156.33	2.59	156.23	2.22	156.17	2.06	156.14	1.76	156.13	1.57
20	Lynette Place	142.03	1.16	141.37	0.70	141.20	0.63	141.11	0.51	141.02	0.39
21	Pringle Avenue	137.58	4.26	137.30	3.21	137.25	3.01	137.22	2.26	137.19	2.33
22	Willow Tree Crescent	154.18	2.33	154.13	2.11	154.11	2.06	154.07	1.46	154.05	1.77
23	Creek Confluence	130.53	5.17	129.94	3.60	129.81	3.48	129.72	2.87	129.66	3.33
24	Elm Avenue	125.74	2.46	125.33	1.07	125.22	0.84	125.18	0.75	125.12	0.58
25	Coora Avenue	143.28	2.19	143.15	1.71	143.11	1.61	143.07	1.23	143.07	1.24
26	Wingara Avenue	131.73	2.55	131.65	1.94	131.62	1.79	131.57	1.56	131.59	1.34

9.4 Model sensitivity

A range of model simulations were simulated in order to understand the sensitivity of the developed modelling system to key model parameters and also to determine the ranges of uncertainty in the model. This also provided an indication of the impact of blockage of key culverts on flood levels in the local area. The sensitivity runs were undertaken for the 1% AEP and PMF design flood events for the 2 hour storm duration only, which is representative in the study area. Key parameters that were tested for model sensitivity were:

- Change model roughness ±20% for the 1% AEP event
- Blockage of stormwater inlets and culverts
  - 50% Blocked and 100% Blocked cases for the 1% AEP event
  - 100% Blocked case for PMF event

Model results for the sensitivity runs are presented in Tables 12 and 13 below. The flood depth impact maps for the blockage cases are shown in Figures 24 and 25 for the 1% AEP event and Figure 26 for PMF event.

9.4.1 Model Roughness

Table 12 Model Sensitivity to Model Roughness Coefficient - 1% AEP 2 hour duration Flood Event

Location		Base Run Depth (m)	Roughness Increased 20%		Roughness Decreased 20%	
			Depth	Difference	Depth	Difference
1	Calool Crescent	1.46	1.12	-0.34	1.64	0.18
2	Calool Crescent	0.18	0.10	-0.08	0.39	0.21
3	Winani Close	0.11	0.08	-0.03	0.15	0.04
4	Trentbridge Road	1.74	1.61	-0.13	1.98	0.24
5	Pringle Avenue	1.56	1.50	-0.06	1.64	0.08
6	Pringle Avenue	0.59	0.59	0.00	0.56	-0.03
7	Knightsbridge Avenue	1.17	1.18	0.00	1.12	-0.05
8	St Annes Close	0.68	0.68	0.00	0.59	-0.09
9	Lyndale Place	0.25	0.24	-0.01	0.25	0.01
10	Curragundi Avenue	0.31	0.30	-0.01	0.32	0.01
11	Burrswood Close	0.18	0.17	-0.02	0.20	0.02
12	Haigh Avenue	1.65	1.55	-0.10	1.63	-0.02
13	Lowanna Street	0.09	0.06	-0.03	0.13	0.04
14	Glenn Street	0.24	0.23	-0.01	0.26	0.01
15	Pringle Avenue	1.30	1.20	-0.10	1.43	0.13
16	Kapunda Place	0.88	0.78	-0.09	1.00	0.12
17	Kapunda Place	0.28	0.26	-0.01	0.29	0.02
18	Willow Tree Crescent	0.57	0.54	-0.02	0.59	0.03
19	Ralston Avenue	0.24	0.23	-0.01	0.25	0.01
20	Lynette Place	0.93	0.93	0.00	0.89	-0.04
21	Pringle Avenue	0.20	0.20	0.00	0.18	-0.01
22	Willow Tree Crescent	0.20	0.19	-0.01	0.22	0.02
23	Creek Confluence	0.71	0.65	-0.06	0.82	0.11
24	Elm Avenue	0.11	0.07	-0.04	0.20	0.08
25	Coora Avenue	0.18	0.17	-0.01	0.19	0.01
26	Wingara Avenue	0.29	0.27	-0.02	0.31	0.02

The model results show that, in absolute terms, the model results are relatively insensitive to changes in model roughness coefficient in most parts of the model. In most parts of the model, the results did not vary by more than +/- 0.1mm with varying roughness coefficients. This is due to the flows in most parts of the catchment being characterised by sheet flows accumulating into shallow overland flow paths.

In areas where a more significant flow volume has accumulated, such as the open channel reaches of the catchment below Pringle Avenue, the model is more sensitive to changes in roughness parameter.

9.4.2 Blockage of Stormwater Inlets and Culverts

The model results in Table 13 indicate that peak flood levels are sensitive in many areas to blockages in the stormwater infrastructure. Blockages of the stormwater pits and culverts in the model caused flood levels to vary by more than 0.5m in some areas.

Table 13 Model Sensitivity to Pit and Culvert Blockage – 1% AEP and PMF, 2 Hour Duration Events

		1% AEP Event					PMF Event		
		Base Run	50% Blocked		100% Blocked		Base Run	100% Blocked	
Location		(m)	Depth	Diff	Depth	Diff	(m)	Depth	Diff
1	Calool Crescent	1.46	1.35	-0.11	1.38	-0.08	1.61	2.28	0.67
2	Calool Crescent	0.18	0.19	0.02	0.62	0.44	0.47	1.23	0.76
3	Winani Close	0.11	0.07	-0.04	0.05	-0.06	0.17	0.21	0.04
4	Trentbridge Road	1.74	2.25	0.52	1.46	-0.28	2.47	2.41	-0.06
5	Pringle Avenue	1.56	1.82	0.26	0.93	-0.63	2.35	1.77	-0.58
6	Pringle Avenue	0.59	0.43	-0.17	0.5	-0.1	1.11	0.89	-0.22
7	Knightsbridge Avenue	1.17	0.93	-0.25	1.04	-0.14	1.78	1.44	-0.34
8	St Annes Close	0.68	0.44	-0.24	0.66	-0.02	1.01	0.89	-0.12
9	Lyndale Place	0.25	0.24	-0.01	0.46	0.22	0.51	0.69	0.18
10	Curragundi Avenue	0.31	0.29	-0.01	0.3	-0.01	0.36	0.35	-0.01
11	Burrswood Close	0.18	0.18	0	0.25	0.07	0.25	0.29	0.04
12	Haigh Avenue	1.65	1.58	-0.07	1.03	-0.62	1.86	1.38	-0.48
13	Lowanna Street	0.09	0.09	0	0.23	0.13	0.33	0.43	0.10
14	Glenn Street	0.24	0.24	0	0.31	0.06	0.33	0.37	0.04
15	Pringle Avenue	1.3	1.21	-0.09	1.14	-0.16	1.46	1.53	0.07
16	Kapunda Place	0.88	0.52	-0.36	0.58	-0.3	0.99	0.94	-0.05
17	Kapunda Place	0.28	0.18	-0.1	0.09	-0.19	0.27	0.16	-0.11
18	Willow Tree Crescent	0.57	0.34	-0.23	0.07	-0.49	0.47	0.08	-0.39
19	Ralston Avenue	0.24	0.24	-0.01	0.31	0.07	0.35	0.41	0.06
20	Lynette Place	0.93	0.73	-0.2	0.93	0	1.59	1.48	-0.11
21	Pringle Avenue	0.2	0.15	-0.05	0.24	0.04	0.48	0.46	-0.02
22	Willow Tree Crescent	0.2	0.2	0	0.23	0.03	0.25	0.26	0.01
23	Creek Confluence	0.71	0.9	0.2	0.38	-0.32	1.15	0.91	-0.24
24	Elm Avenue	0.11	0.39	0.27	0.76	0.65	0.52	1.04	0.52
25	Coora Avenue	0.18	0.18	0	0.26	0.09	0.31	0.44	0.13
26	Wingara Avenue	0.29	0.29	0	0.34	0.05	0.37	0.38	0.01

There are a number of locations where the effect of blocking the stormwater inlets and culverts has reduced the maximum flood depths. This is generally the case where the behaviour of the floodwaters has changed, for example where water is backed up behind

an obstruction, such as a blocked culvert, water quantities downstream may be reduced, which may lead to an associated reduction in downstream water levels. A good example of this is the Calool Crescent culverts, where there is an increase in flood depth upstream of the culvert (Location 2) and a decrease in flood depth downstream of the culvert (Location 1). 100% blockage does cause a significant increase in floodwater depth at some locations, for example, at Location 24, blockage of the Elm Avenue culverts cause a 0.65m increase in floodwater depth over the road in the 1% AEP event. Additionally, floodwater travels more quickly down piped drainage systems than overland. The results of 100% blockage at some of the key locations are discussed further in Section 10.2. Reference should also be made to the descriptions of the overland flow paths in Section 10.1.

The Frenchs Creek catchment is characterised by leafy, tree-lined streets, many of the trees being deciduous. Kerb and gutter stormwater inlets affected by leaves are a potential blockage problem in the area. Blocked stormwater inlets were observed during field inspections and commented upon by a number of residents during the community consultation process. While it is unlikely that all stormwater inlets would block simultaneously, there is a high chance of individual inlets becoming blocked to varying degrees during storm runoff, especially during the autumn period.

The overgrown nature of the floodplain on Corridor Creek above the Pringle Avenue culverts would suggest that some blockage of these culverts with vegetation debris is likely during flood events. Floodwaters passing through this area in a large flood would be of a depth and velocity capable of eroding the channel banks and also picking up fallen debris (e.g. tree branches) upstream of the culverts. It is also considered likely that debris from this area could pass onwards to the Elm Avenue culverts.

A partial blockage of the Elm Avenue culverts in the blockage analysis resulted in a significant increase in water depth in the local area upstream of the culverts resulting in further overtopping flows of the road surface at Elm Avenue. The likelihood of blockage of these culverts is also increased by the skewed alignment of the culverts to the predominant flow direction and the concrete encased manhole located at the entrance to the culverts.

In the PMF with fully blocked stormwater inlets and culverts, the change in depth of flooding from the base PMF flood depths is, in many cases, less than the change in depth in the 1% AEP flood event. This is because in the PMF most of the piped and culverted systems will already be surcharged due to the extreme quantities of rainfall runoff through the catchment and so blocking of the inlets and culverts will generally have less impact on water depth in the catchment than in the 1% AEP flood event.

9.5 Provisional Flood Hazard Estimation and Floodplain Hydraulic Categorisation

9.5.1 Definition of Flood Hazard and Floodplain Hydraulic Categories

The NSW Floodplain Development Manual (Reference /1/) defines flood hazards and hydraulic categories based on the degree of risk to personal danger and physical property and to flood behaviour on the floodplain. Table 14 below provides a summary of these definitions.

Table 14 Definitions of Flood Hazard and Hydraulic Categorisation (Reference /1/)

	Category	Description
Hazard Category	Low Hazard	Possible danger to personal safety. Evacuation by trucks is difficult. Able bodied adults would have difficulty in wading to safety. Potential for significant structural damage to buildings.
	High Hazard	Trucks could evacuate people and their possessions. Able-bodied adults would have little difficulty in wading to safety.
Hydraulic Category	Floodways	Areas where a significant volume of water flows during floods. Often aligned with obvious natural channels. Areas that, even if only partially blocked, would cause a significant increase in flood levels and/or significant redistribution of flood flow, which may in turn adversely affect other areas. Often areas with deeper flow or where higher velocities occur.
	Flood Storage	Parts of the floodplain important for the temporary storage of floodwaters during a flood. If the storage capacity is reduced, flood levels in nearby areas my rise and peak discharge downstream may increase. Substantial reduction in flood storage capacity my cause a significant redistribution of flood flows.
	Flood Fringe	The remaining areas of land affected by flooding after floodways and flood storage areas have been defined. Development in flood fringe would not have any significant effect on the pattern of flood flows and/or depths.

9.5.2 Determination of Provisional Flood Hazard Categories

Two of the key parameters in determining the hazard category are flood depth and velocity. NSW Floodplain Development Manual (Reference /1/), Figure L2 is a useful tool in assessing the provisional hazard category for a combination of flood depth and velocity. There are other considerations which will be taken into account in the development of the final flood hazard categories in the Floodplain Risk Management Study and Plan.

Provisional flood hazard categories have been assessed and mapped for the 1% AEP and PMF flood events according to guidelines prescribed in the NSW Floodplain Development Manual (Reference /1/). The final hazard categories will be finalised in the Floodplain Risk Management Plan, as is normal practice. Hazard categories were analysed by assessing the flow velocity and depth at each model grid cell over the course the model simulation and classifying the peak combination of velocity and depth. Plans mapping the hazard are presented in Figures 27 and 28. It should be noted that the provisional flood hazard mapping presented represents the maximum envelope of "velocity – depth product" occurring during the event, which may or may not correspond to the maximum flood level or the maximum flood velocity achieved individually for the flood event.

9.5.3 Determination of Floodplain Hydraulic Classifications

Mapping of hydraulic categories has been undertaken based on the principles given in the NSW Floodplain Development Manual, which are only given as guidance and are not definitive methods for defining the hydraulic categories.

Floodway zones for the 1% AEP event and PMF have been defined on the basis of an analysis of the predicted flood behaviour and were confirmed by subsequent site inspection. Floodways were identified by cross referencing areas of high hazard category with areas of flow depth greater than 0.2m. The most upstream extent of the floodway was defined by the furthest area upstream identified as having high hazard. Floodway zones downstream of these high hazard areas were identified by a continuous flow path to the base of the study catchment. A depth threshold of 0.2m was adopted on the basis that this depth highlighted a continuous flow path to the catchment outlet. Inspections on site in 2004 and 2005 confirmed that interruption of this flow path would likely result in a change in the existing catchment flood behaviour through an increase in flood depth and/or re-direction of flows.

The results of the flood modelling and an inspection of the site indicated that there are no flood storage areas in the study area. The catchment is moderately steep and there are no areas that have been identified by either hydraulic modelling or anecdotal evidence where floodwaters are stored during the storm event. The remainder of the catchment that is subject to flooding and not classified as floodway is therefore considered flood fringe.

Hydraulic category mapping was undertaken for the PMF and 1% AEP flood risk events, the result of which are shown on Figures 29 and 30 respectively.

9.6 Flood Planning Level

DECCW has no formal guidance on inclusion of blockage scenarios in flood studies. This is because each catchment is assessed on its merit and likelihood of blockage. Previous floods, such as in Newcastle, June 2007, have demonstrated that 100% blockage of stormwater systems does happen. As such, previous flood studies within Warringah Council, have assumed 100% blockage.

The final flood outlines are used for the Section 149 certificates and enforcing development controls by Council. Failure to add blockage into the final flood outlines will result in inappropriate development and potentially putting residents at risk, of which they would otherwise be unaware.

A provisional Flood Planning Level (FPL) of 1% AEP level plus 0.5m has been developed on the basis of Council's current Warringah Local Environmental Plan 2000 (Reference /16/). The FPL, 1% AEP 100% blockage extent and PMF 100% blockage extent are presented in Figure 31.

The blockage scenarios represent complete blockage of all receiving pits and so all flood waters are retained as surface waters and there is no inflow to the stormwater pipe systems. The flood extent maps were created for flooded areas where the predicted water depths were greater than 0.04m.

9.7 Future Catchment Conditions

Effective floodplain management requires that the potential impact of future development on flooding in the catchment be addressed and quantified.

Areas of the Frenchs Creek catchment presently zoned for residential or commercial development have generally been fully developed. The exception is the former St Ives – Dee Why Road Corridor between Garigal National Park and Forest Way. A rezoning submission for the corridor, prepared by JBA Consultants (Reference 15) dated July 2002 on behalf of Planning NSW and the NSW Roads and Traffic Authority, has been presented to Council. The submission contains a concept plan for the indicative property lot layout and an assessment of water quality and quantity for the concept development undertaken by Webb McKeown and Associates dated May 2002.

Council received preliminary subdivision plans in December 2009 from the Department of Lands and the Roads and Traffic Authority. The preliminary subdivision plans for water quantity and quality were based on the flood mitigation measures as proposed by Webb McKeown in May 2002. Subdivision plans are required to be developed in accordance with Warringah Council's Belrose Road Corridor Development Control Plan, 2008 (Reference /17/).

The Webb McKeown assessment has been reviewed as part of this study and confirmed that their assessment methodology applied a lumped conceptual hydrological model (WBNM) to the catchment in order to develop estimates of rainfall runoff for existing catchment conditions. The model was then adjusted to account for the proposed corridor development in order to determine the likely effects on flooding of the development in the corridor. The final step was to outline proposed measures to mitigate the impacts of the proposed residential development on the flooding regime in the wider catchment.

Mitigation measures recommended by Webb McKeown for controlling rainfall runoff volumes from the proposed development include a series of above ground flow detention ponds and sub-surface flow detention tanks. The methods used to estimate detention control volumes are considered acceptable and have been widely used in urban developments in other catchments.

While the proposed corridor lot layout and accompanying Webb McKeown hydrological assessment are noted as being indicative, the flood modelling undertaken for this study indicates that there may potentially be flooding issues with the presented lot layout. In particular, flooding in the following areas raises concern:

- *Eastern end of the corridor near Forest Way*. Stormwater from Forest Way discharges from an outlet into the top end of the corridor land. The overland flows from the stormwater outlet presently affect areas proposed for residential lots;
- *Kapunda Place*. Several properties in Kapunda Place backing onto the corridor have been identified as flood affected by overflows from the channel running parallel to the rear property boundaries. Any proposed redirection of upstream flows towards this channel will required careful detailed analysis; and

- *Winani Place*. Analysis for existing floodplain and catchment conditions identified that during large events floodwaters short circuit the confluence of the Corridor Creek and Frenchs Creek channels. The short circuit acts like a pressure release valve where flood waters leave the Corridor Creek channel and flows overland down Winani Close and Elm Avenue to rejoin the Frenchs Creek channel near Calool Crescent. This overland flow path would require careful consideration as part of any future development.

While the assessment undertaken by Webb McKeown is considered acceptable for the rezoning application, when detailed development scenarios are known the proposed measures to mitigate the impacts of development on the flooding regime of the catchment may need to be adjusted to ensure that the existing flood regime is not exacerbated by future development of the corridor land. All development should be in accordance with current principles, as outlined in the Floodplain Development Manual, 2005 (Reference /1/)

10 DISCUSSION OF RESULTS

10.1 Overland Flow Paths

The catchment is characterised by several principal overland flow paths and creeks. The following descriptions provide more details on flooding in specific areas of the catchment. The descriptions hold for all design events modelled, with only the depth and width of flow varying slightly over the range of the design storm events.

10.1.1 Upper Frenchs Creek Catchment (above Pringle Avenue)

Overland flooding in the upper Frenchs Creek catchment is generally characterised by sheet overland flows accumulating in depressions and flowing down slope to the kerb and gutter system. Once in the kerb and gutter drainage, the flows generally follow the road grade to pit inlets to the stormwater system. Flows entering the piped stormwater system pass though this system to the catchment outlet at a faster rate than flows that are forced to pass overland. There are no formalised open channels in the catchment above Pringle Avenue.

In many areas, flows in the kerb and gutter system overwhelm the capacity of the kerb and gutter and flow overland. The upper part of the Frenchs Creek sub-catchment has a series of streets that run across the natural slope of the catchment and flows tend to accumulate on the road surface at sag points in the road profile. Flows that are not able to enter the stormwater system flow over the top of kerb and in most cases, onwards through private property. Many times the initial point of kerb overtopping is at a driveway meaning that the overflow is often initially directed towards a property's garage. Overland flows that enter private property in many cases accumulate in or against buildings and other flow obstructions before flowing onwards around the obstruction.

The first point of noteworthy overland flow accumulation is at Curragundi Avenue. Flows accumulate at this point from the street flows from Charleroi Road and Neridah Avenue. The piped stormwater system at this location has also surcharged in this location in the past. Model analysis of the flow behaviour in this area has confirmed that the sub-surface stormwater system is prone to surcharging at this location under storm conditions. Flows that cannot be conveyed by the sub-surface stormwater system flow overland through private properties to Ralston Avenue. Flows arriving at Ralston Avenue cross at the low point to the open space on the opposite side of the road.

The sub-surface stormwater system running from north of Ralston Road is joined at Ralston Road by an augmented trunk drain originating from Forest Way. These two stormwater lines have a capacity larger than the pipe capacity further down slope. As a result excess flows pass overland here towards Lyndale Close through an open space between properties designated for storm water overflows. Two large basins have been constructed below ground in the open space, but the capacity of the basins is significantly smaller than the runoff volumes arriving at this location for the events modelled and has been shown to have an insignificant attenuating effect on the flow hydrograph at design capacity. Flows that pass overland through the open space are confronted by the rear fence of numbers 3 and 4 St Annes Close. Flows pass overland

through these properties above the residential floor level. Moving further down slope, the flows accumulate in the cul-de-sac of St Annes close before moving on overland to Knightsbridge Avenue. At Knightsbridge Avenue, flows pond in the sag point of the road surface to depths exceeding 1m before flowing overland through private properties. The overland flow path then generally follows the property boundaries at the rear of properties in Pringle Avenue before emerging to cross Pringle Avenue near the intersection of Hews Parade. Flows ponding on Hews Parade then flow off the road surface into the open channel downstream of Pringle Avenue where the overland flows re-join the waters entering the channel from the sub-surface drainage system.

Along the length of the main flow path described above, flows accumulate from other more minor overland flow paths. In particular, a significant flow contribution is made from a flow path originating above Burrswood Close. Flows from above Burrswood Close flow overland through properties to Stratham Place before following the street surface to Pringle Avenue where they join the main flow path.

10.1.2 Corridor Creek Catchment

The Corridor Creek sub-catchment runs through land once gazetted for an arterial road link from Dee Why to St Ives. This sub-catchment begins on the eastern side of Forest Way and collects runoff from the road surface which then runs overland through the vacant land into a channel covered by heavy vegetation. This channel flows in a predominantly north west direction close to and parallel to the rear boundary of properties in Kapunda Place. The channel is man made in this section and has less than 20% AEP event capacity. Flows excess to the channel capacity flow overland through the properties in Kapunda Place onto the road surface which is the natural low point in this part of the catchment. Flows coming overland join the accumulated flows from west of Kapunda Place and flow down the street into the cul-de-sac. Flows that cannot enter the pits in Kapunda Place flow overland through properties at the end of the street to Pringle Avenue. Downstream of Pringle Avenue, flows travel in the natural channel and its adjacent overbank areas through the corridor land to the rear of Winani Close. At Winani Close flows either continue in the channel to the confluence with Frenchs Creek. Alternatively, when the flows exceed the channel capacity here, the excess flow passes onto Winani Close and follows the street surface to Elm Avenue and Calool Crescent where it joins flows on the Frenchs Creek Floodplain.

10.1.3 Lower Frenchs Creek Catchment (Below Pringle Avenue)

Frenchs Creek below Pringle Avenue is characterised by open channel flow. The channel path cascades over and in some places has carved through an igneous rock base. The channel walls are typically steep sided and have been stabilised with rock, concrete or brickwork walls in some sections. Below Elm Avenue the channel is concrete lined to the Calool Crescent culverts.

In larger flood events such as the calibration events of April 1998, March 2003 and the modelled design events the open channel sections between Pringle Avenue and the confluence with Corridor Creek are exceeded, flooding properties either side of the creek channel. Below the Corridor Creek confluence Frenchs Creek has two parallel flow paths. The first follows the creek channel while a second short-circuits the channel confluence and flows parallel to the main channel down Winani Close to Elm Avenue.

Flows which follow the main channel are confronted by the culvert under Elm Avenue. The theoretical capacity of this culvert has been reduced by two factors. Firstly,

capacity is hampered by the skew angle of the culvert to the predominant flow direction and the secondly, the culvert inlet area is reduced by a sewer manhole crossing on the upstream side of the culverts. Under flood conditions, these two factors contribute to flows backing up behind the culvert before overtopping the Elm Avenue road surface. Flows that overtop the road follow the road surface, with some of the flow re-entering the channel downstream of the culvert, but with observably more (both in historical events and in the model simulations) flow following the road surface slopes onto Calool Crescent. Flows on Calool Crescent are joined by the flow path from Winani Close. The resulting overland flow path runs parallel to the channel down Calool Crescent before re-entering the channel at the Calool Crescent culverts. Floodwaters on Calool Crescent flow down the street at a level higher than the flows in the channel.

10.1.4 Haigh Avenue Tributary

The Haigh Avenue tributary originates at Lionel Watts Park. Flows from the park pass onto Glenn Street and onwards to Lowanna Street. Flows that cannot enter the sub-surface storm water system in the Lowanna Street cul-de-sac pass through private property to the open space behind Glenrose Shopping Centre. Overland flows accumulating in the open space flow down slope in a swale to Haigh Avenue where they flow onto the road surface and then fall into the open channel to rejoin the piped storm water flow at this location.

10.2 Impacts of Blockage on Flood Behaviour

Based on the results of the simulations of blockage of pits and pipes in the Frenchs Creek catchment described in Section 9.4, Table 13 and shown on Figures 25 and 26, there is generally little change (0.1m to -0.1m) in flood depths in all areas of the catchment that are not floodways (see Figures 29 and 30 for floodway classifications). This is not unexpected because overland flow is the main mechanism for transporting runoff to the stormwater inlets. For ease of discussion, the 1% AEP flood levels will be discussed in this section, unless otherwise noted.

The impacts of blocking the stormwater inlets and culverts are more marked along the floodways. There are several areas of the catchment where there are significant increases to the peak flood levels namely:

- Curragundi Avenue to Lyndale Place (maximum impact 1.45m);
- Burrswood Close (maximum impact 0.15m);
- south Pringle Avenue culverts (maximum impact 0.33m);
- north Pringle Avenue culverts (maximum impact 0.22m);
- Willow Tree Crescent (maximum impact 0.12m);
- 12 Everton Road (maximum impact 0.16m)
- Glenrose Shopping Centre (maximum impact 0.4m)
- Lowanna Street to Haigh Avenue (maximum impact 0.2m at the southern end Coora Ave); and
- Elm Avenue to Calool Crescent (maximum impact 0.81m upstream of Calool Crescent culverts and 0.75m upstream of Elm Avenue culvert).

Several of these locations will be discussed in more detail below.

Increases in flood levels occur at the upstream ends of the catchment from Curragundi Avenue to Lyndale Place. Water levels along the main flow path in this area increase by over 0.5m in the 1% AEP flood event, with a maximum value of 1.45m just upstream of Lyndale Place (figure 25).

The effect of the blocked culverts at Elm Avenue is to cause backing up of floodwaters behind Elm Avenue and then overtopping of the road which acts like a weir. The greater depth and extent of the floodwater passing over Elm Avenue results in a larger proportion of the floodwater passing down Calool Crescent than in the unblocked scenario, increasing flood depths on the road as a result.

Although the upstream section of the Haigh Avenue Tributary has increased flood levels, the section downstream of Haigh Avenue has reduced flood depth, probably due to the attenuating effect of lower overland flow rates in the catchment to piped flows.

There is generally a reduction in depth of flow in the floodway from Ralston Avenue to Pringle Avenue, where the piped network connects to the open channel section. Although it might have been expected for this area to have greater depth of flooding with no working stormwater pipe network, the overland flow velocities were lower and as such may have had an attenuating effect in the catchment, thereby increasing the time for the surface runoff to reach the floodway. This might also explain the large reduction in peak water level (-0.63m) in Frenchs Creek just downstream of Pringle Avenue, which is the point at which the piped and overland floodwaters would have combined in the unblocked, base case scenario.

The delay in the overland flow reaching the Corridor Creek floodway also has the impact of reducing peak water depths in Corridor Creek and Kapunda Place. This attenuation effect in the catchment also reduces the peak water depths at the confluence of Corridor Creek and Frenchs Creek, reducing depths of flooding in Winani Close and Trentbridge Road.

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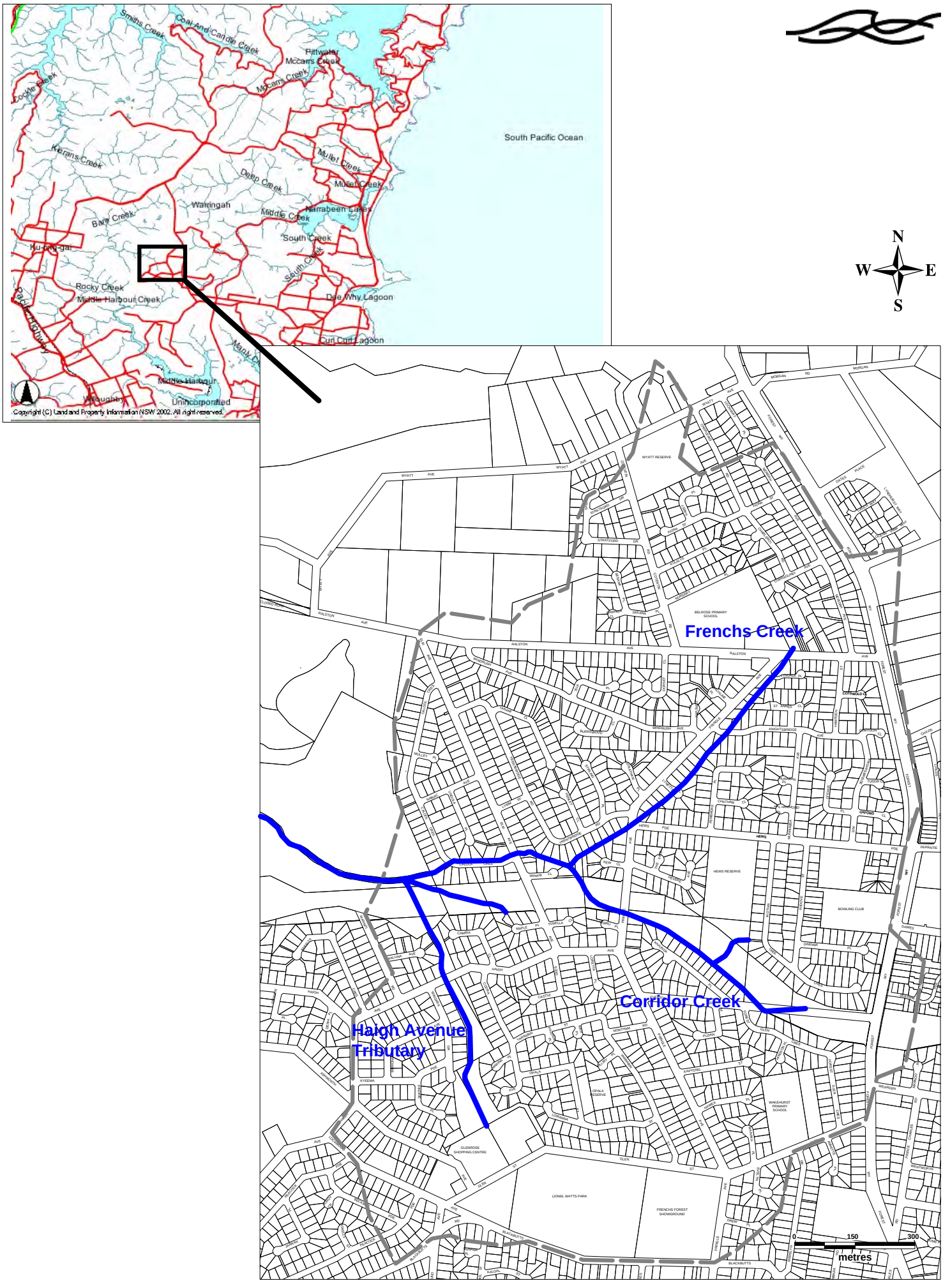
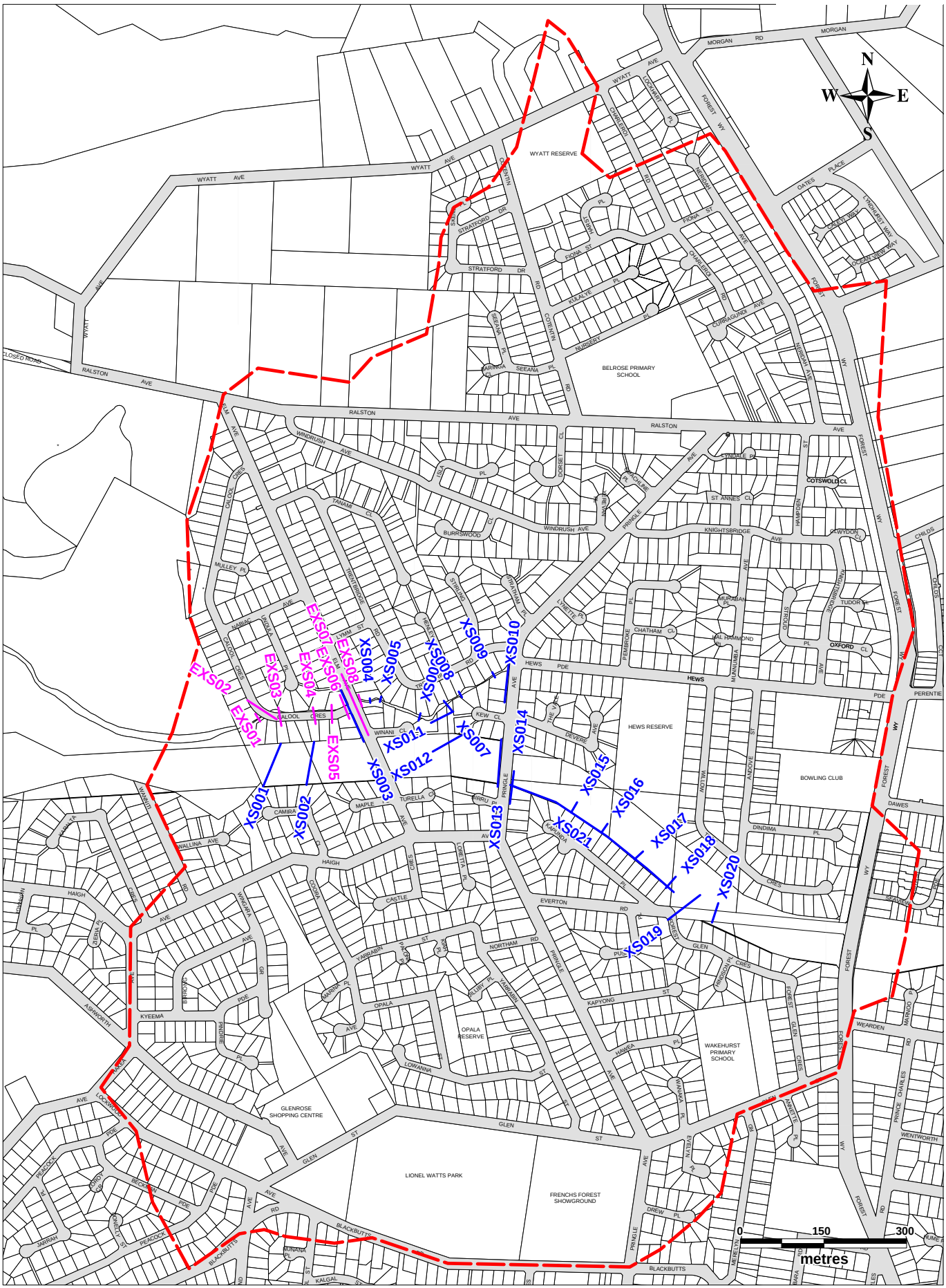
F I G U R E S



Study Area
Figure 1



Study Boundary

Existing Cross-Sections

Proposed Cross-Sections

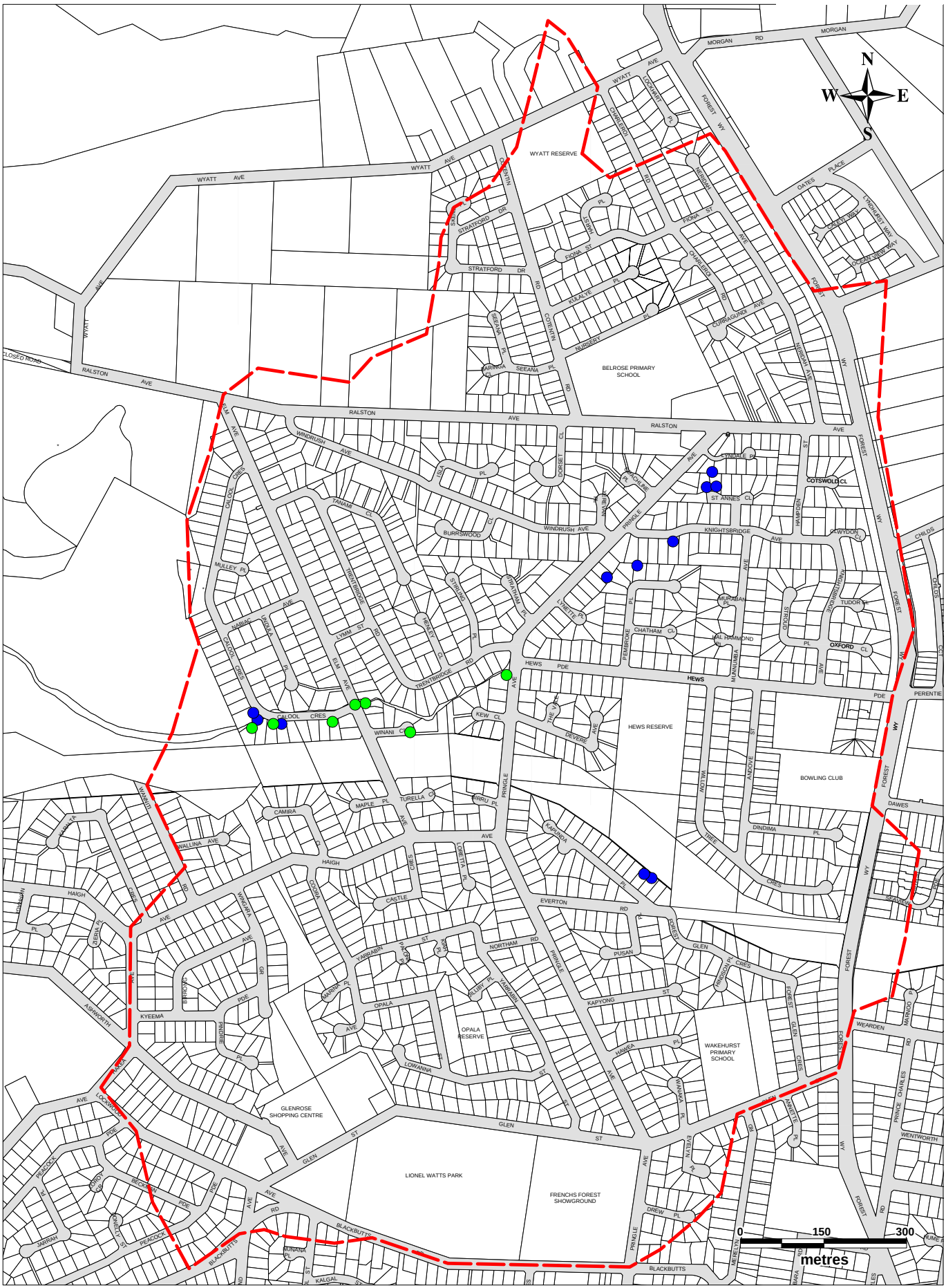
Existing and Proposed Ground Survey
Figure 2

Study Boundary

Stormwater Manholes

Stormwater Pipes

Stormwater System
Figure 3

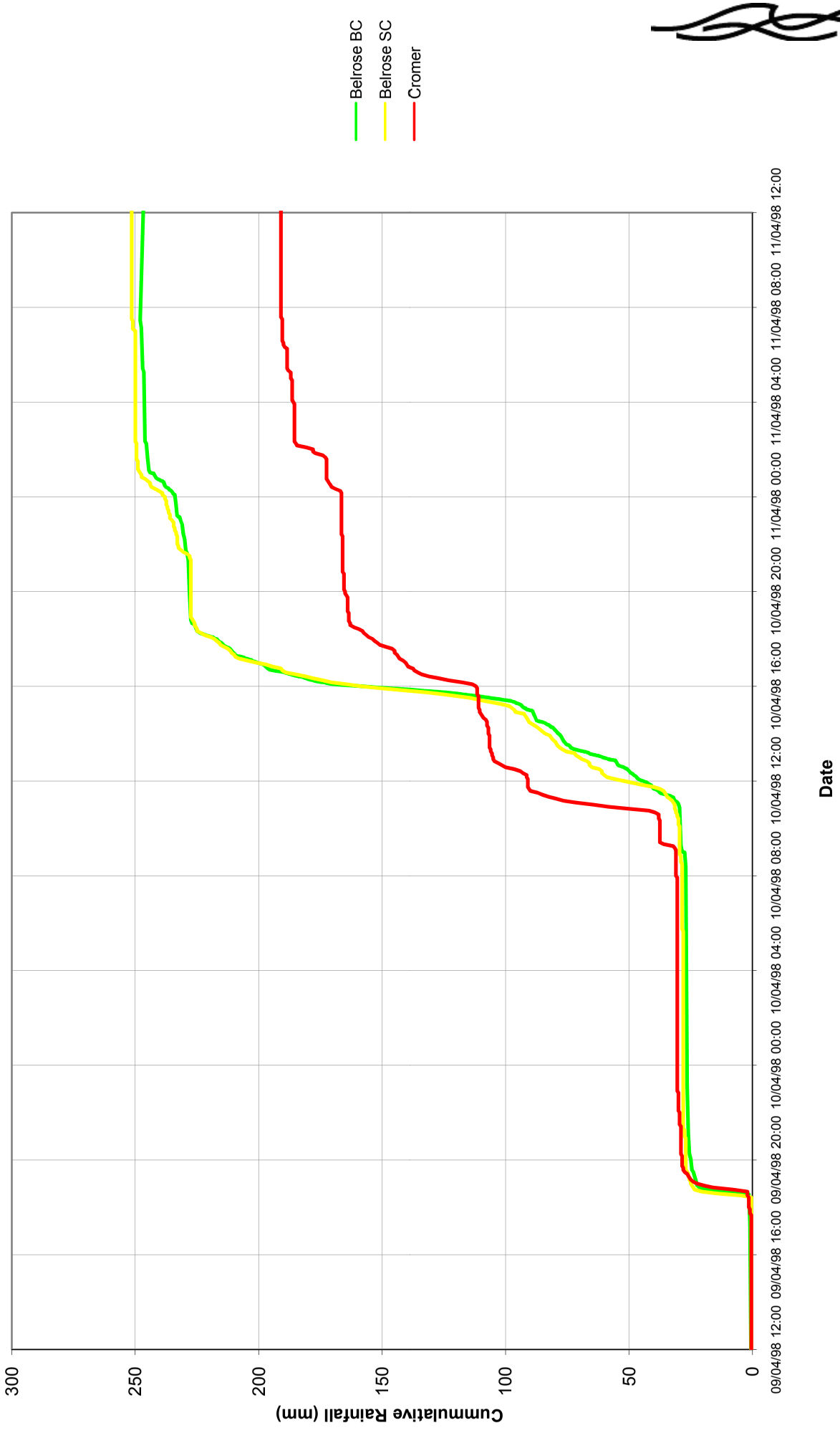


Study Boundary

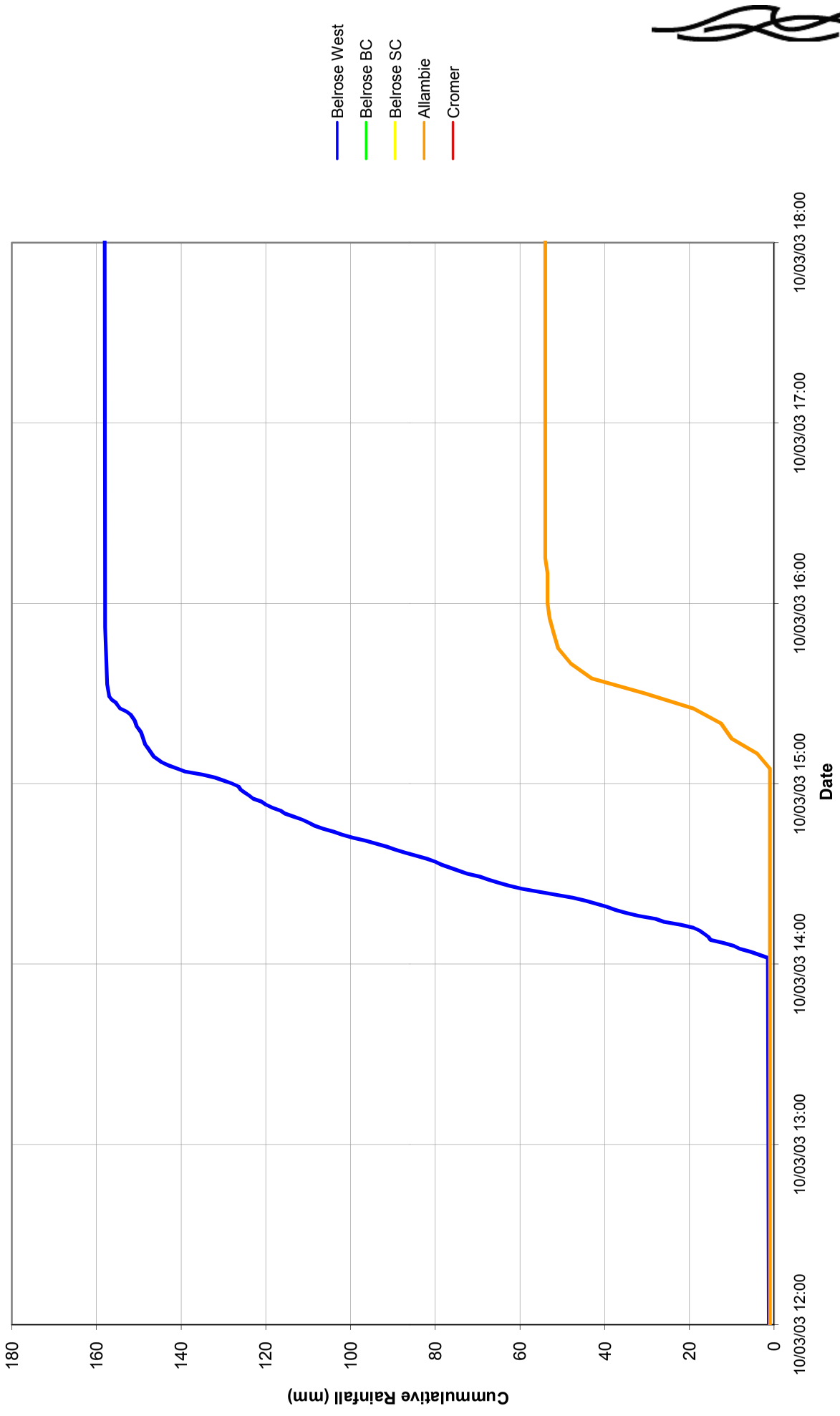
Historical Flood Levels

- 2003 Flood Event
- 1998 Flood Event

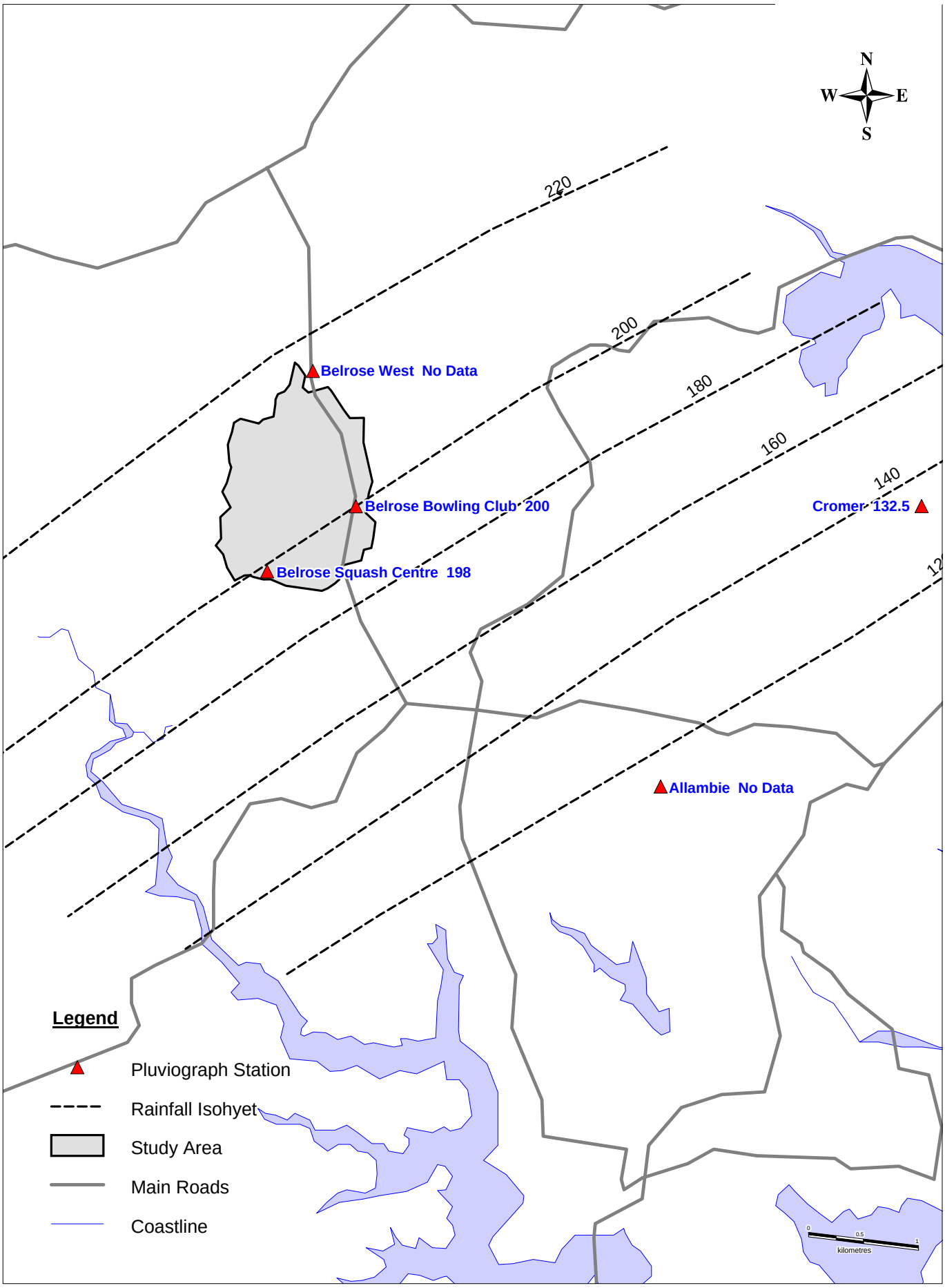
Locations of Available Historical Flood Levels
Figure 4



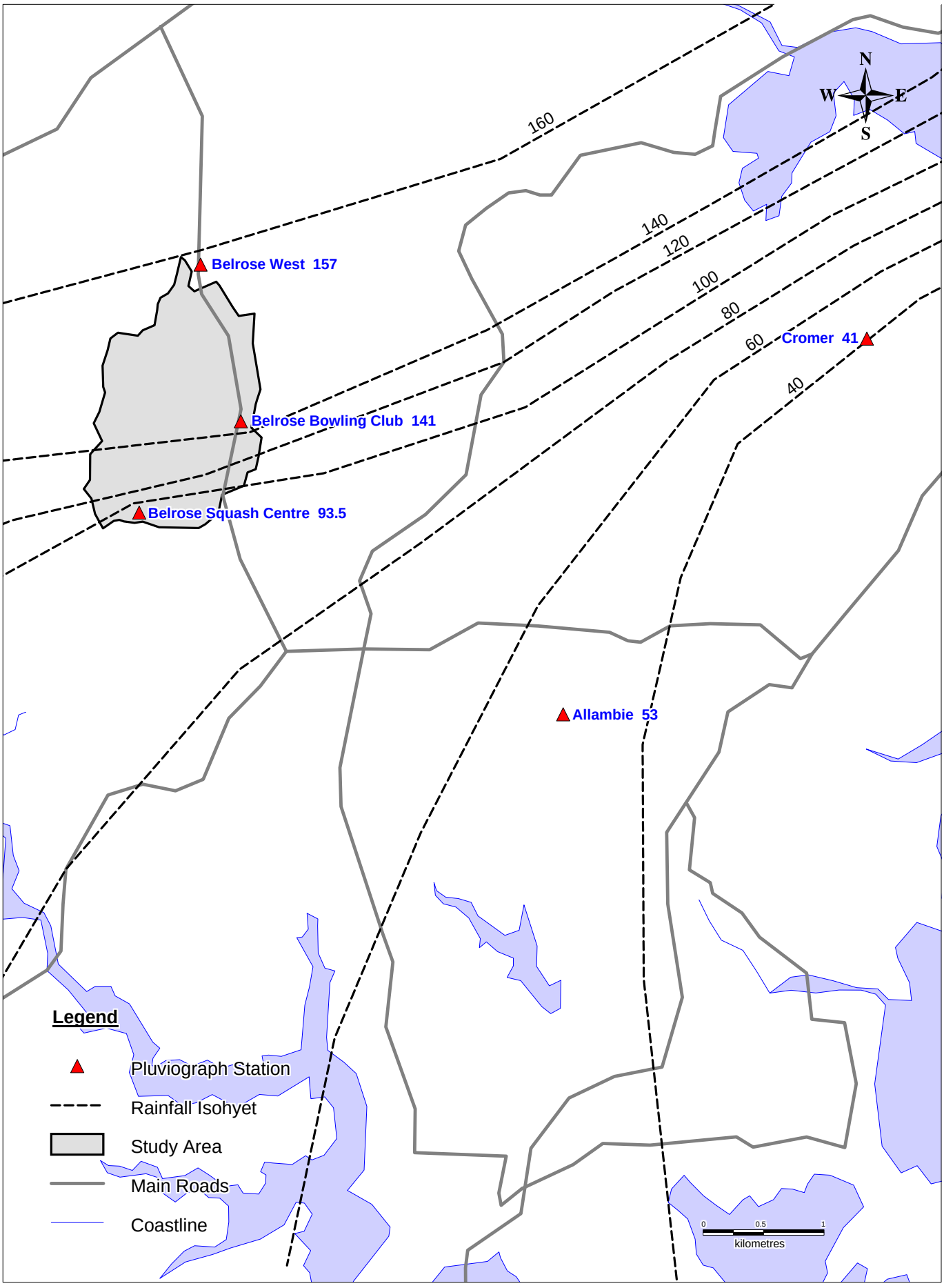
Pluviograph Trace April 1998
Figure 5



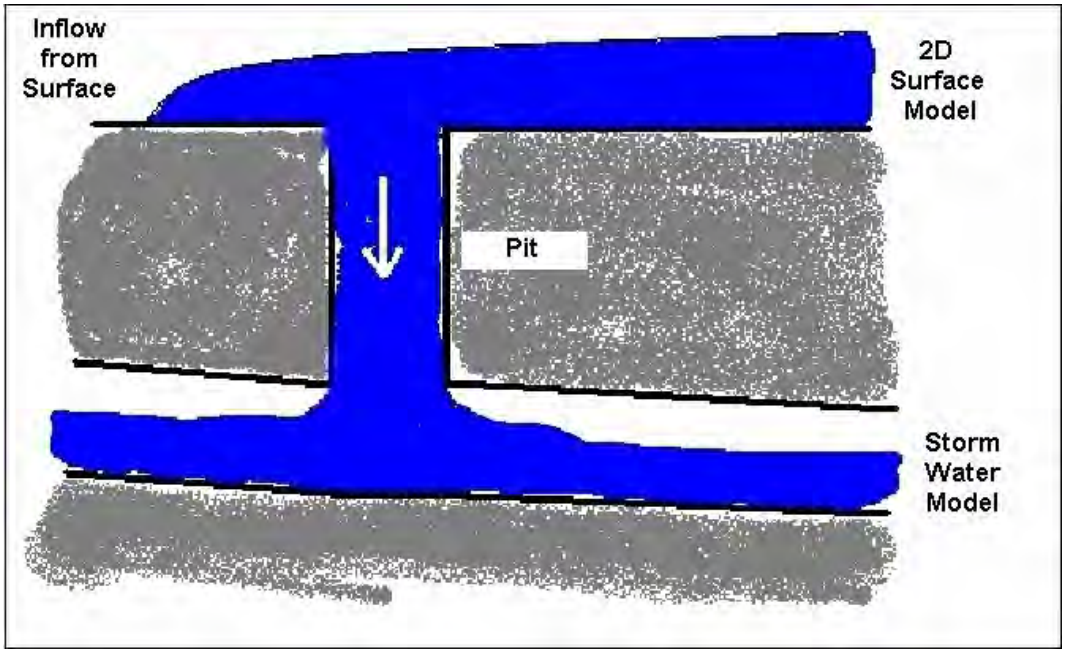
Pluviograph Trace March 2003
Figure 6

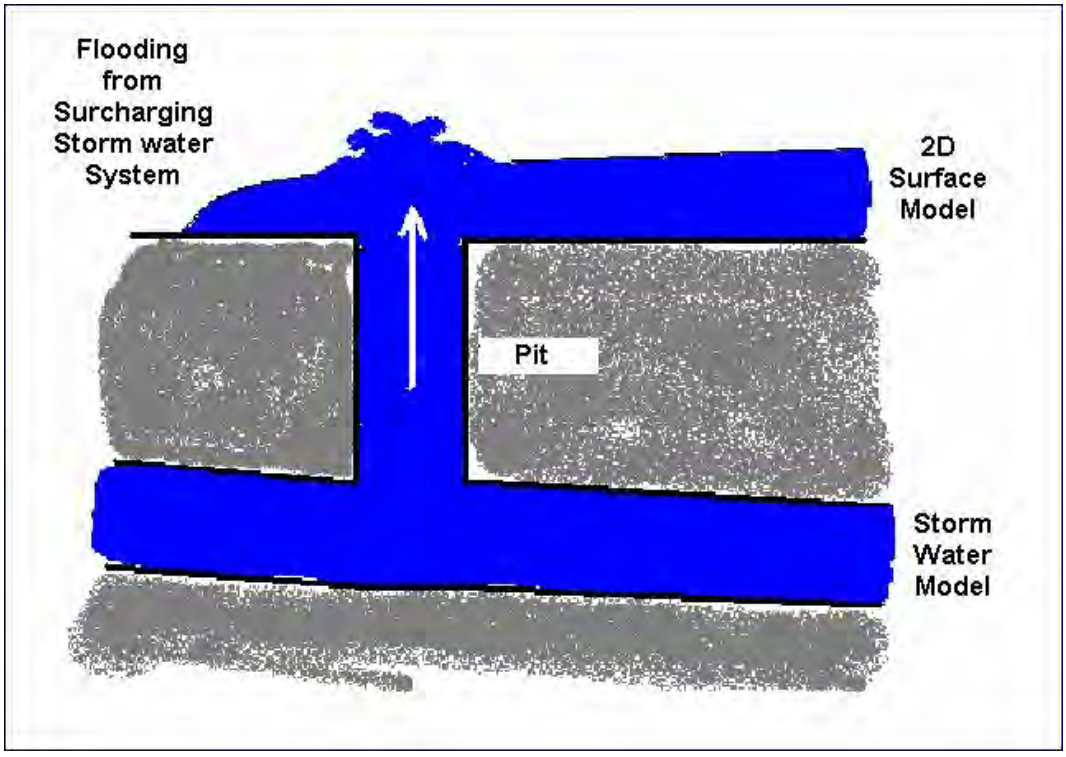


Rainfall Isohyets
April 1998 Storm Event
Figure 7

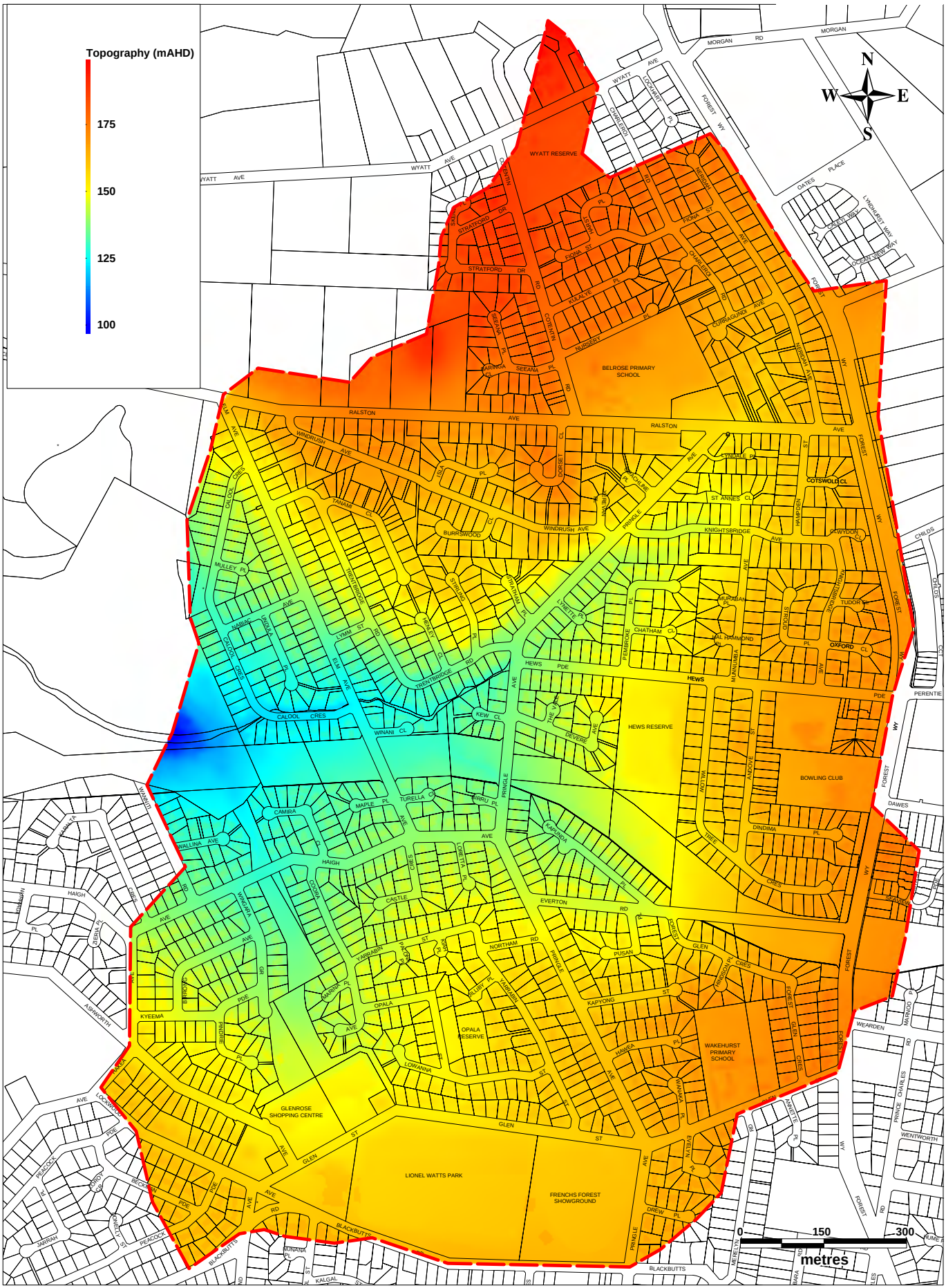


Rainfall Isohyets
March 2003 Storm Event
Figure 8

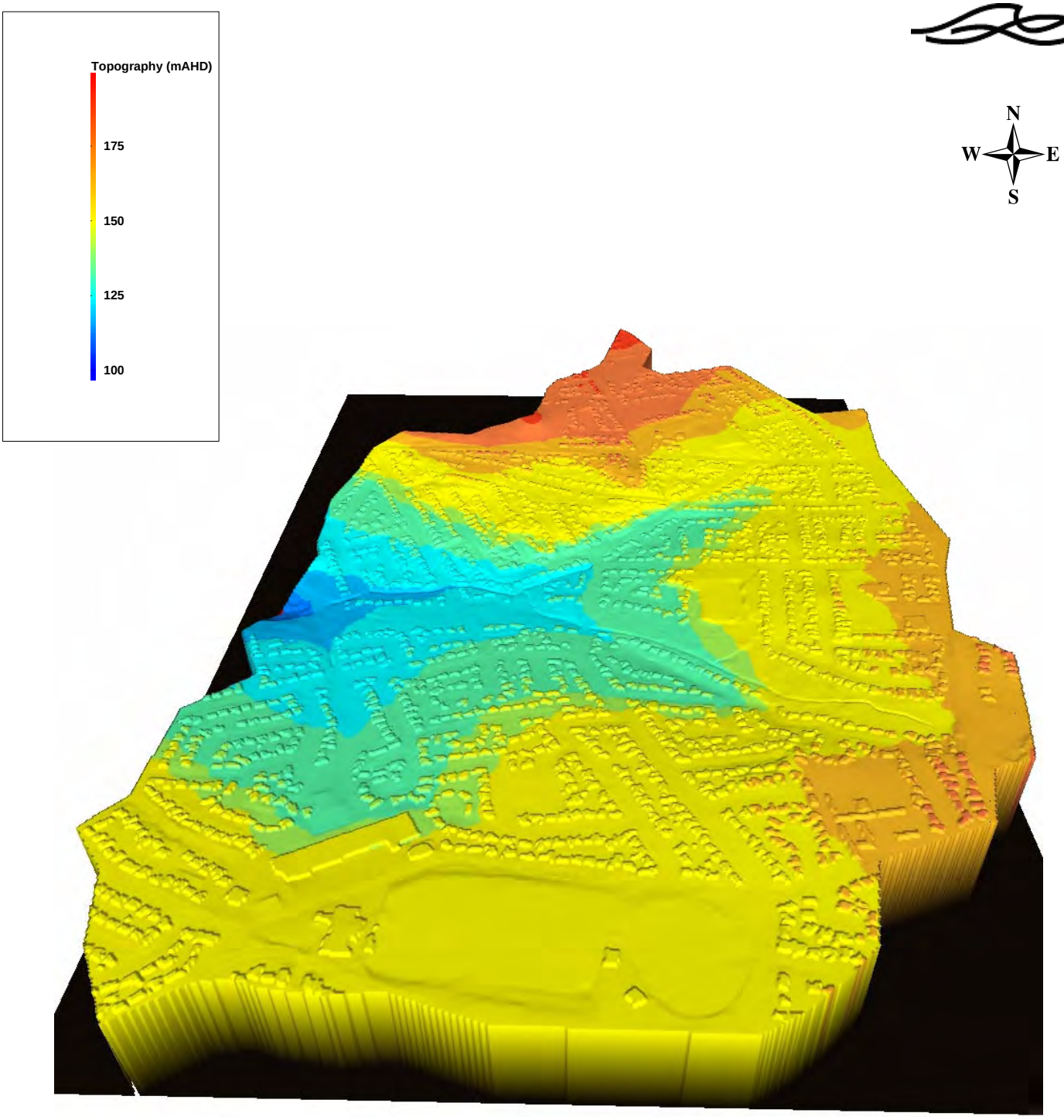




Linkage of Two Dimensional Pit and Pipe System in MIKE Storm
Figure 9



Digital Elevation Model in 2 D
Figure 10

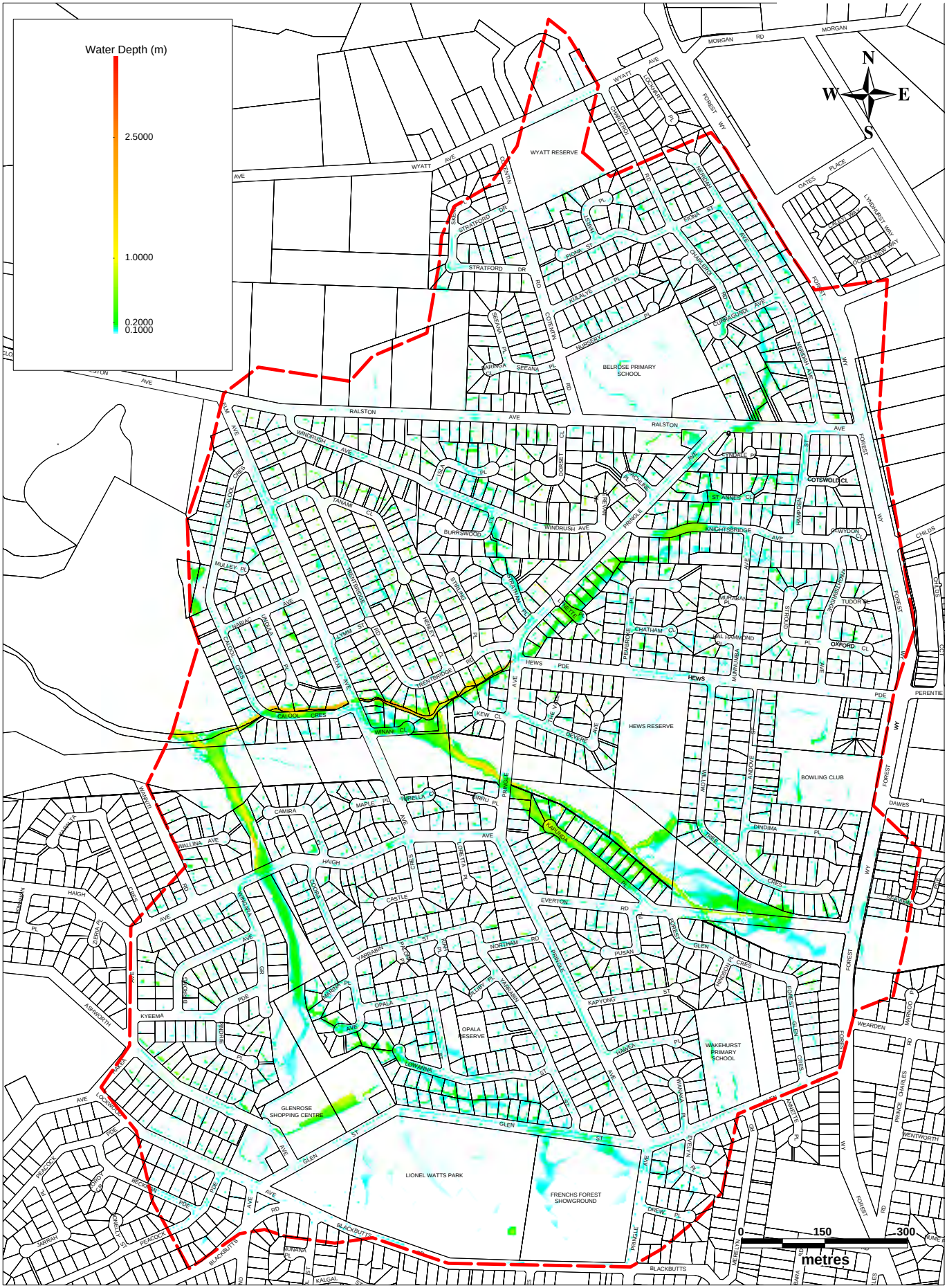


Digital Elevation Model in 3D
Figure 11

Study Boundary

Impervious Areas

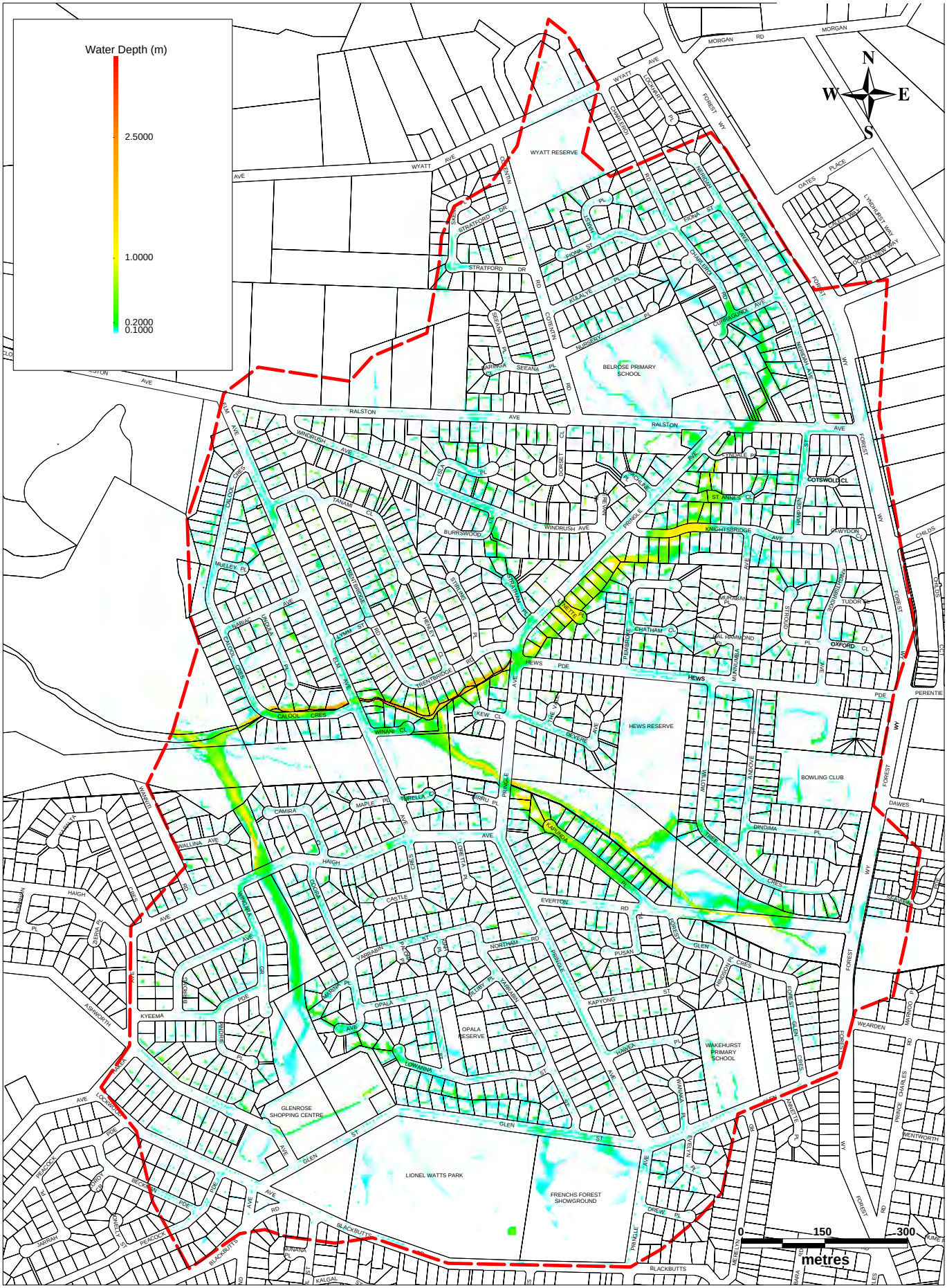
Impervious Areas
Figure 12



Study Boundary

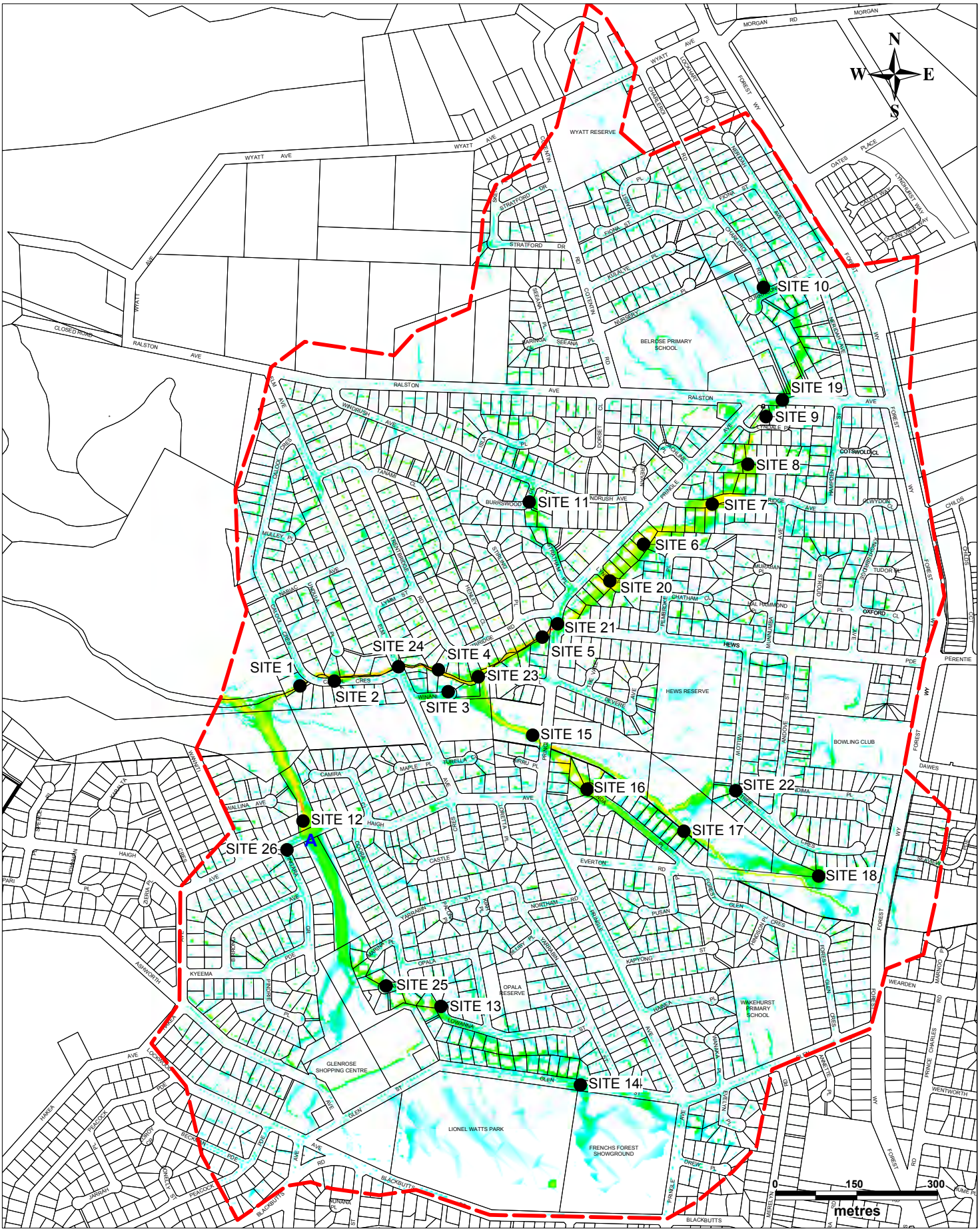
Model Calibration - April 1998 Event
Figure 13

Model Calibration - April 1998 Event
Figure 14



Study Boundary

Model Calibration - March 2003 Event
Figure 15



Study Boundary

Reference Location

A Model Validation Reference Location

Representative Locations for Reporting
Figure 16

Water Surface Level (mAHD)

180 160 140 120 100

0 150 300 metres

Study Boundary

Water Surface Level - Probable Maximum Flood Event
Figure 17

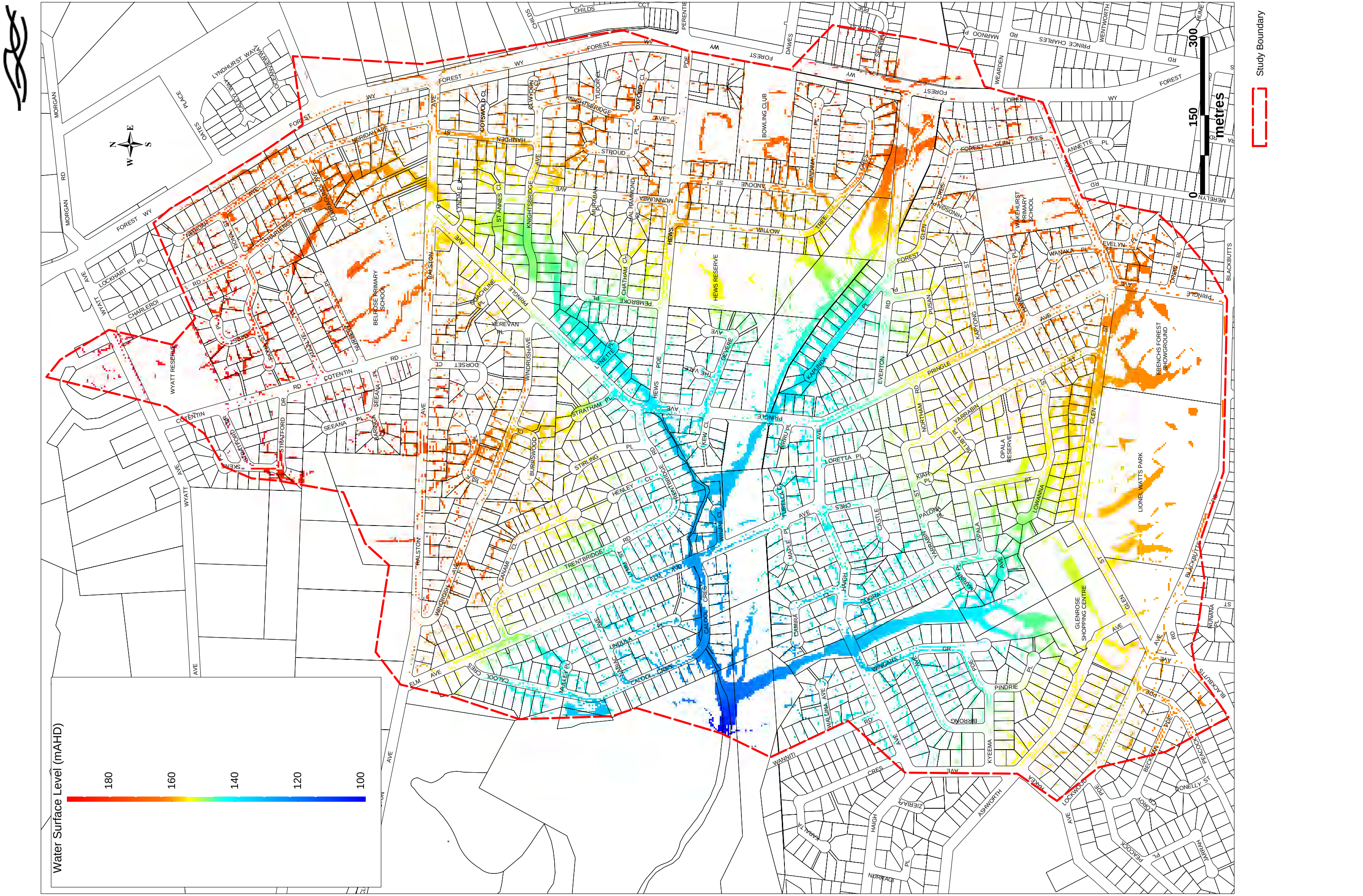
Water Surface Level (mAHD)

180 160 140 120 100

0 150 300 metres

Study Boundary

Water Surface Level - 1% AEP Event
Figure 18



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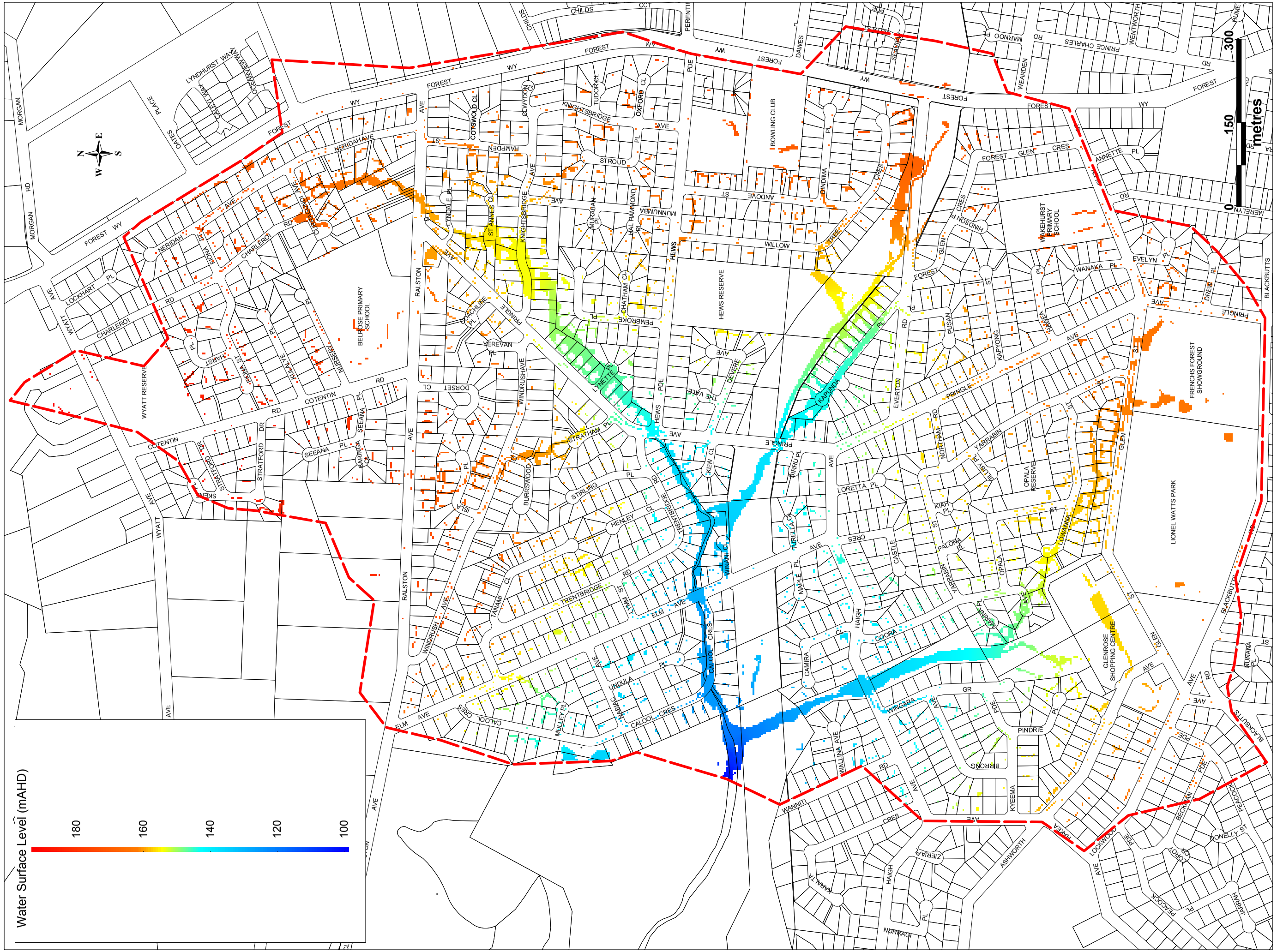
Water Surface Level - 2% AEP Flood Event
Figure 19



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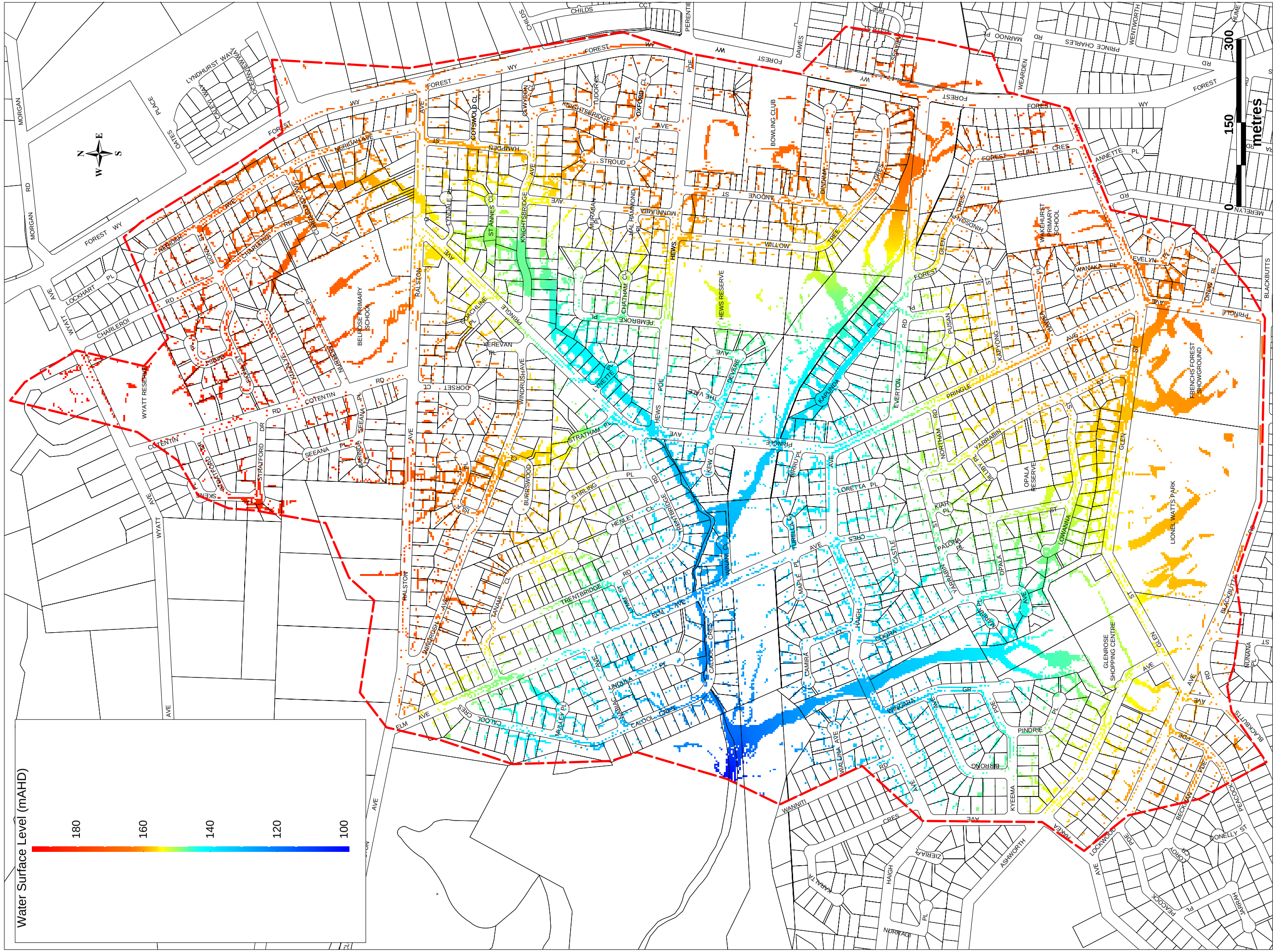
Water Surface Level - 5% AEP Flood Event
Figure 20



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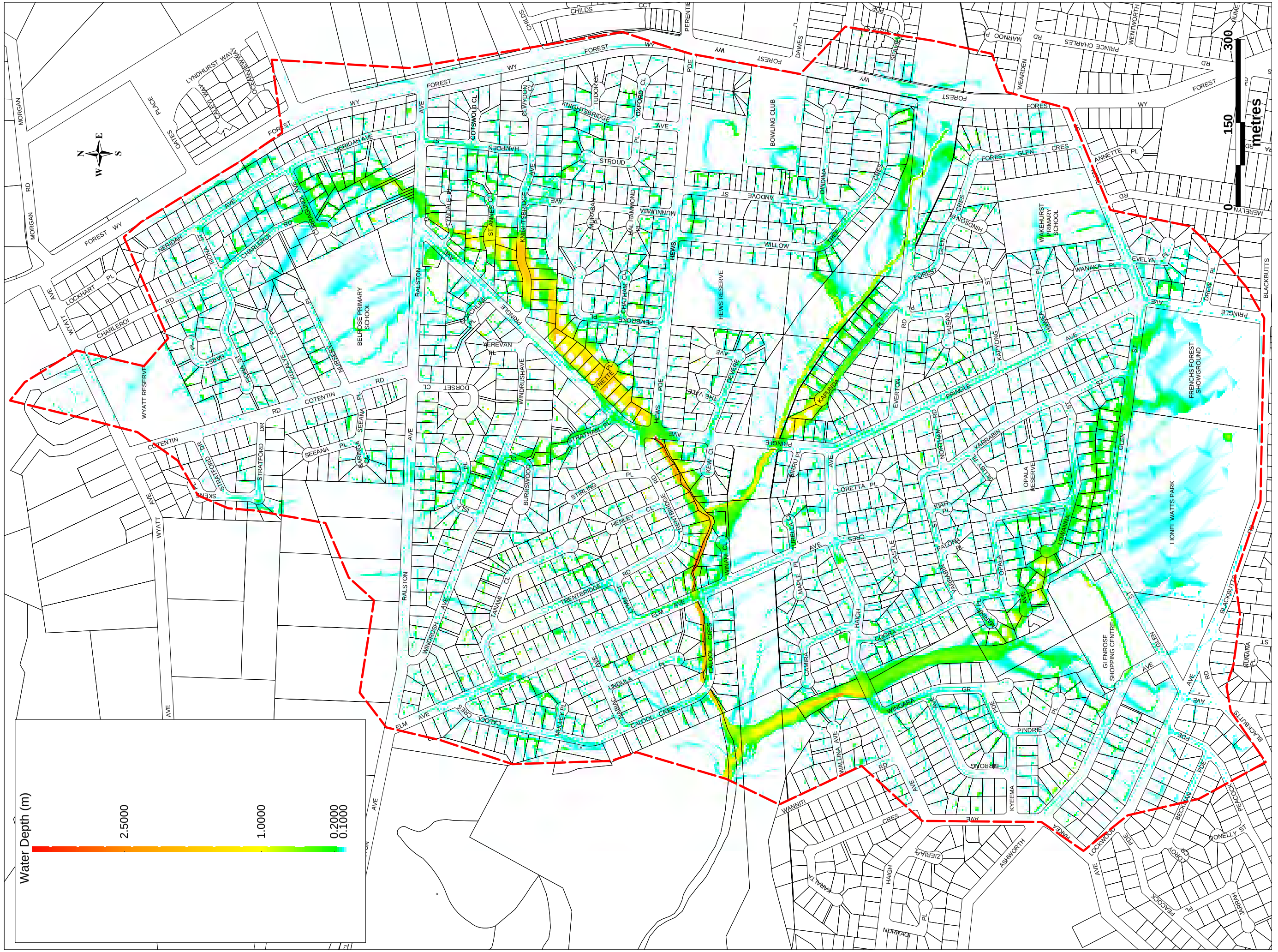
Water Surface Level - 20% AEP Flood Event
Figure 21



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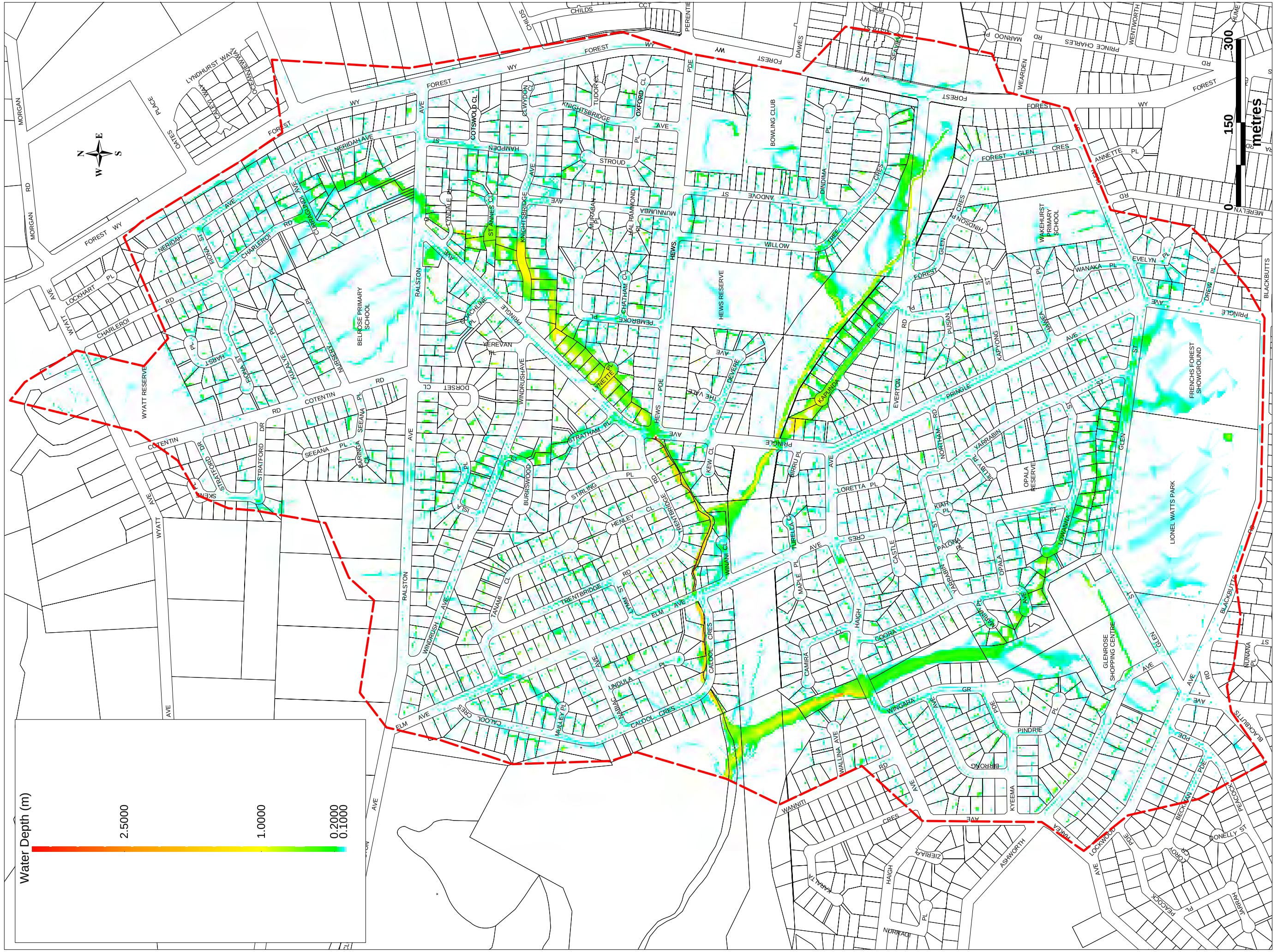
Flood Depth - Probable Maximum Flood Event
Figure 22



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Flood Depth - 1% AEP Flood Event
Figure 23

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1% AEP 50% Blockages - Flood Depth Impact

Figure 24

Water Level Increase m

- > 0.5
- 0.5 to 0.1
- 0.1 to -0.1
- -0.1 to -0.5
- < -0.5

N
W E
S

0 150 300
metres

Study Boundary

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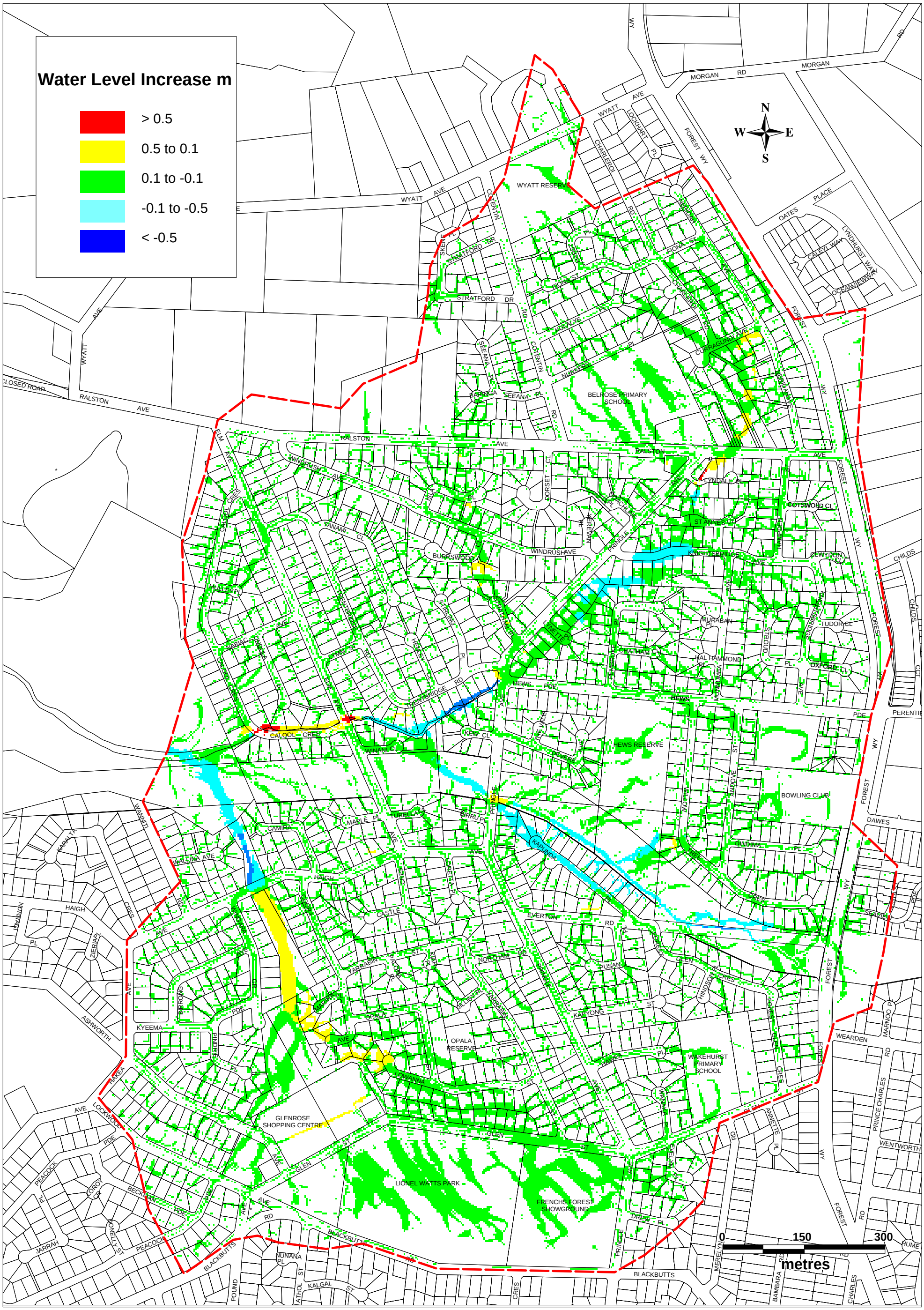

1% AEP 100% Blockages - Flood Depth Impact

Figure 25

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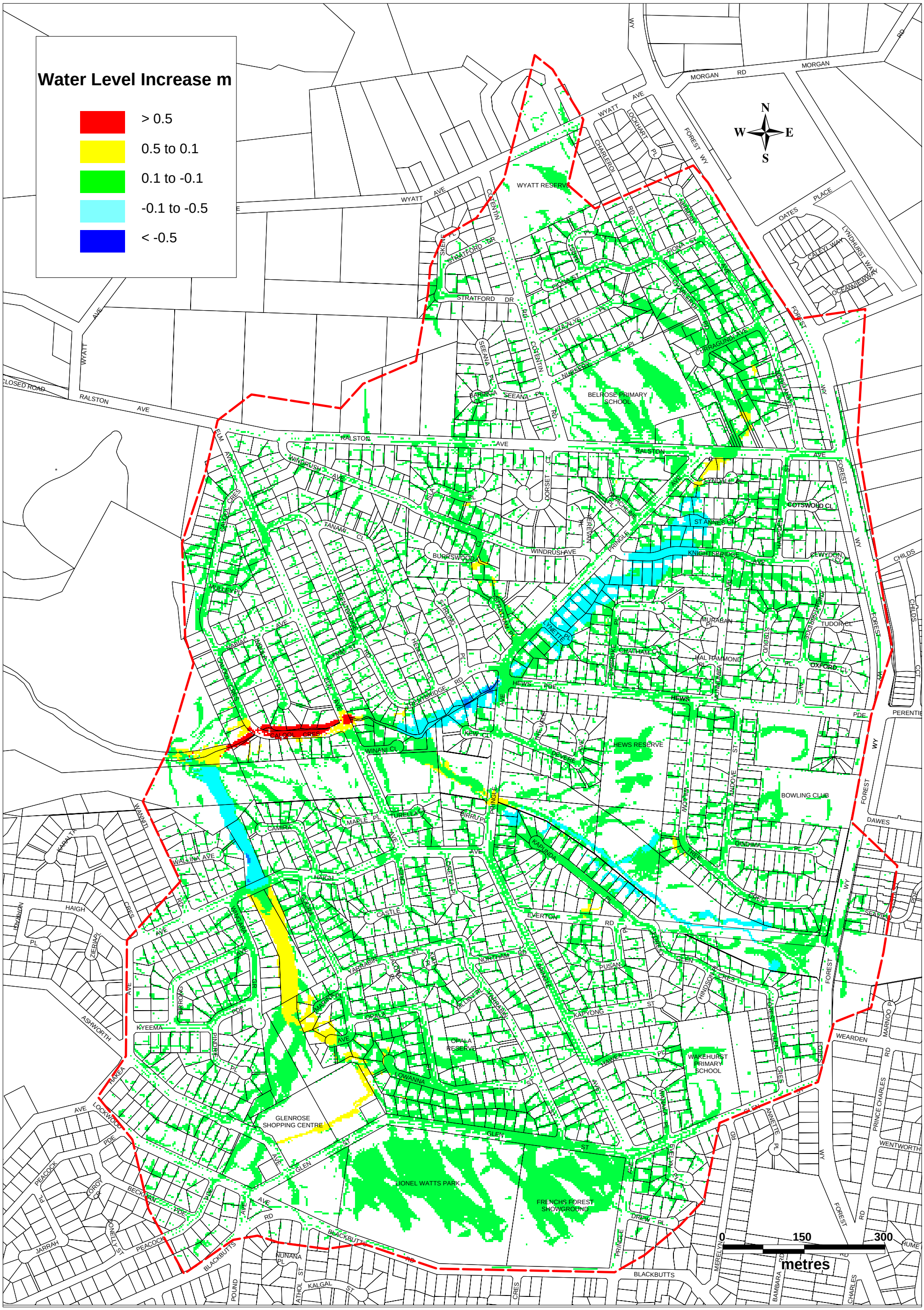

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PMF 100% Blockages - Flood Depth Impact

Figure 26

Study Boundary

Low Hazard

High Hazard

0 150 300 metres

Provisional Hazard Classification - Probable Maximum Flood Event

Figure 27

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Study Boundary

Low Hazard

High Hazard

0 150 300 metres

Provisional Hazard Classification - 1% AEP Flood Event
Figure 28

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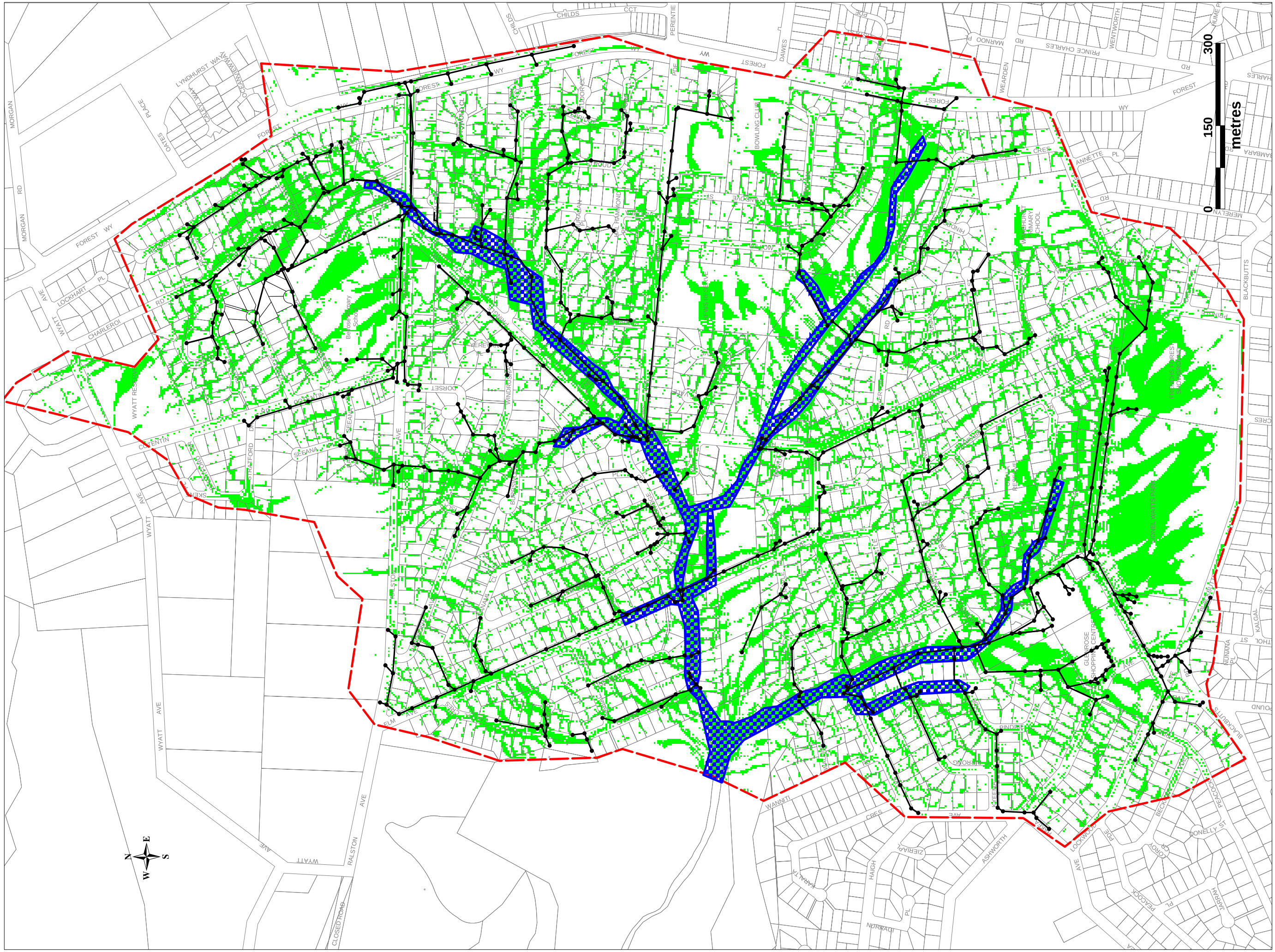

Hydraulic Category Classification - Probable Maximum Flood Event
Figure 29

Study Boundary

Floodway

Flood Fringe

0 150 300 metres

Stormwater Pit

Stormwater Pipe

Hydraulic Category Classification - 1% AEP Flood Event
Figure 30

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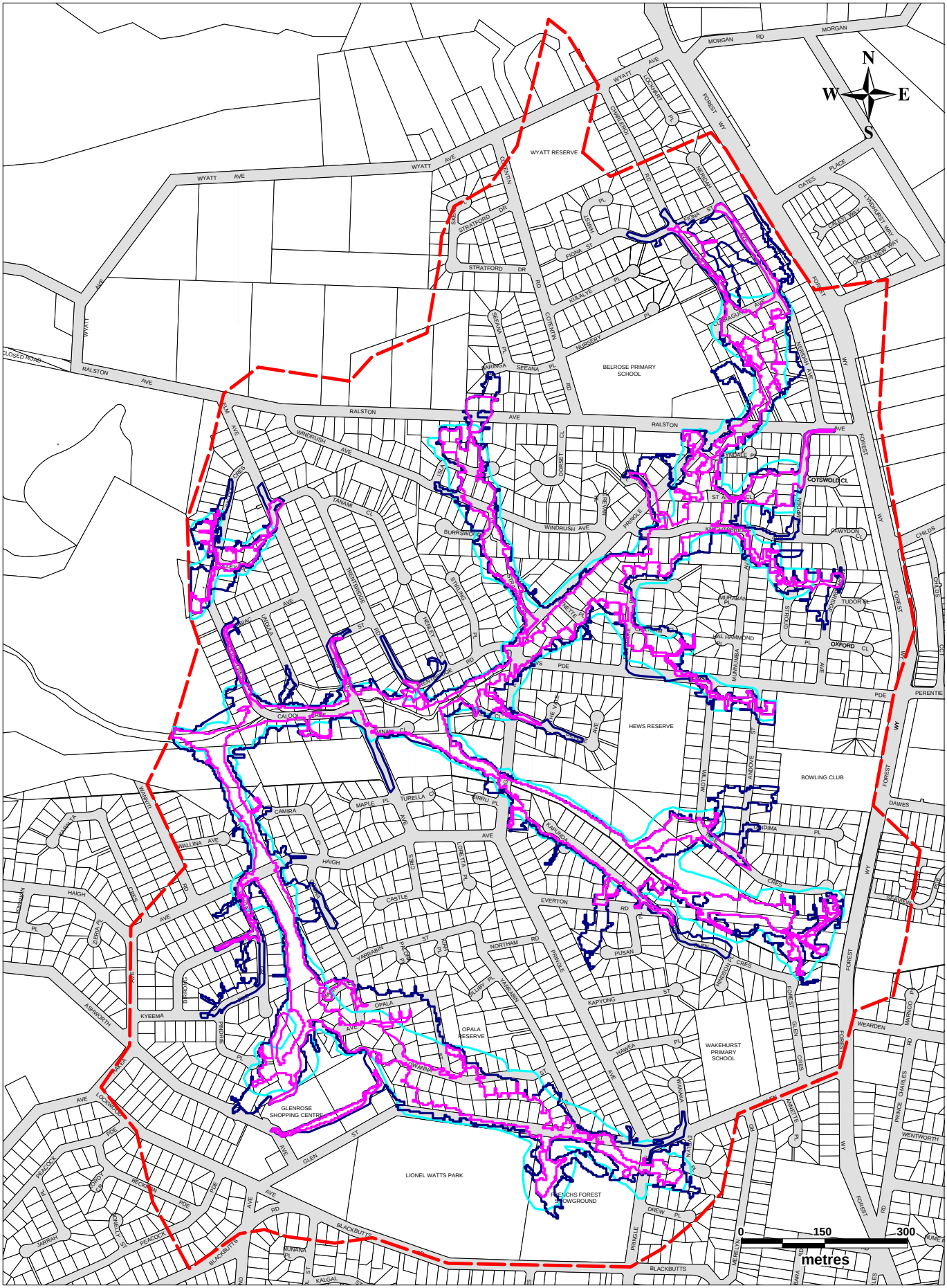
DHI Water & Environment



Study Boundary

1% AEP 100% Blockage Flood Extent

FPL Flood Extent

PMF 100% Blockage Flood Extent

Flood Planning Level
Figure 31

A P P E N D I C E S

A P P E N D I X A

Community Flood Information

Community Flood Information

A.1 Community Newsletter

A.2 Resident Survey

A.3 Press Release to Manly Daily

A.4 Questionnaire Responses

A1 – Community Newsletter

Important Information to Residents of the Frenchs Creek Catchment

Warringah Council

November 2004

Warringah Council is currently undertaking a detailed study for the Frenchs Creek Catchment to help plan flood protection in the future. The work includes a review of previous flood investigations. Council is keen to hear from residents about their knowledge and experience of past floods in the area and this newsletter tells you how you can get involved.

BACKGROUND

The Frenchs Creek Flood Study Review and Floodplain Risk Management Study will investigate overland flooding and stormwater issues in the upper parts of the Frenchs Creek catchment.

The study area comprises the areas of Belrose and Frenchs Forest, draining to Frenchs Creek and Corridor Creek. This catchment area is roughly bounded by Forest Way to the east, Garigal National Park to the west, Wyatt Avenue to the north, and Blackbutts Road to the south. The study area is shown on the map included with this newsletter.

The study will help define the existing flood extent within this area and examine options to reduce the risk of overland flooding in the future. The study is being coordinated on Warringah Council's behalf by independent consultants.

FLOODING IN THE FRENCHS CREEK CATCHMENT

Flooding in the Frenchs Creek catchment occurs naturally. The catchment has flooded in the past and is likely to do so again in the future.

Over time natural flow paths, especially higher up in the catchment, have largely been replaced by a network of stormwater pits, pipes and open channels. In the past, stormwater and the open creek channel flows lower in the catchment have overflowed, on occasions through private property.

WHAT HAPPENS NOW

To protect properties from potential flooding in the future, Warringah Council is revising its current flood study for the Frenchs Creek area.

A review will be carried out, including a detailed investigation of past flooding behaviour in the entire catchment. Information about past flooding, combined with computer models which describe runoff and consequent flow through both piped, channeled and overland flow systems will be used to quantify the depth and extent of flooding in the area.

A range of flood mitigation options will then be examined to reduce the risk to property and impact on the community from overland flooding.

Part of the study includes data on ground and stormwater pipe levels to define flood flow paths. A team of surveyors will be in the catchment area during the next few weeks measuring these levels. In some instances, the surveyors will need access to private properties as part of the survey. Your assistance in allowing the surveyors access over your land would be most appreciated.

HOW YOU CAN GET INVOLVED

If you are a land holder or resident in the Belrose/Frenchs Creek area, you can assist by completing the attached questionnaire and returning it to DHI Water & Environment in the provided reply paid envelope by **Friday 26th November 2004.**

You are also invited to participate in a personal follow up telephone interview. To do so, please indicate this preference on the attached questionnaire and provide details so that we may contact you. Alternatively you may wish to simply contact the nominated person at the end of this newsletter.

If you have any information on flooding in the study area, or thoughts on flood related issues you feel the current studies should take into account, we would like to hear from you.

You will shortly receive an invitation to attend an Open Day, which will help in the development of flood mitigation options.

WHO TO CONTACT FOR MORE INFORMATION

To find out more about the Frenchs Creek Flood Study Review and Floodplain Risk Management Study, or to obtain additional questionnaires or further information please contact:

Ms Zena Smith-White
DHI Water and Environment Pty Ltd
PO Box 5014
West Chatswood NSW 1515

Phone: (02) 8440 5700
Fax: (02) 8440 5701
Email: zsw@dhiwae.com

Mr Tim Meaker
Warringah Council
Civic Centre, 725 Pittwater Road
Dee Why NSW 2099

Phone: (02) 9942 2718
Fax: (02) 9942 2691
Email: meakert@warringah.nsw.gov.au

Thank you for your participation in this study.

A2 – Resident Survey

Frenchs Creek Flood Study and Floodplain Risk Management Study

Important Community Questionnaire

Please complete this questionnaire for the property in the Belrose / Frenchs Forest area in which you have an interest. Please complete as many of the questions as you can.

Information will be used for statistical purposes for the study only and will not be released in any other form.

Please place your completed questionnaire in the reply paid envelope provided and return it before Friday, 26th November 2004.

For clarification or assistance in completing this form, please do not hesitate to contact either Ms Zena Smith-White (DHI - 8440 5700) or Mr Tim Meaker (Council - 9942 2718).

Your House No._____ Street Name_____

Name of Business/Organisation (if applicable)_____

PART A - GENERAL INFORMATION

1. What is your property?
(Tick one or more boxes)

a. House [ ]
b. Apartment [ ]
c. Business [ ] Type: _____
d. Commercial [ ] Type: _____
e. Vacant Land [ ]
f. Other [ ] Type: _____

2. Please tick as appropriate:

a. I am a resident [ ]
b. I operate a business on the property [ ]
c. I own the property [ ]
d. I rent the property [ ]
e. Other (please specify) [ ]

3. How long have you owned, lived, conducted business at or had knowledge of this property?

a. Less than 1 year [ ]
b. 1 year to 5 years [ ]
c. 5 years to 20 years [ ]
d. More than 20 years [ ]

4. Do you expect to undertake any further development of your land in the near future?

a. None [ ]
b. Minor extensions [ ]
c. New dwelling [ ]
d. Dual occupancy (granny flat) [ ]
e. Sub division [ ]
f. Other (please specify)_____

PART B - FLOOD EXPERIENCE

5. Have you ever experienced a flood at the property or witnessed flooding in the area?

a. No [ ]
b. Yes [ ]

6. On average, how often would you experience flooding, and which floods can you remember?

How often?_____

Year_____ Month_____ comments_____
Year_____ Month_____ comments_____
Year_____ Month_____ comments_____
Year_____ Month_____ comments_____

7. In the biggest flood that you have experienced, was your property flooded above the floor level of the main residence?

a. No [ ]
b. Yes [ ]

If yes, what was the depth of water over the floor?_____

8. How long were the floodwaters over your property in the largest flood?

a. Less than 1 hour [ ]
b. 1 hour to 3 hours [ ]
c. 3 hours to 12 hours [ ]
d. More than 12 hours [ ]

9. What information can you provide on past floods?

a. No information [ ]

b. Information on extent or depth of floodwater at particular locations [ ]

c. Any permanent marks indicating the maximum flood level for particular floods [ ]

d. Photographs or video of flooding that you are willing to lend to Council to be copied and returned to you [ ]

e. Information on flow directions and velocities [ ]

f. Information on activities that may have affected flow paths [ ]

10. Are you able to mark on the enclosed study area map (or a more detailed map that we could supply to you) the extent of floodwaters near your property and/or the general directions of flood flows?

a. Yes [ ]

b. Yes (would like a more detailed map) [ ]

c. Unsure [ ]

d. No [ ]

PART C – FLOODPLAIN RISK MANAGEMENT MEASURES

11. What level of control should be placed on new development to minimize flood-related risks? Please tick only one box.

a. Prohibit all new development on land with any potential to flood. [ ]

b. Prohibit all new development only in those locations where it would be extremely hazardous to people and property. [ ]

c. Place restrictions on development such as minimum floor levels and/or the use of flood compatible building materials. [ ]

d. Advise of the flood risks, and allow people to choose how they would reduce flood damage. [ ]

e. Provide no advice regarding the potential to flood nor of the measures that could minimise potential flood risk. [ ]

12. What notifications should be given about the potential flood affectation of individual properties? Tick one or more boxes.

a. Advise every resident and property owner on a regular basis of the known potential threat. [ ]

b. Advise only those who enquire to Council about the known potential flood threat. [ ]

c. Advise prospective purchasers of property of the known potential flood threat. [ ]

13. Please indicate your level of support for each of these floodplain management measures.
(Use one tick for each row)

	Strongly Support	Support	Neutral	Against	Strongly Against
Measures that modify the way a flood behaves					
a. Constructing detention basins					
b. Constructing bypass channels					
c. Enlarging bridges and culverts					
d. Creek widening and/or dredging					
e. Clearing creeks of debris					
f. Removing creek and floodplain obstructions					
g. Constructing permanent levees					
h. Filling low-lying land					
Measures that modify property					
i. Voluntary purchase					
j. Voluntary house-raising					
k. 'Flood-proofing' measures in a property					
l. Controls on new development (e.g. floor levels, extent of filling, site detention, impervious areas)					
Measures that modify people's response to flooding					
m. Improving flood warning systems					
n. Improving formal evacuation procedures					
o. Promoting community flood awareness					
- Installing flood markers (e.g. on telegraph poles)					
- Providing a flood notification certificate to owners					
p. Promoting community flood readiness					

14. Which one or two solutions for dealing with the flood problem do you think deserve most consideration, and why?

_____

_____

_____

_____

_____

_____

15. Are there any particular locations that warrant attention, or do you have any other suggestions about what the study should address?

_____

_____

_____

_____

_____

_____

16. How would you like to become more involved in this project? Tick one or more boxes.

a. Please put me on your mailing list [ ]

b. Please contact me for a phone or field interview [ ]

c. I am interested in attending the Open Shop Day to be held during the development of floodplain management options [ ]

Please provide your contact details:

Name _____

Telephone Number_____

Best time to call _____

Any other comments?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Please place your completed questionnaire in the reply paid envelope provided and return it **before Friday, 26th November 2004.**

Reply address: DHI Water and Environment P/L
Reply Paid 5014
West Chatswood NSW 1515

For additional questionnaires or further information about the Frenchs Creek Flood Study and Floodplain Risk Management Study, please contact:

Ms Zena Smith-White
DHI Water and Environment Pty Ltd
PO Box 5014
West Chatswood, NSW 1515

Phone (02) 8440 5700
Fax: (02) 8440 5701
Email: zsw@dhiwae.com

Mr Tim Meaker
Warringah Council
Civic Centre, 725 Pittwater Road
Dee Why NSW 2099

Phone: (02) 9942 2718
Fax: (02) 9942 2691
Email: meakert@warringah.nsw.gov.au

Thank you for your participation in this study.

Frenchs Creek Flood Study
Study Area North

Frenchs Creek Flood Study
Study Area South

0 200 400 metres

BOWLING CLUB
HEWS RESERVE
WAKEHURST PRIMARY SCHOOL
FRENCHS FOREST SHOWGROUND
LIONEL WATTS PARK
OPAL RESERVE
GLENROSE SHOPPING CENTRE

A3 – Press Release to Manly Daily

PRESS RELEASE

FRENCHS CREEK FLOOD STUDY REVIEW AND FLOODPLAIN RISK MANAGEMENT STUDY

Warringah Council, in partnership with the State Government, has recently commissioned consultants DHI Water and Environment Pty Ltd to carry out this important study.

The study aims to define the existing flood extent and flood hazard within the study area and to determine viable floodplain management options to reduce the risk of overland flooding in the Frenchs Creek catchment.

The study area comprises the areas of Belrose and Frenchs Forest draining to Frenchs Creek and Corridor Creek. This catchment area is roughly bounded by Forest Way to the east, Garigal National Park to the west, Wyatt Avenue to the north, and Blackbutts Road to the south.

A questionnaire is being forwarded to properties in areas that are considered likely to be affected by overland stormwater flows in order to seek any information on past flooding, including dates, places and impacts of floods that may have been witnessed.

If anyone has an old photograph, video or any recollection of a flood event having occurred inside or outside your home or which may have stopped you travelling into or out of the study area, Council Staff or its consultants would be happy to discuss the information.

Please contact either:

Ms Zena Smith-White
DHI Water and Environment Pty Ltd
Phone: 8440 5700

Mr Tim Meaker
Warringah Council
Phone: 9942 2718

A4 – Questionnaire Responses

Street	Years at Address	Flood Info?	Above Floor	Duration (hours)	Levels?	Map (Y/N)	Photos (Y/N)	Level of Control?	Notification of Flood Risk?	A Constructing Detention Basins	B Constructing bypass Channels	C Enlarging Bridges and Culverts	D Creek Widening and/or Dredging	E Cleaning Creeks of Debris	F Removing Creek and Floodplain Obstructions	G Constructing Permanent Levees	H Filling Low-Lying Land	I Voluntary Purchase	J Voluntary House-Raising	K "Flood-proofing" Measures	L Controns on New Development	M Improving flod warming systems	N improving formal evaculation procedures	O Promoting Community flood awarenedss	O Installing Flood Markers	O Providing a flood notification certificate	P Promoting community flood readiness	Which deserves most consideration?	Comments
Andove Street	20+	No	No			No	No	a	a	5	5	5	5	5	5	5	5												
Birrong Avenue	5 - 20	No	No			No	No	a	c				1	5		1	1	4											Turn all flood prone areas that have not been developed into natural swamp/ park and give the native birds and animals a living/ breeding/ feeding area
Birru Place	20+	Yes	No			Yes	No	a	a/c	5	4	5	3	5	5	4	2	4	4	4	5	5	5	5	5	4	5	l	Being part of the family property which extended from Haigh Ave to Frenchs Ck, with frontage to Pringle Ave. Flooding approximately every 10 years. Major restrictions on buildings and improvements that add water to runoff, particularly upstream of Elm Ave due to critical flooding problems downstream of Elm Ave. Maintain/restore natural vegetation over all of the corridor upstream of Pringle Ave- Prefereably upstrteam of Elm Ave to reduce runoff. Corridor (needs attention). Frenchs Ck upstream of Pringle Ave and downstream of Elm Ave. I believe we need to severly restrict development to allow concentration on attempting top solve activities to reduce the adverse effects of past planning mistakes. Sugget any proposed subdivisions only allow lots over 800 sqm, with natural vegetation, but only in the case of the corridor, downstream of Elm Ave provided runoff from access is effectively piped away from Frenchs Ck above the National Park.
Burrswood Close	5 - 20	Yes	Yes	3 - 12	2.5 cm	Yes		a	a/c	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	a-h, l	March 2001, March 2004, March 1998. Major problem every three years due to overdevelopment in area without infrastructure to mittigate flooding.
Calool Crescent	1 - 5	Yes	No	<1		Yes	No	b	a	4	4	3	2	5	5	4	3		2	3	4	3	3			4	3	e	March 2003. I am in favour of first clearing and removing any obstructions on a regular basis to see if this makes any difference, then adress the latter, detention basins etc. I have only seen flooding on one occasion, as we have only been in this house 2.5 years. Water just tipped over the kerb onto the grass therefore the house suffered no effect. Canal opposite was brimming over. I don't feel I have witnessed enough to be able to elaborate any further. There was a lot of vegetation debris buildup from I'd say the last flood. Once this was cleared water seemed to flow faster and susided quickly.
Calool Crescent	1 - 5	Yes	No	<1	40 cm	Yes	No	b	c	1	5	5	4	4		5	1	2	1	1	5	3	5	3	3	4	3	c	flooding approximately every 2 years. March 2003, knee deep. Enlarge bridges & culverts, the problem is the roads. Leaves from liquid ambers and gums block the culverts which drain into the channel. If I was designing a Hydro engineer project, I would look at the road of the cannal at Calool Cres and decide to eliminate all kerbing to the Roseville river side as to allow free flow of sodden downpours.
Calool Crescent	1 - 5	Yes	No			No	No	a	c	3	3	4	4	5	2	2	1	2	2	3	5	4	3	4	4	4	5		Once a year on average.
Calool Crescent	5 - 20	Yes	No	1-3		Yes	Yes	a	b	3	5	5	5	5	5	5	3	2	2	2	2	2	3	2	2	2	2	b	Flooded five times in eight years, can't remember dates. Creek running under Calool Cres near our house, road floods here in heavy rain.
Calool Crescent	5 - 20	Yes	No	<1		Yes	No	a		5		5	5															d / l	April / August 1998, almost enetered my house in March, 2003. Restrict development which is likely to aggravate the well known existing flooding problems. Advise that the council is finally going to address this problem (which they have known about for years), and take appropriate corrective action. The main problems are that the creek is too narrow (constructed due to close building) upstream from Elm St. The culverts under Elm St are inadequate + once flood waters have passed over Elm St. They flow down Calool Cres, through properties before re-entering the waterway. Solutions: 1) Expand culverts at Elm St or build a bridge at Elm St. 2) Remove kerb on creek side of Calool Cres + alter the camber of the road to redirect water back into the creek. I believe that this flooding problem is caused directly by Warringah Council's approach to planning and Civil Engineering. Warringah Council indicated years ago that money would be set aside (funds) in the budget for corrective action to be taken, but nothing has been done. I am very concerned that Warringah Council continues to propose developments which are likely to aggravate the existing flooding problem
Calool Crescent	20+	No	No			No	No			2	4	3	4	4	3	3	3	4	4	4	4	4	3		4	3	3	a/d/e	Solutions a, d and e should be addressed in the flood prone areas. Ensure we maintain low density houseing to ease pressure on drainage
Calool Crescent	20+	Yes	No			Yes	No	a/c	a	5	3	3	3	5	2	2	2	1	3	3	3	5	4	4	4	2	3		Water running from No29 through to No27 Calool Cres every time it rains hard. The owners of No 29, after moving in a few years ago, removed a 4 foot brick retaining wall running along their driveway to the street to park two cars across their front yard. This created the water to flow across our property. We have asked them could they put some drainage in to combat this problem and shown them the river of water flowing underneath our home as well as across it. They said they would include drainage with the new driveway to be built along our border front to rear in their building plans- with council at present. There is no indication of this on the plan. I discussed the problem with Warringah Council sometime ago and was informed unless a brick wall or fence is washed away they would not intervene. So we tried to resolve the problem amicably with our neighbours to no avail. Could you pelase help up with this problem?

Street	Years at Address	Flood Info?	Above Floor	Duration (hours)	Levels?	Map (Y/N)	Photos (Y/N)	Level of Control?	Notification of Flood Risk?	Constructing Detention Basins	Constructing bypass Channels	Enlarging Bridges and Culverts	Creek Widening and/or Dredging	Cleaning Creeks of Debris	Removing Creek and Floodplain Obstructions	Consturcting Permanent Levees	Filling Low-Lying Land	Voluntary Purchase	Voluntary House-Raising	"Flood-proofing" Measures	Controns on New Development	Improving flod warming systems	improving formal evacuation procedures	Promoting Community flood awarenedss	Installing Flood Markers	Providing a flood notification certificate	Promoting community flood readiness	Which deserves most consideration?	Comments
Calool Crescent	20+	Yes	No	1-3		Yes		a	c	3	3	5	5	5	5	3	2	3	3	4	5	5	5	5	5	5	5		Local flooding on property not related to creek but reflects intensity of Belrose rainstorms. House is split level- flooding regularly in underfloor area adjacent to garage. No flooding on property, street flooded this year, major street property flooding in last 5 to 6 years. Frenchs Ck floods in Calool Cres- this is above a waterfall and steep valley, this would never occur naturally. The design of the creek stormwater channel should be corrected to prevent this bizare backup problem, which residents were told would not occur following creek widening and deepening in 1980's. Street drains in Calool are also overloaded in downpours- this casuses damage to road surface and subsidence of road. Belrose is an area prone to torrential downpours, this can cause local house flooding and overloading of street drainage. Frenchs Ck is poorly designed for quick water evacuation during heavy storm periods. The sight of a flooded house, only 100m from a 10 -20m drop, is something that nature could not provide and residents could not believe til they saw it. The rebuild of the channel around 1990 has caused the problem, not alleviated it- please engage a competent engineering cunsulte
Calool Crescent	5-20	No	No			No	No	c	b	4	3	3	3	4	3	1	1	3	4	3	4	4	3	4	4	4	4	o	Community awareness. Pollution.
Calool Crescent	1-5	No	No			No	No	d	a	3	4	4	4	5	5	3	2	3	3	3	5	4	4	4	5	4	4		
Calool Crescent	1-5	Yes			5 cm	No	No	c	a	4	4	3	3	4	4	3	4	4	3	5	4	5	4	4	3	4	4		
Camira Close	20+	No	No			No	No	a	c	4	3	2	2	5	4	3	3	3	3	4	5	4	3	4	4	4	4	e / l	Grass swales should be given high priority. Water sensitive urban design and the employment of rainwater tanks should be considered in the development control plan.
Camira Close	5-20	No	No			No	No	a	a				5	5							5	5							Calool Cres (requires attention), I know this area is extremely prone to flood. The "road corridor" west of Elm Ave has a creek running through it. Very marshy, swampy & overgrown with weed & willows. The weed & willows are rampant, this area is not maintained at all. How does this effect future water / flood behaviour?
Camira Close	5 - 20	No	No			No	No	a	a/c																			l	No developments as this would greatly reduce the potential runoff to the existing creek from new court yards, roads, roofs etc. This questionairre is flawed as it appears to assume that some sort of development will take place.
Camira Close	1-5	No	No			No	No	a	c	4	3	5	5	5	5	3	3	3	2	4	5	5	5	4	4	4	5	l	To proceed with further development will only extend the problem, even if flood measures are incorporated. The vacant land that forms the Warringah / St Ives corridor would be better utilised as recreational / sporting area to allow natural disspation of the excess water and provide much needed leisure facilities to the area.
Castle Crescent	20+	No	No			No	No																						Age: 92 years.
Castle Crescent	5-20	Yes	No			Yes	No	a	a/c																			l	Flooding every 3-5 years. Limiting up stream developments. Maintaining natural environments surrounding natural water courses. Calool Cres, Winani Cl, & Elm Ave. The over-development or any development on the road corridor through through the catchment area (all require attention). I am concerned about any development of the abandoned road corridor and the effect of runoff to areas that already experience flooding.
Charleroi Road	20+	Yes	No			No	No	a	a	4	4	4	3	4	4	4	2	4	4	4	5	4	5	4	4	4	4		During heavy flooding, water washes down from land running from Cotentin Rd, down the slope & through our backyard, down Charleroi Rd, to Curragundi Ave, where in years past the water on the road has cut off access to Charleroi Rd, except via Neridah Ave. This is a natural watercourse, because of the slope of the land behind our home & that of our neighbour's homes. On the map you supplied, I would have liked to have seen exactly where is French's Ck, and where is the catchment?
Charleroi Road	5-20	Yes	No			Yes	No	a	c	5	5	5	5	5	5	5	5	2	2	5	5	5	5	5	5	5	5		Floods occur twice yearly. Feb 2003, no. 35 Flooded. Apr 1998, Severage outlet overflowing on reverse opposite. (supports) any measures available that alleviate the worst affected areas.
Clwydon Close	20+	Yes	No		Yes	Yes	No	a	a	3	3	3	3	5	5	2	1	4	4	5	5	5	5	5			5	l	Pringle Ave (needs attention)
Clwydon Close	5-20	Yes	Yes	<1	5 cm	Yes	Yes	a	a	5				5	5					5	5	5			5		5	e/l	3-4ft. Deep Flooding in Knightsbridge Ave. Flooding about every second year. Oct 2003, heavy downpour, runoff from Forest Way. 2000 & 2002, inundated shed, backed into garage & laudry. Water 2 inches above ground floor level. Keep creek & floodplain clear of obstructions. Ensure planning approvals for development property consider the effect of any water flow problems. Attention to: Creek under Pringle Ave, Waterflow on Knightsbridge Ave. Rapid development in the area increases roof runoff, as did the widening & raising of Forest Way.
Coora Avenue	20+	Yes	No	1-3	1-2 cm	Yes	No	a	c			4	4	4	4		1			4	4				4	4		e	Flooding about 10 years ago. Wingara Reserve turned into a lake, the rest of the time it is a bog after heavy rain. 2003-4, heavy rain over northern beaches. Garage (flooded) only 1-2cm. If creeks are cleared there is less chance of damming and overflow. This should NOT be done by putting creeks in pipes. Wingara Reserve (Haigh Aven) creek has been piped in on the South side of Haigh Ave, causing problems.
Coora Avenue	1 - 5	No	No			No	No	a	a	3	3	3	3	3	3	3	3	3	3	5	5	5	5	5	5	5	5		Education and environment (natural management) should get most consideration.

Street	Years at Address	Flood Info?	Above Floor	Duration (hours)	Levels?	Map (Y/N)	Photos (Y/N)	Level of Control?	Notification of Flood Risk?	Constructing Detention Basins	Constructing bypass Channels	Enlarging Bridges and Culverts	Creek Widening and/or Dredging	Cleaning Creeks of Debris	Removing Creek and Floodplain Obstructions	Consturcting Permanent Levees	Filling Low-Lying Land	Voluntary Purchase	Voluntary House-Raising	"Flood-proofing" Measures	Controns on New Developments	Improving flod warming systems	improving formal evacuation procedures	Promoting Community flood awarenedss	Installing Flood Markers	Providing a flood notification certificate	Promoting community flood readiness	Which deserves most consideration?	Comments
Coora Avenue	20+	Yes	No	1-3	80cm	Yes	No	b	b	3	5	4	4	5	5	3	2	3	2	3	3	4	3	3	3	3	3	e	April 11th, 1998. 1995?. Water rose above foundations on one occasion. Our problem is that gutter drains at Glenrose shopping centre at not kept clean of leaves and rubbish. If these entry points (mainly the two above the pathway from Coora Ave at the rear of woolworths) we would have no trouble. Shopping centre denies responsibility - Council does nothing!! As residents we take crow bars etc and try to fix it ourselves. Thanks for the opportunity. The large flood on the 11/4/98 was caused by the drains in and around Glenrose shopping Centre that could not cope. Being at the bottom of the pathway into Coora Ave, we get the natural overflow. Stockland mall (Glenrose shops) only need to keep their gutter drains clear and I don't think we would have any problems. In 1998, we lost a Paling fence and lots of garden. Neighbours below us in Warrina Pl were worse off. Furniture stored under the house was ruined, and debris from the neighbourhood was strewn all over our property. Lost many tons of soild from garden, and lost plants.
Cotswold Close	20+	Yes	No	1-3		No	No	b	a	4	3	3	3	5	5	4	3	3	3	3	3	4	5	4	2	4	4	o/e	March 2003, Runoff from Forest Way. Stop people from using drains for rubbish. More runoff is required. Clean grates. Replace plants as they die on council / other property.
Curragundi Avenue	20+	Yes	yes	1-3	50 cm	Yes	No	d	a		5	5	5	5						5								b/ e	Flooded 3 times in 26 years. Need to address Charleroi Rd and Curriagundi Ave. This flood study has been a long time coming.
Curragundi Avenue	20+	Yes	No			No	No	c	a/c																				>10 years ago, flood waters would be present in our street, however, since new stormwater drains were built, there have been no problems. We do not get flooded, however several houses in Curragundi Ave have been flooded (>10 years ago).
Curragundi Avenue	5-20	Yes	No	<1		Yes	Yes	b	b	4	4	3	4	4	2	2	2	2	2	4	4	4	4	3	3	3	4		Flooding twice. April 1997???, Good Friday Deluge. Another a few years ago.
De Vere Avenue	20+	Yes	No			Yes	No	a	a/b/c	1	4	5	5	5	5	3	3	4	4	4	5	4	4	5	4	4	5	e / f	Flooded at least three times in last 10 to 15 years. Water has flowed through the garage, however house is on piers. Clearing creeks of debris and removing creek and floodway obstructions- need to get water away as fast as possible not store it somewhere. Earth drain on western boundary of Hews Reserve. Drain has not been maintained and water flows down public pathway to De Vere avenue instead of off to Corridor Creek. No 18 De Vere Avenue has been flooded a number of times in the past.
De Vere Avenue		Yes	No	1-3		No	No	a	a/c	3	2	2	2	4	4	2	1	3	3	4	5	3	3	3	3	4	3		Flooded annually. Re-appraisal of stormwater infrastructure. Current system has already been impacted by development and future additional development will.
De Vere Avenue	5 - 20	Yes	No	1-3		Yes	No	b	b	4	5	5	4	4	4	2	2	2	2	2		4	2	4	4	4	4		Flooding every 5 - 7 years.
Dorset Close	1-5	No	No			No	No	d	a	2	4	3	2	4	4	4	2					4	4	4	4	4	4		Constructing of bypass channels, this would improve the problem of flooding in private properties. Q15) Not that I personally know of, I am a fairly new resident to the area and I have not experienced any problem with flooding in and around the neighbouring area. I didn't know that this area has got a flodding problem, more information on this would be appreciated.
Dorset Close	20+	No	No			No	No	b	a	4	5	4	4	5	5	5	4	3	3	4	3	3	3	3	3	4	3		
Dorset Close	5-20	No	No			No	No	a	a					5	4					5		4		4			4	d	
Elm Avenue	20+	Yes	No	<1		Yes	Yes	a	a			5	5	5				5				5		5					Flooded March 2003 (severe), August 1998 and April 1998 (severe). Widen culvert at Elm Ave Bridge; Widen Channel eastwards to Pringle Ave; Accept the notion that Frenchs Ck has become a drain. Have fought for an upgrade to Frenchs Ck for 15 years with little success. Have video's, have interviewed councillors over years with no effect. Check on the runoff off Forest Way, does it flow into Frenchs Ck?
Elm Avenue	1 - 5	No	No			No	No	d	c	5	5	5	2	5	4	2	3	4	4	4	4	4	4	4	4	4	4		
Elm Avenue	20+	Yes	Yes	1-3		Yes	Yes	a	a	5	5	5	5	5	5	5		4	4	5	5	3	3	3	3	4	5	e	3 times in the last 6 years, it has become more frequent. 1998, 263mm/24hrs (have photos). 2003, Flood levels worse than previous level (have photos). 2000, 29mm/1 hr. Garage floods. Ensure property easements are maintained & functioning, and that creek instructions are removed. Allow extra drainage lines from properties to other streets. e.g. 29 Elm to drain into Undula via house behind (No. 2 Undulla). Creek at Calool Cres cannot cope with the amopunt of water. No further developments should be approved until thr current flooding is managed satisfactorily. New developments must have retention facilities & re-use of water facilities. We have installed a new pipe into our easement to ensure it drains our property. Our drainer tested with dye & no water was carried into French's Creek at Calool Cres.

Street	Years at Address	Flood Info?	Above Floor	Duration (hours)	Levels?	Map (Y/N)	Photos (Y/N)	Level of Control?	Notification of Flood Risk?	Constructing Detention Basins	Constructing bypass Channels	Enlarging Bridges and Culverts	Creek Widening and/or Dredging	Cleaning Creeks of Debris	Removing Creek and Floodplain Obstructions	Consructing Permanent Levees	Filling Low-Lying Land	Voluntary Purchase	Voluntary House-Raising	"Flood-proofing" Measures	Controns on New Development	Improving flod warming systems	improving formal evaculation procedures	Promoting Community flood awarenedss	Installing Flood Markers	Providing a flood notification certificate	Promoting community flood readiness	Which deserves most consideration?	Comments
Elm Avenue	5-20	Yes	No			Yes	Yes	a	a					5							5	5						e/L/m	Once every five years. Easter 1988, Calool Cres, Serious flooding. August 1988, Not a flood, but our embankment was partially swept away. 2003, flooding across Elm Ave was serious. Since 1994 when the main road (Forest Way) was widened & the runoff was directed to the west side of the road, there has been a tendency for Council to build on low lying, flood-prone land (e.g Ralston & Pringle Ave) and push water into pipes. This causes more water to flow in French's Ck instead of being able to drain away. Therefore when there is heavy rain, there is a huge rush of water after a few minutes. If houses are built on the old road corridor, this will become much worse as a very wide area will be taken away from natural drainage, and will leave the council open to accusations (and court actions). Water flow in Frenchs Ck seems to have changed over the past 20 years. Please let us know, preferably by letter or fax, when the computer model was last updated (and/or how often it is updated).
Evelyn Place	20+	No	No			No	No	c	a/c				2	4	4	2	2			4	4	4		4	4	4	4		
Everton Road	1 - 5	No	No			No	No	a	a/c	4	4	3	3	5	4	2	2	2	4	4	4	4	4	5	5	5	4	and n/o	
Everton Road	20+	No	No			Yes	Yes	a/b/c/d	a	1	4	5	5	5	5	4				4	4	5	5	5	5	5	5		I do not support one or two solutions, the problem needs holistic solution. Calool Cres, St Annes Cl, Trentbridge Ave, Neridah St. Confirm comments made to Zena Smith-White and Grantley Smith during their onsite visit.
Fiona Street	20+	No	No			No	No	a	a/c	4	4	4	3	4	4	2	2				4	4	4	4	3	4	4		
Forest Glen Crescent	20+	No	No			No	No	a	a/c	4	1	2	5	5	5	2	1	4	4	5	5	5	4		5	5	4	e	Clearing creeks of debris + removing creek and flood plain obstructions because I believe this would allow the water to get away quickly, not dam up and cause flooding.
Forest Glen Crescent	5 - 20	Yes	No			No	Yes	a				5		5														c/d	Small bends. 2003, minor flooding, exterior property boundary. 1996 & 1997, extreme flooding into rear yard of house.
Forest Glen Crescent	20+	No	No			No	No	a	a/c	4	4	4	4	4	4	4	4				4	4	4	4	4	4	4		
Forest Glen Crescent	20+	Yes	No	3-12		Yes	No	a	a/c	1		5		5							5							c/e/l	Prohibit any development that causes any destruction of piping of corridor creek with resultant increased flowsinto Frenchs Ck. Culverts at Pringle Ave and Elm and Calool Aves. Interscetion of Corridor and Frenchs Ck.
Forest Glen Crescent	20+	No	No			No	No	a,b,d	a,b,c	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	a	Detention basins - they are effective controls on new development, essential when altering natural bush etc.
Forest Glen Crescent	20+	Yes	No	3-12		No	No	a	a/c				5	5						5		5		5		5		e	Clear debris in open drain & creek in Belrose corridor to enable water to get away quickly & not flood yard. The possible housing development in the Belrose corridor could well increase flooding at the bottom of the corridor. The flow of water in the creek and drain at the back of my property, if cleared of debris will enable the flood water to move quickly, stopping flooding in my area, but some sort of retention basin would need to be constructed to stop the extra flow into French's Creek. Otherwise houses in Kupunda Ave would be subject to major flooding with unempeeded water from the creek and drain.
Forest Glen Crescent	20+	Yes	No	<1		Yes	No	c	c				5	5														d/e	
Glen Street	5-20	Yes	No	<1		No	No	a	a/c	2	5	2	5	5	5	2	3	3	3	4	5	4	3	4	3	4	5		Flooding only once
Glen Street	20+	Yes	No	<1		Yes	No	a	a	4	4	4	4	5	5	5	2			4	5	4							Flooding probably 6 times in 30 years.
Haigh Avenue	20+	No	No			No	No	a	a	2	2	4	4	4	4	2	2												NO FLOODING IN PAST 40 YEARS. Belrose is now developed (Housing / Roads / etc.). No further "Developments" safely possible. What flood plain? No problems as yet.
Haigh Avenue	>1	No	No			No	No	a	a/c	2	2	2	3	4	3	2	1	3	3	3	4	4	4	4	4	4	4		The options of less land clearing, restoration of riparian areas and flow areas and reduction of hard surface areas are important ie development. Encourage stormater retuention for use on property and council lands, ie water tanks etc. Drainage which encourages soaking on rather than going straight through to pipe system.
Haigh Avenue	20+	Yes	Yes	>12		Yes	Yes	a	a		5		5	5															Heavy rain always causes little flooding in the reserve next to our house and takes days or even weeks to dry out. Often floods under the house. We have lived alongside this reserve for approximately 28 years and have always had trouble with water gettiing away. Its not unusual when it's heavy for cars and trucks driving up the reserve making it worse. Sign should be installed in Haigh Ave, not at the opposite side of the reserve.
Haigh Avenue	20+	No	No			No	No	b/c	a	2	4	4	4	5	5	3	3	3	3	3	3	4	4	3	4	3	3	e/f	

Street	Years at Address	Flood Info?	Above Floor	Duration (hours)	Levels?	Map (Y/N)	Photos (Y/N)	Level of Control?	Notification of Flood Risk?	Constructing Detention Basins	Constructing bypass Channels	Enlarging Bridges and Culverts	Creek Widening and/or Dredging	Cleaning Creeks of Debris	Removing Creek and Floodplain Obstructions	Constructing Permanent Levees	Filling Low-Lying Land	Voluntary Purchase	Voluntary House-Raising	"Flood-proofing" Measures	Controns on New Development	Improving flod warming systems	improving formal evacuation procedures	Promoting Community flood awarenedss	Installing Flood Markers	Providing a flood notification certificate	Promoting community flood readiness	Which deserves most consideration?	Comments
Haigh Avenue	5 - 20	Yes	No	3-12		Yes	No	a/b	c	4	4	4	5	5	5	4	3	3	3	3	5	4	4	4	4	4	4	e/l	Keep all natural runoff creeks clear of debris so as to not obstruct the natural flow of water into middle harbour. If the creeks ar kept clear they generally do not backwash & flood. As demonstrated by the runoff problems at the Peppercorn Ridge development, strict guidelines should be made upon the developers as to how they divide up the land, so that new owners are not forced into extra expense, fixing up problems after purchase. The creek next to 34 Haigh Ave needs clearing badly. There are fallen logs in it and debris which in summer decay, causing it to stink! The logs obstruct the flow of water. There is also lots of bamboo which is a weed and has caused one resident to have her insurance increased, because the insurance company deemed it a fire hazard. The Coucil planted it in the first place! A water sample should be taken to deem if it is toxic as children play near/in creek frequently & as my dogs drank from it once, they ended up with acute gastro-enteritis. Not healthy for animals / humans. 1998 & 2003 flooding.
Haigh Avenue	5 - 20	No	No			No	No	c	b	4	4	5	4	5	4	3	4	3	3	4	4	4	4	4	3	5	4		
Henley Close	20+	No	No			No	No	c	a/b/c												5	5	5	5	5	5	5		I cannot rate the proposed solutions above because I believe each situation should be considered and treated on its own merit. Any one solution is not necessarily the best for all situations. What is good for one may be bad for another when also taking into consideration the ecology.
Hews Parade	5 - 20	No	No			No	No	e	a	3	3	3	4	5	5	3	3	3	3	4	4	4	4	4	4	4	4		
Hews Parade	5 - 20	No	No			No	No	c	c	4	3	3	2	4	3	3	4	3	3	3	4	4	4	4	4	4	4		The pedestrian crossing at Forest Way shops across forest way, needs to be overhead.
Hews Parade	20+	No	No			Yes	No	b	a	1	1	3	1	4	4	1	1	3	3	3	4	4	4	4	4	4	4		(indicates on map) Lay of the land suggets an old creek flowed in the direction of the arrow. Never flooded but used to get moisture under the house after very heavy rain.
Hews Parade	20+	No	No			No	No	a	a	3	5	2	2	5	5	3	2	3	3	4	5	5	4	4	4	4	4		
Hindson Place	1-5	Yes	No	>12		Yes	No	a/d	a/c	1	3		2	5	4	3	3	4	2	4	5	4	4	5	3	4	4	L	Floods twice a year. 2003, around June. Control on new developments, because development detracts from land which otherwise used to assist storm water absorption. The study should investigate the increased risk of flooding if the proposed development of tghe "nature corridor" in Belrose is to go ahead.
Hindson Place	20+	Yes	No	<1		Yes	No	a	a/c	2	5	4	3	5	5	1	3	3	2	4	5	5	5	5	3	5	5	d/e	Since 1973 I was the local councillor living in the area and witnessed actually the flooding as it occurred or saw the aftermath in response to phonecalls from residents. I was instrumental in the council spending many $100,000's in rectifying flooding problems in the area. Areas marked in blue (on the map) signify flooding. I retired from council in Sept 1995. (Flooding occurs) whenever rain intensity reaches 25 mm / half hour. Clear and widen creeks so that water can get away quickly. Divert all stormwater from Forest Way to the East toward Narrabeen catchment as originally agreed to by D.M.R. The development of the road corridor between Forest Way and Elm Avenue will exacerbate extensive flooding to existing homes. Retention basins are NOT the solution.
Kapunda Place	20+	Yes	No	<1		Yes	No	b	a/c	1	4	5	4	5	4	2	2	2	2	4	2	4	4	4	4	4	4	e	Areas marked "X" on the map need attention. Study should address effects of replacing bushland with housing development on water flows further down the flow path. Clearing / enlarging existing existing blockage potential. Flooding every 10 years. March 2003, see map for flow through property, almost to floor level.
Kapunda Place	5 - 20	Yes	No	<1		Yes	No	a	a/c	1	1	5	5	5	5	4	1	1	1	4	5	4	4	4	4	4	4	l	Flooded twice, April 1994 and November 1987, flooded up to back fence. Controls on new development. Flooding problems need to be addressed. If any development went ahead at the back of my property the flooding nned sto be addressed.
Kapunda Place	5 - 20	No	No			No	No	b	a																				
Kapunda Place	20+	Yes	No			Yes	No	a	c	3	2	5	5	5	5	2	5	2	2	2	4	2	2	2			4	d/e/f	At bottom of Pringle Ave where house is, and there is no level to stop the front of house being flooded. Storm pipe outside rear of no 16 Kupunda Pl needs to be inspected more frequently, and creek needs to be checked and cleaned more often. Also grass between rear of properties and creek needs to be mowed more often. We were told some months ago that this work would be done regularly, but lately this has not been done at all. Flooding occurred 3 or 4 times, worst in April 1998.
Kapyong Street	5-20	No	No			No	No	b/c	a/c	2	5	2	2	5	5	5	2	5		5	5	5	5	5	5	5	5	o	None experienced in 18 years of occupancy. Notify potential flooding to prospective property purchasers (moral obligation). Compensation to affected homeowners is imperative as its an immediate solution to their problems. Failure to do so (act upon the the issue) is financially crippling. (attention to:) lower lying areas. I have not personally witnessed flooding in the area in the 18 years I have been a resident. However, since I live a considerable distance from the creek, and occuppy land higher than the creek, I am not affected. I am however, aware of a number of residences in low lying areas that are often subjected to flooding in heavy rains.

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Kapyong Street	1 - 5	Yes	No	3-12	2.5 cm	No	No	c	a/c	4	3	4	2	5	4	3	2	4	4	4	4	5	4	4	4	3	4	e/p	I think it might be worthwhile to provide residents with a small bin for vegetation to be collected with their usual vegetation monthly pickup. This small bin should be used specifically for cleaning up the gutter. This way the council would be encouraging residents to clean their gutter on a monthly basis. Everytime there is too heavy or long a downpour, our backyard fills like a pond of 3 - 4 inches deep. The street gutters fill and the driveways are like waterfalls. Laundry floods about 1 inch. Regularly clearing the gutters & creeks of debris leaf build up. A formal package (should be) given to residents telling them what they can do to prepare for floods and minimise impact.
Kapyong Street	20+	No	No			No	No	b/d	a/c				1	5	5						5	5				5			
Kapyong Street	1 - 5	Yes	No	3-12		Yes	No	a	a/c	3	3	4	2	5	5	3	1	5	3	4	5	4	4	4	4	4	4	4	e	Flooding about once per year. Sept 2004, caused by blocked drains. Aug/Sept 2003, caused by blocked drains. Keeping existing creek lines, floodways, stormwater drains and pits clear of debris. Why? Because blocked pits always causes our flooding. Secondly, keeping existing water courses open will protect existing property from smaller flood events. and restrict damage to more extensive flood frequencies. Our floods come from blocked pits or stormwater drains from government open space. Maintenance of open space and subsequent open space must be addressed.
Kapyong Street	20+	No	No			No	No	a	a	4	4	5	5	4	4	3	3	4	4	4	4	4	5	4	4	4	4	5		Possibly the water drainage at the rear of wakehurst school, drain cover at the base of steps in Kapyong St is sometimes lifted off by the force of the water. Then drainage spills out into the street during heavy runoff.
Kew Close	5-20	Yes	No	<1		No	No	a	b	5	5	3	4	5	4	5	2	1	2		4	3	2	2	1	1	2	a/e	Construction of detention basins & clearing of debris. I believe these options would have the least imapct on the environment & neighbourhood. April 1998 & Feb 2003 Floods.
Kew Close	5 - 20	No	No			No	No	b	a	4	4	4	3	5		4	4	3	3	4	4	4	4	4	5	5	5		I do not think our property is in a high risk location. Although the level of the creek at the back of our property rises during heavy rain there have been no flooding issues.
Knightsbridge Avenue	5-20	Yes	No	3-12	25 cm	Yes	No	c	a				1	4	2		1		4		4							e/L	Flooding once a year. Spring 2002, Stormwater drain on road blocked. Summer 2002, 2001 & 2000: Next door neighbour's backyard (#10). House #10 flooded inside. More regular clearing of leaf litter from roads to ensure gutters are not blocked. Fines for people found sweeping leaf litter or garbage down the drains. I feel a large amount of the problem is due to blocked drains and over-development. I know the council loves to make money, but over-developing areas will always create flooding problems, especially on the rain belt.
Knightsbridge Avenue	5 - 20	Yes	No			Yes	No	a	c	2	3	3	4	4	4	3	3	3	3	4	5	4	4	4	3	3	4		Flooded once, in vicinity of 40 kinghtsbridge Rd. 2003 (October?) Very heavy rain, drains unable to cope. At same event Forest Way western side of road and about 200m south of Belrose Bowling club 3 lanes blocked due to flooding
Knightsbridge Avenue	20+	Yes	Yes	1-3	5 cm	Yes	No	a	a	3	3	4	3	5	4	2												L	Flooded 4 times. April 1991, lower level flooded. March 1994, lower level partly flooded. April ?, Knightsbridge Ave flooded. April again ?, Knightbridge Ave flooded. Better drainage when property developed. Less development and restriction on paved areas. Water tank installation on new development.
Knightsbridge Avenue	1-5	Yes	No	3-12		No	Yes	c	b	3	4	4	4	4	4	4	3	4	4	4	4	5	5	5			5		October 2003, flooded street and neighbouring property.
Knightsbridge Avenue	5 - 20	Yes	No	<1		Yes	No	a/b/c	b	3	5	5	3	5	5	3	3	3	3	3	3	3	3	3	3	3	3	l	Flooded twice, March 2003 and April 1998. Forest Way widening in the area around Ralston and Wyatt avenue has caused excess runoff
Knightsbridge Avenue	20+	Yes	No	1-3		No	Yes	a	b			5		5							5	5		5	5	5			Everytime we have a continuous heavy downpour, water from the Munumba Reserve into our rear garden like a torrent. The two worst floods: April 1998 & March 2003. On Good Friday, our front street was also flooded on both occasions, we could not drive down our driveway. We are not qualified to know the answers to these issues, but all those indicated above (in the survey) deserve attention. We would like to thank you for tackling this important issue. We apologise for the lateness of our reply, as we have been away in the country.
Knightsbridge Avenue	5 - 20	Yes	Yes	1-3	10 cm	Yes	No	a/c	a/c	3	5	4	5	5	5	3	4	3	2	4	5	3	3	4	3	4	4		Flooded twice, April 1998 and March 2003. Its too late to undo all the development. The only practical solution is to increase the storm water runoff capacity- bigger channels and tunnels. Pinebark should be removed from all areas of landscaping. Leave larger areas of open ground for surface absorption. The major runoff on both occasions took place from Ralston Ave at Forest Way and the stormwater passed through properties in Lyndale Pl, St Annes Cl into Knightsbridge Ave. It rose to 1m in Knightsbridge and passed through driveway at No 43 and proceeded through properties in Lynette Pl and Pringle Ave to the head of Frenchs Ck. A six foot stormwater tunnel passes 12ft beneath our backyard and the water blew off the inspection lid.
Knightsbridge Avenue	20+	Yes	Yes	1-3	15 cm	Yes	Yes		c	2	2	2	2	4	4	3	3	3	2		4	3	3	4	3	3	3		Flooded twice in 5 years, April 1998 and March 2003. I am not sure that the above really applies to the area in Knightsbridge Ave, the areafor my concern- the flash flooding was due to stormwater not the free to flow in the existing system, due to debris in the creeks and stormwater pipes and levies. I think that the flow from the highest area of Forest Way caused the flooding- since the construction of the 6 lane carriageway was completed, stormwater could not be contained within its existing system. The design of the roads (especially Knightsbridge Ave) seems to casue all problems to my property.
Knightsbridge Avenue	20+	Yes	No	1-3		No	Yes	c	a	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	a/e	Photos in Manly Daily. Flooding has occureed twice. March 2003, flooded garage, house on piers. Easter 1999?, Flooded garage, thankfully. (attention to) Knightsbridge Ave, lower end towards Pringle Ave. We were of the understanding that the flooding problem at the lower end of Knightsbridge Ave Belrose, had been fixed.

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Knightsbridge Avenue	20+	Yes	No	3-12		Yes	Yes	a	a/c	5	5	5	5	5	5	5	5											Flooded six times at least, since the slums were built in Lyndale Pl. St Annes C becomes flooded which then flows to and floods Knightsbridge Ave. Refer photo Manly Daily 12/03/2003. DON"T BUILD ON FLOODPLAIN!
Kyeema Parade	20+	Yes	Yes	1-3	10 cm	Yes	No	a	a	5	4	3	3	4	3	4	3	4	4	4	5	4	4	4	3	3	3	a	Flooded four times, latest 2003. Suggest improving drain systems and construction of detention basins
Kyeema Parade	5 - 20	No	No			No	No	a	c						5		1	2		4		3					e and	By cleaning out the rubbish from creeks etc the problem would diminish, and if owners ensure that blockages on their properties are reduced it is to their own benefit. We have never had a problem with flooding of our property.
Loretta Place	5-20	No	No			No	No	c	c	5	5	3	3	5	3	3	3	5	5		5	5	5	5	5	5	5		
Lowanna Street	5 - 20	No	No			No	No	b	a/c	4	3	4	4	5	3	3	2	5	5	5	5	5	5	5	5	5	5	e/l	Ensure all creek beds are free of debris and have appropriate flora and fauna in them, i.e. native to the area. (ensure) All houses that are being built/renovated on the known floodplain have appropriate drainage and owners are aware of floodplain. Study to look at impact that current housing has on floodplain, i.e. change in course of creeks/floods, so that floods have occurred in places where normally would not have occurred. We need to be more aware of impact of medium density housing in area has on floodplains, catchment areas and overall environment within Belrose/ Frenchs Forest.
Lowanna Street	5 - 20	Yes	No			Yes	No	d	a/c	3	3	3	4	4	4	3	4	3	3	4	3	4	4	4	4	4	5	e and	Flooding once in seven years. Our property has not experienced a flood itself but we have seen the result of a flash flood from Lionel Watts Oval. I do not know what caused this flood, maybe a number of things- blocked drains, a lot of rain all at once- but recently with the development on Glen St, drains have been installed in the walkway beside this development. Maybe this will help next time. Also the area behind the tennis courts behind Glenrose shops floods after a lot of rain and the creek accross the road should be kept cleen so it can cope.
Lowanna Street	20+	Yes	No	<1		Yes	No	c	a/c	3	2	4	2	5	5	2	1	2	4	4	5	4	4	4	4	5	4	f and	Flooded at least four times in 30 years, including 1971, 1987, 1996, 1998. I realise that past relaxation of standards are very difficult and costly to correct- therefore good controls and strict enforcement of those conrols is the best method of protecting all persons in these areas.
Lyndale Place	1 - 5	Yes	No	3-12		Yes	Yes	b/c	a/c	3	5	5	5	5	5	5	2	4	4	4	5	2	3		3	3	3	a/d/e	March 2003. I am not sure of your terminology/measures and pracrtical application of the above measures. The new drain through our property did not work during the last flood (2003) due in part to large blockage, water could not escape quick enough. design could easily be imporved to keep (slow down) mulch catchment and provide overflow. Also down stream could be improved. Having clearly identified this paricular basin/catchment area, then all new development should be in harmony with an overall masterpaln that allows for water catchment and removal, ideally to ensure no one is flooded or inconvenienced in the future. Rainfall and creeks are a natural part of the environment we all enjoy. Every reasonable measure should be taken to ensure that in the 22nd century no one has to live in fear that they might come home to a flooded house simply becasue we have had a heavy downpour. You can't stop the rain or gravity but you can encourage water to go where you would prefer it. Maybe purchase the house that has been continualy flooded (5 times in 20 years I think) below us in St Annes Cl and make a lake/water feature/playground?
Lyndale Place	1-5	Yes	No	<1	4 cm	Yes	Yes	c	a	3	4	5	4	4	4	3	3	3	3	4	5	3	3		4	4	4		I have a photo from the 11th of March 2003, which shows how high the water rose in our garage that day. (flooding) every 2 years. March 11th 2003, heavy rain, estate drainage couldn't cope. Most Lyndale Pl residents have had some problems with drainage. From my point of view the flood problem occurs when water is being dumped on us quicker than it can drain away, so I support increasing the size of the pipes and ensuring our estate's stormwater channel is always clear and is as large as possible.
Lynette Place	5 - 20	Yes	No			Yes	No	b	c	4	3	2	1	4	4	2	1	2	2	3	4	4	4	4	4	4	4	e	
Lynette Place	5 - 20	Yes	No			No	No	d	a/c	5	4	4	4	4	4	4	3	3	3	4	4	4	4	4	4	4	4		Heavy rain has caused local flooding in Lynette Pl. I would support any measures to re-use water.
Lynette Place	5-20	Yes	No			No	No	a	b	4	3	4	5	5	5	4	2	4	2	5	5	4	4	4	4	3	3	e/d	Clearing of debris keeps water flowing its natural course. Creek widening / dredging, to allow more flow of water volume. Cnr of Ralston & Pringle, since development a creek has been filled. The volume of water down Pringle Avenue has increased dramatically, causing problems for No. 1 Lynette Pl (Cnr Pringle Ave).
Maple Place	5-20	Yes	No			No	No	a	a	4	4	3	4	4	4	3	2	4	4	4	5	5	5	5	5	5	5	L	Severe flooding in Elm & Calool, Easter ('97 or '98). I believe controls on new development is critical to managing flood control thus water runoff. There is currently too much "land" being replaced with new development, which I believe is exacerbating the problem of runoff. I believe Elm/Calool and the open space corridor is in need of attention.
Maple Place	20+	Yes	No			No	No	a	c																				
Maple Place	20+	Yes	No			Yes	No	b	c																				Proposed Government development along abondoned road corridor will increase runoff and add to flooding potential.
Marina Place	5-20	Yes	No	3-12		Yes	No	c	a	5	5			5															Flooding once in 12 years.
Marina Place	5 - 20	Yes	Yes	1-3	1 cm	Yes	Yes	c	a	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3		Flooded twice in 12 years, April 1998 and 1992.

Street	Years at Address	Flood Info?	Above Floor	Duration (hours)	Levels?	Map (Y/N)	Photos (Y/N)	Level of Control?	Notification of Flood Risk?	Constructing Detention Basins	Constructing bypass Channels	Enlarging Bridges and Culverts	Creek Widening and/or Dredging	Cleaning Creeks of Debris	Removing Creek and Floodplain Obstructions	Consturcting Permanent Levees	Filling Low-Lying Land	Voluntary Purchase	Voluntary House-Raising	"Flood-proofing" Measures	Controns on New Development	Improving flod warming systems	improving formal evaculation procedures	Promoting Community flood awarenedss	Installing Flood Markers	Providing a flood notification certificate	Promoting community flood readiness	Which deserves most consideration?	Comments
Marina Place	20+	Yes	Yes	1-3		Yes	No	b/d	a	3	4	4		5	4	5	3	3	3	4	4	4	4	4	4	4	4	c/e	Floods average about every 5 years. April 1990, worst experienced. May 1992, better prepared. Water was just above the floor level. Regular drain maintenance to remove tree debris and to allow water entry. If present existing easements drains are in adequate for volume of water runoff from lionel watts oval, then new larger pipes need to be installed and levees built to runoff water in Garigal reserve. The enormous area of Lionel Watts Oval seems to direct all / most of its surface water toward the Glenrose shopping complex which acts as a dam and diverts water around the complex and into our area, behind & below the centre. We are expecting another flood in the next couple of years, you can't beat a wall of water!. It would be a positive move to see some levee banks established so that the water from Glenrose DID NOT end up in our property. These were promised 14 YEARS AGO!. We lived here before Glenrose was established and never had the problem. Glenrose was built on the water runoff course which means we now get flooded. It would be nice to have the problem that council created, fixed.
Marina Place	5 - 20	Yes	No			Yes	No	c	a	4	3	2	4	5	4	2	2	3	3	3	4	4	3	4	4	4	4	e/o1	Flooding onec every 2 years. Flooded in 1998. Making residents aware of flood potential sp they can be prepared. Keeping drains free of debris so they work efficiently.
Nabiac Avenue	20+	Yes	No	<1		Yes	No	a/d	a	4	4	4	4	5	4	3	3	3	4		4	4	3	3	2	2	3		Flooding every 10 years. We have a community drainage system that services 5 houses for rain water removal. This drain is in our yard and as far as I remember, has never beena ble to handle heavy rainfall. Hence the installation of 5 sumps in our yard to heed excess water until it can drain.
Neridah Avenue	20+	Yes	No	<1		Yes	No	a	c	3	4	5	4	5	4	3	2	3	3	4	5	4	5	4	5	4	5		2003, Flooding in Knightsbridge Ave. 1998, Flooding beside Forest Way, council was advised and an inspector came out. Western side of Forest Way between Ralston and Wyatt Aves on "nature strip" - No drainage at Ralston Avenue end.
Neridah Avenue	1-5	Yes	No	3-12		Yes	No	d	c																				(considering renovation:) Trying to stop flooding of backyard and patio. Floods everytime it rains since we have moved in. March 2003 flooded. Nearly (over floor level) first day we moved in, had to keep sweeping water away, then called in plumber to help. We purchased this house 20 months ago, everytime it rains it floods. The first day here we flooded really bad, our furniture was floating out the back!. Our neighbours said it has been happening for years since roads were built. The old owners built a big rockery to stop it, but now all concrete is breaking away and water runs through it. We got plumbers in and it cost a fortune, they said they couldn't help since it was coming from council property at the back on Forest Way. We were told by the neighbours that our pools were flooded with mud from rain, so they built a big rockery to stop it.
Neridah Avenue	5 - 20	Yes	Yes	3-12	2-3 cm	Yes	No	b	a/c	3	4	4	5	5	5	3	3	4	4	5	5	5	5	5	5			5	e/f	Maintain and clear drains to improve water flow/removal- street stormwater drains not routinely cleared unless asked by resident- failure to do this caused flooding of residence due to poor and blocked drainage- council advised they don't clean these drains as apart of routine maintenance- why?
Neridah Avenue	5 - 20	No	No			No	No	d	c	3	3	4	2	4	4	3	3	3	3	3	3	4	4	4	4	4	4		
Neridah Avenue	5-20	Yes	No	1-3		Yes	Yes																					e	PHOTOS ATTACHED!, please return Photos. For flood info refer to previous correspondence with Warringah Council. Council should regularly clear the flood relief drain on reserve facing Forest Way, as shown on the attached map. This alone would have prevented previous flooding. To protect my property in Belrose, regular maintenance of the stormwater drains at the rear of the properties on the eastern side of Neridah Ave is required. Lack of maintenance in the past resulted in the blockage of the drain and flood waters in my garden and others in this street. At the risk of appearing negative, none of my previous efforts to get remedial action from the local authority resulted in a proper maintenance programme.
Neridah Avenue	20+	Yes	No	3-12		No	No	a	a	4	4	4	4	4	4	5	3	4	4	3	5	5	4	4	5	5	5	g	Surveyors' equipment must NOT necessitate removal of trees / vegetation on the nature strip at back of properties backing onto Forest Way, as they unfortunately did in the past. There is very little vegetation / trees left, and traffic noise is almost intolerable as a result. PLEASE LEAVE OUR TREES AND SHRUBS ON THE NATURE STRIP. Constructing levees in flood prone areas to hold / divert water away from properties.
Neridah Avenue	20+	Yes	Yes	<1		Yes	No	b	b				5	5	5					5	5								four to five floods over 24 years. Water mainly from adjoining properties where drains couldn't cope with deluge. Water in property just soaked edges of carpets.
Neridah Avenue	20+	Yes	No			Yes	No	a	a/c	5	4	3	5	5	5	5		3	4	5	5	5	4	5	4	5	4	b	Flooded once over 20 years ago. Bypass channels deserve much consideration. The council solved the flooding of properties downstream from Browns nursery by putting a dish drain at the rear of houses backing onto Forest Way. That has now dissappeared and this in very heavy and persistant rain the problem.
Neridah Avenue	5 - 20	Yes	No			No	No	a	a	5	5	5	5	5	5	5	5	3	3	3	5	5	5	5	5	5	5	l	Flooding observed in exceptionally heavy rain. Suggest commence at the high ground and progressively identify the natural flow of water where houses have been constructed. A number of houses in my vicinity have been constructed without adequate drainage facilities. Thereore water just flows in any direction instead of being channelled into drains or street gutters.
Neridah Avenue	5-20	Yes	No	<1		No	No	a	a/c	3	5	5	5	5	5	5	3	2	1	1	5	3	3	3	3	3	3	d	Better drainage and creek widening
Neridah Avenue	5 - 20	No	No			No	No	a	a	2	5	3	4	5	5	3	2	4	1	5	4	5	5	5			5	b	We are on flat land and the house is well built and we get no water in it even in very heavy downpours when we see a very heavy flow of water dopwn the gutters heading towards Ralston Ave.

Street	Years at Address	Flood Info?	Above Floor	Duration (hours)	Levels?	Map (Y/N)	Photos (Y/N)	Level of Control?	Notification of Flood Risk?	Constructing Detention Basins	Constructing bypass Channels	Enlarging Bridges and Culverts	Creek Widening and/or Dredging	Cleaning Creeks of Debris	Removing Creek and Floodplain Obstructions	Consturcting Permanent Levees	Filling Low-Lying Land	Voluntary Purchase	Voluntary House-Raising	"Flood-proofing" Measures	Controns on New Development	Improving flod warming systems	improving formal evacuation procedures	Promoting Community flood awarenedss	Installing Flood Markers	Providing a flood notification certificate	Promoting community flood readiness	Which deserves most consideration?	Comments
Opala Street	20+	No	No			No	No	c	a/c	3	3	4	4	4	4	3	4	3	3	4	4	4	4	4	4	4	4	d and e	items d and e- flooding is generally due to a large volume of water unable to escape via normal path therefore if path improved and maintained flooding should be considerably reduced.
Opala Street	5 - 20	No	No			No	No	d	a																				I am unable to give responses to Q 13 to 15 as I do not have the expertise or knowledge to comment on these items.
Opala Street	20+	Yes	No	3-12		Yes	No	a	c	5	5	5	5	5	5	5	5	3	3	5	5	5	5	5	5	5	5	f and l	
Pembroke Place	5-20	No	No			No	No	a	a/c	2	2	3	3	4	4	2	2					4	4	4	4	4	4	L	Never build near flood areas - water & fire are our best friends/greatest enemies. Let the water courses run free, you should not interfere with the natural water course. I have no knowledge of areas that flood in the immediate area. But know that houses built too close to water courses do flood. Common sense dictates that the over development of the area leads to problems. The loss of habitat for native animals, & flora. Take care of the land and the land will care for the people. Put a stop to anymore development. The roads are almost parking stations now, we are making the area unhealthy.
Pembroke Place	20+	Yes	No			No	No	a	a/c																				Property experiences flooding whenver there is unusually heavy rain. As my property only gets flooded under the floorboards I just let it gradually drain away. Our flooding is due to runoff from other properties. I don't have a clue about how to address the problem and will leave it up to your experts. Please protect the corridor and its native wildlife and plants and thank you for arranging this survey.
Pembroke Place	20+	Yes	No			No	No	b/c	c	4	4	4	5	5	5	2	2	3	3	3	4	5	4	5	5	5	4	L	Over-development without adequate drainage or runoff provision is a major concern. We do not have flooding as such but runoff during continuous heavy rain is an ongoing problem in our immediate area. The reason for flooding must be considered before a solution/s can be contemplated. With the ongoing drainage problems we have, I fail to understand the overdevelopment (massive) that has been going on in this area and continues without regard (seemingly) to the infrastructure or concern of residents.
Pembroke Place	5 - 20	Yes	No	1-3		No	No	a	a/b/c	5	4	4	4	5	4	3	3	4	4	4	4	5	5	5	4	4	4	f	Marked on map direction of flow of flood in our immediate area. In our backyard garden furniture floated to other parts of garden. Depth of water came over the top of my gumboots (over 1ft). Water came ino our garage halfway from front doors to rear of garage. Concerned about new development, houses off Forest Way, Perentie Ave.
Pembroke Place	5 - 20	Yes	No	1-3		Yes	No	c		5			5	5	5													L	Flooding every 2 - 5 years. No notifications, just fix the drains!. "The underground system" cannot cope with extensive rainfall in a short period. This needs enlarging and modernising.
Pembroke Place	1-5	Yes	Yes	1-3	15 cm	Yes	No	c	a	5	5	5	5	5	4	3	2	3	3	5	5	5	3	5	5		5	b/k	Flooding is annual. July? 2002, flooded lower level of house. Flood-Proofing properties to asist residents to cope with future flooding. Bypass channels to prevent the localised flooding where possible.
Pindrie Place	<1	No	No			No	No	a	a	2	4	4	5	5	4	3	2	3	3	3	4	3	3		4	4	4	e and	e- simple approach, little effect on environment. B- positive impact on solving problem, detention basins pose problems with stagnant water (mosquitos, risk of drowning for kids,)
Pringle Avenue	1 - 5	No	No			No	No	d	c	4	4	2	3	5	4	3	2	3	3	4	4	4	4	4	4	5	4		
Pringle Avenue	1-5	No	No			No	No	a	a/c		5			5	5										5	5			
Pringle Avenue	5 - 20	Yes	Yes	1-3		No	No	b	a	4	4	4	4	5	5		3	3	3	5	5	3	3	3	3	3	3		Flooded once, April 1998, water from road. Suggest improving surface water drainage from Hews Pde onto Pringle Ave. Repairs required to embankment of Frenchs Ck at exit of tunnel under Pringle Ave.
Pringle Avenue	20+	No	No			No	No	a	a	4	4	4	3	5	5	5	4	3	3	3	4	4	3	4	3	4	4		
Pringle Avenue	5-20	No	No			No	No	b/c	a/c	3	3	4	4	5	5	4	3	3	3	4	5	5	5		5	5	5	e/m	Clearing creeks of debris allowing flood waters to flow more freely. Notify residents of possible flood water inundation so they may prepare themselves. (attention to) The water course (creek) that runs across (under) Pringle Ave at the back of Hew's Pde. Playing Fields.
Pringle Avenue	73	Yes	No			Yes	Yes	a	c	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	and d	Lived in area all my life. Biggest flood ever experienced the lower garden flooded (where Stratham Pl is now). A neighbour behind property had a soil contractor come in and take away several truckloads of soil and he disturbed the natural watercourse, and our creek and my fathers garden was covered in tons of silt, this was in the 1950's. I have lived in the same property all my life and I can still recall the terror I experienced as a child seeing and hearing the force of water rushing past the front of my home (frenchs creek) and also the floodwaters of the creek running through my parents property and joining up with the creek across the road, and crashing down to the falls in Lady Davidson Park, now known as Garigal.
Pringle Avenue	20+	Yes	No	1-3		Yes	No		a/c	5	5	5	5	5	5	2	2	3	2	4	5	4	4	5	2	5	5	a and	Flooded twice, April 1998 and May 2003 (?). Next door had 1" water in property. Buliding of multiple dwelling developments seems to be putting a huge strain on eisting drainage system. Lack of street cleaning causing blockages to the drainage system.

Street	Years at Address	Flood Info?	Above Floor	Duration (hours)	Levels?	Map (Y/N)	Photos (Y/N)	Level of Control?	Notification of Flood Risk?	Constructing Detention Basins	Constructing bypass Channels	Enlarging Bridges and Culverts	Creek Widening and/or Dredging	Cleaning Creeks of Debris	Removing Creek and Floodplain Obstructions	Consturcting Permanent Levees	Filling Low-Lying Land	Voluntary Purchase	Voluntary House-Raising	"Flood-proofing" Measures	Controns on New Development	Improving flod warning systems	improving formal evacuation procedures	Promoting Community flood awarenedss	Installing Flood Markers	Providing a flood notification certificate	Promoting community flood readiness	Which deserves most consideration?	Comments
Pringle Avenue	20+	Yes	Yes	1-3	45 cm	Yes	Yes	a/c		5			4	4		4				5	5							a	Flooded twice, March 2001 and March 2003, both of these floods resulted in $20,000 damge because the whole downstairs of house was up to 450mm underwater. We have lived here for 31 years. Flooding was bot a problem until Forest Way was widened. Putting the runoff into the stormwater drains means that they fill up before our property so that we have no stormwater access as the drain is too full. The problem must be fixed. Construction of detention basins described below and control of the waters in the open end of Frenchs Creek from the drains outlet at Pringle Avenue and further down. Construction ofdetention basins along Forest Way, most flooding has occurred since its construction and putting the runoff into local stormwater drains. Construction of a detention basin in Munmumba Park, this is a large area totally uncontrolled which adds to the problem in our area. The main roads department should d the right thing and control their runoff. Council could easily help by controlling water from Munmumba PArk and reduce the flow and flooding
Pringle Avenue	5 - 20	No	No			No	No	c	a	5	3	4	3	4	4	3	3	4	4	4	5	5	4	4	4	4	4	m	
Pusan Place	20+	No	No			No	No			3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		I have lived at this address since 1971. Even during the wettest periods, I have never witnessed any flooding, even on the lower lying properties.
Ralston Avenue	20+	Yes	No			No	No	b/c	a	3	3	3	4	4	3	3	3	3	3	4	4	4	4	4	4	4	4		Flooded February/March 2002. Property not flooded.
Ralston Avenue	5 - 20	Yes	No	<1	2 m	Yes	No		a/c	5	5	5	5	5	5	4	3	3	3	3	3	5	4	5			5	n	
Ralston Avenue	20+	No	No			No	No	a	a/b/c					5	5						5								It seems pretty simple to me that a contour be done of the area, then you read the map, see the low points and address them. These points ahould be taken into account before doing a development. Why do flood problems appear after houses are build? Very poor council planning. Autumn leaves are a major cause of flooding. Perhaps in suburbs where there are a lot of trees street cleaners could be more prolific.
Ralston Avenue	1 - 5	Yes	Yes	3-12	3 cm	No	No	c	b	5	5	5	5	5	5	5	5	4	3	4	4	4	4	4	4	4	4	a and	Flooded three times: October 2004, 2004, 2003, flooded garage each time. Has info on extent and depth of floodwaters.
Ralston Avenue	5 - 20	Yes	Yes	3-12	20-30 cm	Yes	Yes	b/c/d	a	4	4	3	4	5	4	3	4	4	4	5	4	5	5	5	5	4	5	b	Flooded April 1998 and March 2003, flooded whole downstairs, pool turned brown. Construction of bypass channels or stormwater drains to divert water elsewhere because I think it would be the most effective in my situation and you cannot prevent flooing you can only reduce its effects. Its never going to stop raining! Outside my residence, across the road, is a reserve and bushland on Ralston Ave which needs to be addressed. Due to the downward gradient heading towards my residence and Frenchs Ck there is a large amount of floodwater that cannot be retained. More stormwater drains need to be installed here! Thankyou for taking action on this problem. My property has only been damaged twice over a long period of time but the costs of removing carpet for tiles and refilling pool, damage to garden and many plants, silt deposits, new pool filter and pump the list goes on has been very time consuming and expensive. Everytime it rains heavily we are at risk. So thanks again for finally addressing this problem.
Ralston Avenue	5 - 20	Yes	No	<1		Yes		a	b	2	2	2	2	5	4	2	1	3	3	3	4	3	3	3	2	3	3	e and	Flooding every six years or so, April 1998 was last time. The natural land formation should be retained where possible. Any man made obstructions to natural water flow should be removed.
St Annes Close	5 - 20	Yes	Yes	1-3	10 cm	Yes	Yes	a	b	5	5	5	1	5	5	4	1	5	5	5	5	3	3	3	3			i	Flooded with major damage 10/02/1995, 31/08/1996, 10/04/1998, 10/03/2003, plus two or three smaller nuisance floods where just carpets wet. Don't fully understand some of these measures. Because of our particular type of flooding- I think some ofd these measures are not applicable. Basically the large stormwater pipes fill in heavy rain- all extra water runs overland and fills backyards, cul-de-sacs, etc and homes built on slabs. Our house would be very difficult to sell with flood history. Diverting some stormwater in another direction ie drain flow from Forest Way to the east instead of into Frenchs Ck- flood problems only started when Forest Way was widened from two to six lanes and runoff sent in our direction instead of east as planned. Frenchs creek cannot cope with amount of stormwater being fed into it. Water flowing off Belrose Primary School, where there will soon be a new housing development. Australand development at Lyndale Pl- water flows have changed since this was built. Forest Way- massive amount of water comes from road between Ralston and Morgan Rds. It is very distressing living in a home that is subject to flooding at any time
St Annes Close	1-5	Yes	Yes	1-3	7.5 cm	Yes	Yes	a	a	5	5	5	5	5	5	5	5	5	3	5	5	5	5	5	5	5	5	e	Water from back, September 2001 & March 2003. 3 inches above floor level. Clearing + ensuring that all drains are able to flow (many drains in higher areas are full of debris and completely unable to admit any water. Building of better headwalls (is beneficial). Belrose shopping centre (all drains completely blocked). Forest Way (Drains become blocked by wood chips in heavy rain). Drainage from new developments (have minimum drainage on property so water runs onto neighbouring properties. We have very big problems with the amount of water running down hill from neighbouring properties (new developments), and all the drains on higher ground seem to be completely blocked. The water runs down from Forest Way, and there seems to be no drains on the way to stop it.

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St Annes Close	5 - 20	Yes	No			Yes	No	a	a	5	5	4	4	4	4	5	3	4	4	5	5	4	4	5	5	5	5	l	Flooded twice in 5 years, last time March 2003. Suggest stopping inappropriate development that changes water flowpaths to the detriment of others and rectifying damage to drainage paths from previous development. The development in corner of Pringle and Ralston regularly floods to properties in lower St Annes Cl. This development was overfilled and is now causing changes in drainage to St Annes Cl. Since the Lyndale Pl development was allowed and the resultant overfill to the site our property shows signs of poor drainage at street level. The gutter in St Annes Cl runs continuously even in dry times and the road outside Nos 4 and 5 is gushing water in rain periods- this will eventually collapse. The water flowpaths have changed and we would ask- Who is responsible and who must bear the cost of replacement?
St Annes Close	20+	No	No			No	No	d	b/c	4			4		4						4								
Stirling Place	1 - 5	No	No			No	No	a	a/c	2	2	3	3	5	4	1	1	3	3	4	5	5	5	5	3	5	5	d/f	No flooding at my property but have seen flooding in Knightsbridge Ave.
Stratham Place	5 - 20	No	No			No	No			4	4	3	4	4	3	4	3	3	3	4	4	3	3	4	4	3	4	l and	Talking to the person from whom we bought the house in 1999- he had lived here from 1984- he stated that he only knew of one flood in the area right at the bottom of stratham Pl in the house directly opposite- the other side of Pringle Ave, as hatched on map. Apparently this was one of those storms one gets every 100 years!
Stroud Place	20+	Yes	No			No	No	a	a	3	3	5	5	5	5	3	1	5	5	5	3	5	5	5	5	5	5	5	l/L	I am worried that all the creeks in this area will be covered over. We need a bit of bushland around housing developments. So much has been lost already. I often go down to French's Ck to see the waterfall at the bottom of Hews Pde, especially after rain and report any creek there and in the other creek further down Pringle Ave. There are so many creeks covered and built on which I think causes a lot of the problems. If all of this area is covered in housing, I may as well go and live in a unit in Chatswood. Voluntary purchase, no new houses should be built on flood plains, on or near creeks. They should be left in their natural state providing "lungs" for the area, providing habitat for native fauna. Housing developments need "breathing space". Flooding has occurred twice in this area, on the creek with no name on Pringle Ave and Knightsbridge Ave. I don't remember the dates.
Stroud Place	20+	Yes	No	<1		No	No	a/b	a												5							l	Put infrastructure and necessary modifications into place before approving any new development.
Stroud Place	20+	Yes	No	<1		Yes	No	a	c	5	5	5	5	5	5	5	5	3	5	5	5	4	4	4	4	4	4	L	One major flood, 10-12 years ago. There must be adequate stormwater drainage to cope with potential floods. No development should be approved without this, as it causes so much cost & inconvenience to home owners.
Stroud Place	20+	No	No			No	No	a	a/c	5	4	3	2	5	5	3	2	4	3	4	5	5	4	5	4	5	4	b/l	Construct bypass channels- permanent solution. Prevent development in areas that flood or contribute to flooding. No further action required.
Stroud Place	20+	Yes	Yes	1-3	2 mm	Yes	Yes	b	b	4	4	4	4	4	4	3	3	2	2	3	4	3	3	2	2	2	2	d/e	March 2003 - Flood damage to interior. April 1998 - Build up of water, no damage. Firstly, all stormwater drains need to be kept free from debris, predominantly vegetation litter. Whilst they should be residents' community responsibility, it certainly appears otherwise. Maintainence work by council required. Adequate removal of water in peak rain periods. Additional stormwater drains, and windening/clearing of creeks to handle flow volumes. Additional stormwater drains constructed in our street following at least 5 years of "badgering" of council. Administrator got the job done! Study should address the dissemination of water in floods and not making the area a publicly listed flood area (effect on real estate values). Our experience is that with adequate and cleared drainage, the potential for flooding in minimised. Every now and again, every few years (10?) when torential rain and drainage backs up, that is when the flood danger emerges.
Stroud Place	20+	Yes	No	1-3	15-30 cm	No	No	d	a/c	2	4	4	4	4	4	2	1	3	1	4	4	3	4	4	3	3	3	L	Flooding approximately 1 in 5 years. The impact of flooding potential in one area on adjacent areas following development would need consideration. Improved stormwater drainage to cope with calculated runoffs e.g. construction of bypass channels, creek widening & clearing and drain designs to cope with estimated runoff volumes. Controls on new developments by way of drainage, site runoff assessment, (assessment of) impervious areas, and if necessary, retention systems. I have not given the matter serious thought at this stage as areas adjacent to our residences are elevated when compared with many areas within the boundaries as defined where potential flooding would have a more frequent problem.
Trentbridge Road	5-20	No	No			No	No		a	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		We are not affected, good luck.
Trentbridge Road	1 - 5	Yes	No	<1		No	No	c	a/c	3	5	5	4	5	4	3	3	3	3	4	5	5	5	5	5	5	5	4	d/e	Flooding March 2003, street drains failed to cope. Would also suggest advising potential flood risks to potential owners- make this madator, via estate agents or council.
Trentbridge Road	5-20	Yes	No			Yes	No	a/d	c	3	4	2	5	5	5	3	2	1	1	1	4	4	3		5	5	4	e	Clearing creeks of obstructions & debris Monitoring of vegetation blocking flow. Merging of stormwater drains, too close together causing major surge in flow during downpours.
Trentbridge Road	20+	No	No			No	No	c	a/c	5	5	5	5	5	5	5	5			5		5	5	5	5	5	5	m	I look after Dad on a daily basis, please call me should you require any further information- Anne Stephens.
Tudor Close	<1	No	No			No	No	d	a		5		5	5	5							5	5	5			5	m/p	I would like more information on the potential for flooding extent, flood depth (AHD) etc so I could plan better and also consider insurance to my property for flood related risks. An addedum report that can be made available to insurance companies to help them to understand the risk of flooding in the area and provide insurance.

Street	Years at Address	Flood Info?	Above Floor	Duration (hours)	Levels?	Map (Y/N)	Photos (Y/N)	Level of Control?	Notification of Flood Risk?	Constructing Detention Basins	Constructing bypass Channels	Enlarging Bridges and Culverts	Creek Widening and/or Dredging	Cleaning Creeks of Debris	Removing Creek and Floodplain Obstructions	Consturcting Permanent Levees	Filling Low-Lying Land	Voluntary Purchase	Voluntary House-Raising	"Flood-proofing" Measures	Controns on New Development	Improving flod warming systems	improving formal evaculation procedures	Promoting Community flood awarenedss	Installing Flood Markers	Providing a flood notification certificate	Promoting community flood readiness	Which deserves most consideration?	Comments
Turella Close	20+	No	No			Yes	No	b	a	5										5				5					The corridor behind Turella Cl (requires attention). In heavy rain water runs straight over land into Winani Cl, therefore flooding the creek behind Winani Cl (see map). Haven't experienced flooding to my house as water gushes past onto vacant land behind as we are on a slope.
Undula Place	1-5	Yes	No	<1		Yes	Video	a	a	5	5	5	5	5	5	5	5			5	5	5	5					b/e	One big one (flood) since living here. March 2003, Had to cancel extension plans, drain outside property hopelessly inadequate, end of cul-de-sac was like a pond. Mud from virtually the whole street ended up in my pool. Constructing bypass channels seems like a good way of tackling the problem, especially around properties which lie low on any street. Creek debris should of course be cleared regularly. Our property is the lowest in the street, something that was not obvious at the time of purchase. Seems we get flooded every 3 years!
Undula Place	20+	Yes	No			Yes	No	a	a	3	4	4	4	4	4	3	2	4	4	4	4	4	4		5	5	4	o	Flooded several times, including 2002, mid 1990's, plus other minor events over the years. Flooding in 2002 due to blocked drain at end of our street, severe flooding occurs at No 9, lowest point in the street. Flood markers should prevent the possibility of cars/people attempting to cross. Flood notification to potential owners of property- they should be made aware of any potential problem. All other measures depend on the situation and appropriate steps should be left to experts. Stormwater drains should be cleared on a regular basis, a proactive response is required. Community education on measures that property owners could take to prevent flooding
unknown	20+	No	No			No	No	a	a	3	3	5	3	5	5	2	2	3	3	4	5	5	5	5	5	5	5	L/o	New developments should not be allowed where land filling, ehich allows natural water to be diverted, (especially if) in areas of known flood risk(I.e. Ralston Ave, end of Pringle Ave, Belrose). Community awareness very necessary!
Wallina Avenue	20+	No	No			No	No	a	a	2	2	3	5	5	5	4	2	1	1	2	4	3	3	4	4	2	4	d/e	Part of Frenchs Ck at the rear of Wallina Ave is in need of attention. Overgrown Lantana has obliterated the view of the creek in many places. This combined with the large "Coral" tree which is growing in the creek causes the flow problems. The easement drain at the side of my property which leads to the creek becomes blocked on many occasions and backs up at the end of Wallina Ave. Of course these matters get reported and receive attention in the "fullness of time".
Wallina Avenue	20+	Yes	No			Yes	No	a	b				5	5										5					Flooded once, before creek was deepened. The growth at the bottom of the stormwater at the end of Wallina Ave. No flooding since creek was deepened.
Wallina Avenue	<1	No	No			No	No	a	a	1	4	1	1	5	5	1	2	5	5	5	5	5	5		1	1	4	e	Clearing debris from creek. Reasoning is due to large amounts of native fauna using creek. Any construction may upset natural balance. We have only resided at our property for 2 months.
Wallina Avenue	20+	Yes	No	<1		Yes	No	b	a	3	3	3	5	5	5	3	3	4	4	4	4	4	4	4	4	4	4		Infrequent flooding, 1988 & 1989. Flooding across Haigh Avenue where drain to Frenchs Ck begins. Road closed.
Wanniti Road	20+	No	No			No	No	d	c	3	3	3	5	5	5	5	3	3	3	4	3	3	3	3	3	3	3		We are not unduly affected by flooding. It appears the easement drain running south to north in Properties in Karalta Cres is blocked. It doesn't carry away surface or stormwater during very heavy rain- properties in Haigh Ave also use this drain.
Wanniti Road	1-5	Yes	No	1-3	7.5 cm	No	No	b	c	4	3	3	4	4	4	3	3	3	3	5	5	4	4	4	4	4	4	o	Flooded once 2003? can't remember exactly. 3 inches off garage floor. Making people aware of potential problems when purchasing home (in the trouble spots). Observing the runoff the road and down to the creek at the end of Wanniti. I don't believe there is a serious problem at this location.
Willow Tree Crescent	5-20	No	No			No	No	a	a	1	1	3	5	5	5	1	1	1	1	1	5	5	5	3	3	3	4	e	Clear the creeks and ensure that water is safely channelled away.
Willow Tree Crescent	5 - 20	No	No			No	No	a	a/c	3	4	5	3	4	5	3	2	5	3	4	5	4	4	4	4	5	4		
Willow Tree Crescent	<1	No	No			No	No	a	a					5							5	5	4	5	5	5	4	e	(supports) Moving / clearing all creeks large or small of debris / overgrowth of plants, trees, grass, etc. The back of my property and other properties in Willow Tree Cres, Forest Glen CL, Kupunda Pl, this bushland should be cleared for safety.
Winani Close	5-20	Yes	No			Yes	No	a	a/c	4	4	3	3	4	4	3	3	3	3	4	5	4	4		4	3	4		April 1997, creek flooded. Modifying the way the flood behaves by ensuring proper drainage, because it's a bit unfair to property owners to have to modify their properties for a fault which they haven't caused. Unstable trees and debris falling into creek, I think should be monitored and mainatained regularly.
Winani Close	5 - 20	Yes	No	1-3		Yes	Yes	a	a	3	5	5	5	5	5	3	3	4	2	2	2							b/d	Our creeks cannot handle the water flow, constructing bypass channels and creek widening deserve the most consideration. The creek behind 4 Winani Cl cannot handle the water flow. This creek that runs from Pringle Ave near Birru Needs to be piped down the belrose corridor. I would consider the council negligent if they consider any developments in the Belrose Corridor unless the current flooding problems are rectified. The Creek that causes flooding in Calool is not even shown in the attached maps.

Street	Years at Address	Flood Info?	Above Floor	Duration (hours)	Levels?	Map (Y/N)	Photos (Y/N)	Level of Control?	Notification of Flood Risk?	Constructing Detention Basins	Constructing bypass Channels	Enlarging Bridges and Culverts	Creek Widening and/or Dredging	Cleaning Creeks of Debris	Removing Creek and Floodplain Obstructions	Consturcting Permanent Levees	Filling Low-Lying Land	Voluntary Purchase	Voluntary House-Raising	"Flood-proofing" Measures	Controns on New Development	Improving flod warming systems	improving formal evaculation procedures	Promoting Community flood awarenedss	Installing Flood Markers	Providing a flood notification certificate	Promoting community flood readiness	Which deserves most consideration?	Comments
Winani Close	5 - 20	Yes	No			Yes	Yes	a/d	a	5	5	5	5	5	5	5		3	3	4	5	3	3	4	3	3	4	L	Flooding is irregular, mostly 3 - 5 year intervals. February 1992, Pushed neighbours retaining wall over. April 1998. August 1998, major damage. March 2003 minor effects. Prohibit any new development on land with any p[otential to cause flooding of existing properties. Ensuring that authorities are held responsible for damage resulting from the approval of developments which result in flooding. Attention is required for) all locations upstream of Elm Ave in both Frenchs Ck and Corridor Ck. Make assessments of the potential effect of developments on presently vacant land in these areas. Vacant land Kulalye Pl, off Cotentia Rd, was subdivided many years ago, but has not yet been built upon. Portion of surplus school grounds north of Ralston Ave is presently subject of a development application for 17 x 4 bedroom dwellings on an area of 6,390 square metres. Flood prevention by way of detention tank in old dairy farmers property does not appear to have avoided flooding of properties in St Annes Cl.
Windrush Avenue	20+	Yes	No	<1		No	No	a	a	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	e	Minor flooding, could not remember time or date. With deciduous trees growing on many footpaths and only one streetsweeper in the shire, the drainpipes must become blocked at some stage. Many households sweep their own gutters but many other don't have time I would like to see more roadsweepers to sweep fallen leaves to prevent blocked pipes. Belrose public school has sold land for housing development, at the corner of Ralston and Pringle Aves, there used to be an open drain. This is covered over now and houses built on top of it. I hope sufficent drainage will be introduced to cover future water runoff from the public schools housing development. I would prefer to see the existing open space shown on the map from Forest Way to Wanniti Rd remain as such.
Windrush Avenue	1-5	No	No			No	No	c	a	3	3	3	4	4	4	3	2	3	3	3	3	5	3	4	5	5	5		Let people know about flood history in the area. Would like a more detailed map for flood information.
Windrush Avenue	5-20	Yes	No			No	No	a	a/c					5						5	5	5		5		5		e/o	Removing of creek debris will also improve creek water quality & control rubbish build up. Improve education to people in "flood proofing" measures on a property, so that flood waters can be easily drained away from each property and not just into the next property. Flooding occurs 1 - 2 times a year, in heavy rain.
Wingara Grove	20+	No	No			No	No	e	c	3	3	3	2		3	4	3	2	4	2	3	3	3	3		3	3		
Wingara Grove	5 - 20	No	No			No	No	a	a/c	4	4	4	4	5	5	4	3	4	4	4	5	4	3	5	4	5	5		Clearing drains more frequently and cease residential and commercial development as our local infrastructure cannot and is not coping.
Yarrabin Street	1 - 5	No	No			No	No	c	a/c	5	5	5	5	5	5	3	4		4	5	5	5	5	5	5	5	5	a/f	Creek widening and/or dredging- allows heavy rain to escape without potential build-up. Regular maintenance of clearing roadside gutters of leaf and litter build-up and clearing of creeks of debris. All helps prevent flooding and water build-up.
Yerevan Place	20+	No	No			No	No	d	a									4	4	4	4	4	4	5	4	4	5		
Yerevan Place	5 - 20	Yes	No			Yes	No	b	a/c	4	3	4	5	5	5	2	4	3	4	5	5	4	3	3	3	3	3		Flooded every couple of years in heavy rains. Council should review storm water pipe sizing in areas around the Ralston to Pringle Ave area. Due to construction over the past 20 to 30 years storm water drains are not capable of handling severe storm runoff.

A P P E N D I X B

Newspaper Records

12/03/2003

Rescued from deluge

Swamped . . . the car from which a young girl and her mother were rescued **Picture: THEA YOUN**

by KATE SIKORA

TWO Belrose women fought to free a young girl and her mother from their car after it was hit by raging floodwaters on Monday.

The woman and her child, aged about 10, became trapped when the vehicle was struck by flash flooding in Knightsbridge Ave.

It was one of several incidents recorded across the northern beaches after Monday's sudden deluge.

One of the rescuers, Thea Young, heard the car ''whoosh'' down her street.

''The water had come and I was taking some photos. I walked back inside and then I heard the whoosh and saw a car bobbing and spinning around,'' Mrs Young said.

''They were screaming . . . the girl was trying to open her window.''

Telling them not to open the door, Mrs Young and her neighbour, Christine McCabe, rang for help before deciding to rescue the pair themselves.

Mrs Young opened the boot and pulled the pair from the car.

''I consciously thought about where the water was and the dangers before I did it,'' she said.

''They were pretty shaken.''

Belrose was the suburb hardest hit by the torrential rain, which caused widespread flash flooding within hours.

As roads turned into rivers, people also had to be rescued from their cars along the Wakehurst Parkway.

From 9am on Monday until midnight, Belrose received 113.6mm of rain while Frenchs Forest received 77mm.

Dee Why firefighters abandoned their engine at Wakehurst Parkway when the road became too dangerous to cross.

Firefighters walked to a car where it was believed a woman was trapped but she was later found safe.

Warringah/Pittwater SES controller Graeme Nelson said of the 50 calls received on Monday, 20 were from the Belrose area.

''This was certainly one of the heaviest rainfalls in such a concentrated area,'' Mr Nelson said.

Most of the SES calls related to flash flooding and retaining walls collapsing.

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Havoc as Big Wet continues

by LORNA KNOWLES

TORRENTIAL rain wreaked havoc across the peninsula at the weekend, threatening to make a Belrose home collapse and causing mudslides, car smashes and a road closure.

Warringah-Pittwater State Emergency Service controller Angus Fergusson said crews worked around the clock to respond to calls for help across the northern beaches.

On Sunday afternoon, SES workers spent four hours sandbagging the side of a house on Ulo Ave, Belrose.

The house had threatened to collapse into the adjacent creek after rising waters began eroding the sandstone slab supporting the property's structural piers.

Owner Ken Drysdale said rainstorms had washed away a 2m-high fence, barbecue area and a walkway this month.

He said he had remained in the house but his wife had become nervous and gone to a friend's place.

Mr Drysdale said his solicitors had served a damages claim on Warringah Council, which he alleged fed a stormwater drain into the creek this year.

Rising waters undermine Belrose home

SES workers attended another home on Barrenjoey Rd, Newport, after a mudslide burst into the ground-floor lounge room.

Mr Fergusson said the mudslide had threatened the structural integrity of the second floor and workers built props to support the home.

Just a few blocks away, Roads and Traffic Authority consultants Transfield were yesterday assessing the damage of a mudslide which swept on to a pedestrian walkway, uprooting trees and displacing large chunks of shale.

SES crews attended another minor mudslide in Rickard Rd, Narrabeen, which residents feared would turn into a repeat of a more serious mudslide last weekend.

Mr Fergusson said workers attended many jobs involving fallen trees, the most serious at Duffys Forest, where a tree collapsed on to Telstra lines.

Traffic was also disrupted early yesterday on Mona Vale Rd, Kimbriki, when a bread van collided with a LandCruiser 4WD travelling in the opposite direction.

A police spokesman said the van driver was trapped for 20 minutes.

A Fire Brigade rescue unit released the man, who was taken to Mona Vale Hospital.

● To Page 3

King and his kids . . . Cliffy Lyons takes his children (from left) Gabriel, Courtney and Mathew on his farewell lap of Brookvale Oval PHOTO: Renee Nowytarger

Lyons' share of the glory

CLIFFY Lyons' traditional post-match ciggie had to be put on hold on Sunday.

There was a small matter of a farewell lap, a guard of honour from team-mates and countless media commitments to get through before the Manly star could light up in the Brookvale Oval dressing rooms.

Politically correct he isn't, but there are few more popular players than King Cliffy Lyons. The Brookie faithful stood in their thousands, ignoring the persistent rain, to give their hero a fitting send-off after he helped Manly lasso the Cowboys 28-12.

It was Lyons' final appearance at Sea Eagles HQ and the guest of honour was visibly touched by the rousing goodbye.

"There was nearly a tear or two or maybe it was just the rain," he said. "It would be great to go on but it's got to end some time."

● Manly re-sign Colella. See Back Page.

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last

LORNA KNOWLES

0ft cruiser near the Roseville

his two passengers suffered
ad injuries. Mr Boyd also
ultiple traumas and had to be
at the scene before being
Westmead.

I said it was strange that both
brother had suffered such
uries in the prime of their

nd of ironic, I suppose," he

d said he had been a strong
se for his brother because he
Brett was going through.

his brother was disheartened
ives had not made progress
investigation and lived in fear
attack.

Brett was staying with friends
undisclosed locations and was
dy to discuss his ordeal.

with information which may
police investigation should
anly detectives on 9977 9499.

uture

n is to conserve the cultural
nificance of the station and it
tlines the way the site must be
naged to maintain and preserve
heritage values.

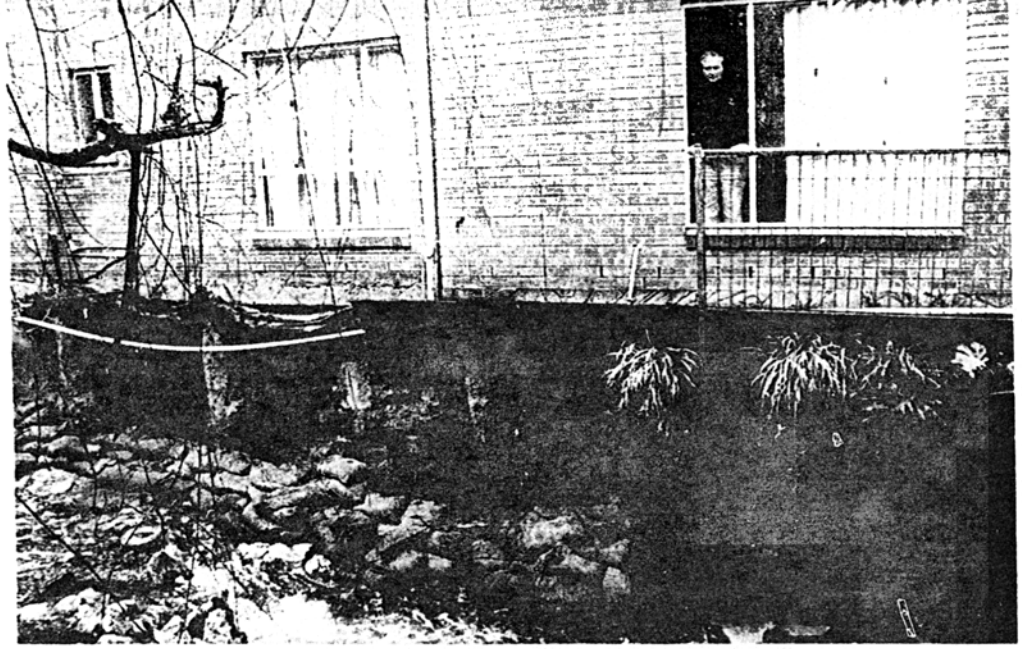
"It places constraints and limits
the extent of changes to
portant buildings as well as
niting the possibility of new
nstruction on the site."

NPWS has described the station
a rare and virtually intact
ronicle of a lengthy part of
ustralia's history.

Thursday's public meeting will
held at Manly Surf Life Saving
lub, South Steyne, from 7.30pm.

Copies of the conservation plan
ere available to view or buy at
e Quarantine Station, Manly
ibrary and Manly Council.

ly Daily



ABOVE: Ken Drysdale looks out the window of his Belrose house which almost collapsed in torrential rain at the weekend BELOW: The mudslide which swept on to a pedestrian walkway on Barrenjoey Rd, Newport, yesterday

18 Aug 1998

SES crews battle to save house

● From Page 1

with minor injuries. Local police also reported minor wet weather-related car accidents throughout the day.

Northern Beaches Traffic Sergeant Ray Black said the Wakehurst Parkway was closed at the weekend due to flooding and reopened about 10.30am yesterday.

Three men sailing a 40ft catamaran on Pittwater had a lucky escape on Saturday when the vessel flipped over in 40-knot winds.

A Broken Bay Water Police spokesman said a man in the cabin suffered a cut to his forehead and two other passengers were flung overboard when the boat pitch-poled. He said the vessel came close to rocks at the base of West Head and two police launches spent several hours trying to get the $150,000 vessel upright.

The spokesman said a number of boats broke from their moorings in high winds and rain over the weekend.

A Weather Bureau spokesman said rainfall on the peninsula from Saturday to 9am yesterday exceeded the average reading for the month.

Gordon recorded the highest level at 113mm, followed by Frenchs Forest with 96mm, Belrose with 94mm and Newport with 62mm.

The rain is expected to ease today and tomorrow.

Samurai man ill, court told

A MAN who slashed two others with samurai swords at North Avalon Beach last December was mentally ill at the time, a psychiatrist told the District Court yesterday.

Zoran Glamocak, 30, of no fixed address, pleaded not guilty on the grounds of mental illness to having wounded Adam Michael Jelf with intent to murder and having maliciously wounded him with intent to do grievous bodily harm on December 30.

Glamocak also denies having assaulted Paul Michael Redding, occasioning actual bodily harm.

If Acting Judge Wall accepts that Glamocak, also known as Soren Crooke, was not guilty by reason of his mental illness, he will remand him in strict detention at the Mental Health Review Tribunal's pleasure.

Psychiatrist Christopher Corcos said Glamocak's family had reported he had been behaving oddly and expressing bizarre ideas for five years.

Dr Corcos said Glamocak had delusional ideas of his origins and about his father being a US ambassador which had influenced him to change his name to Soren Crooke.

He said Glamocak was convinced the two men he had attacked were part of a paedophile conspiracy.

After examining Glamocak he believed he was deluded.

Glamocak believed he was employed by the US secret services and that satellite monitoring was going on. He said he had a Purple Heart for bravery and the Queen wanted to give him an award but got him mixed up with someone else.

"There wasn't very much sensible coming from him at the time," Dr Corcos said.

Asked whether he would submit to treatment, Glamocak had said he would ask God and adopted a listening attitude before saying "See, he doesn't want me to have the injection."

The doctor concluded Glamocak was paranoid schizophrenic or could be suffering bi-polar disorder or possible brain damage and was not fit to be tried.

Professor Paul Redding said Glamocak had approached him as he sat with his wife in their car at the beach car park about 5.30pm on December 30, tried to open his driver's door and demanded he get out.

When Professor Redding would not and tried to close the door, Glamocak swung a large samurai sword at him, cutting his arm and bruising his chest.

The professor's wife screamed and he closed the door. Glamocak swung the sword again, smashing the driver's window and the sword landed at Mrs Redding's feet. The professor drove away.

Glamocak then approached 23-year-old surfer Mr Jelf who was showering and accused him of molesting his daughter. Crown prosecutor Paul Lynch said Glamocak did not have a daughter.

Mr Jelf said he ran to a fence, tolled over it on to the sand and ran to the water. Glamocak chased him, but when Mr Jelf looked up he saw Glamocak sitting cross-legged on the beach with the sword pushed into the sand.

The blow severed the lower part of Mr Jelf's earlobe and he has been left with muscle spasm in his neck.

Michael Egan, who was at the beach, and who, with two others, held Glamocak until the police arrived, said Glamocak told him God had told him to do it.

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WIND HAVOC

Peter Macdonald

Manly MP in row on sewage risks

Manly independent Peter Macdonald was accused by the Government yesterday of misleading Parliament over the health risks of sewage incinerators at North Head and Malabar.

Planning Minister Robert Webster said Dr Macdonald had manipulated the facts to suggest incinerator emissions were a significant cancer risk.

He said this might have led people to be needlessly troubled or afraid.

But Dr Macdonald vowed to pursue his campaign to decommission the incinerators and said he would move to censure Mr Webster if he failed to act on a Lower House resolution.

Last month Dr Macdonald gained Opposition support in calling on Mr Webster to shut down the Malabar incinerators and decommission incinerators at Malabar and North Head.

This followed an Environment Protection Authority order for incinerator operations to be reviewed in the wake of a $3.5 million study showing a cancer risk

● To Page 2

15 April 1994

Ian Bennett, of Arnhem Rd Allambie Heights, with the 20m tree which crashed across his backyard yesterday PHOTO: Milan Scepanovic

24 000 hit by blackout

Electricity supplies to areas of the northern beaches were cut for up to 15 hours yesterday in the aftermath of Wednesday night's storm.

Supply was cut to more than 24 000 northern suburbs homes and businesses.

A Sydney Electricity spokesman said the area from Dee Why to Palm Beach was the most affected.

In some suburbs the electricity went out as early as 9.30pm on Wednesday and was not restored until yesterday afternoon. As of noon yesterday supplies were still out to areas in Balgowlah, Belrose, Curl Curl, Clontarf, Davidson, Fairlight, Harbord, Mona Vale, Newport and Palm Beach.

By 3pm, according to the spokesman, supplies were back on in all areas although the odd home could still be without electricity.

The spokesman said winds reached more than 70 knots during the height of the storm, bringing trees down across power lines.

More than 70 emergency services calls

by PETER ALEXANDER

State Emergency Services officers last night feared a return of the 70-knot winds and driving rain which brought trees crashing down on homes and roads on Wednesday night across the peninsula.

Warringah district SES communications officer Gordon Iles said emergency services were hoping the weather would clear although the wind appeared to be picking up again late yesterday.

Mr Iles said continuing strong winds would bring down more trees because the ground was soft from rain. SES crews attended 52 calls on the peninsula on Wednesday night and more than 20 calls yesterday as the wind and rain brought trees down on homes and power lines.

Trees fell on homes at Bayview, Palm Beach, Newport, Avalon, Dee Why and Belrose and across roads at Allambie Heights and Belrose.

Mr Iles said trees came down on houses in Gilwinga Dr, Bayview, Sir Thomas Mitchell Dr, Belrose, and at Redmond Rd, Dee Why. "We had been responding to calls from people with trees on their houses, roof damage, trees on cars and trees over the roads throughout the night," he said.

"Probably the worst-hit areas were Newport and Avalon."

Seven SES units and three Bush Fire Brigade units were called in for the operation.

Late yesterday Mr Iles said the SES was still working on about 10 jobs – mostly mopping up. Some SES volunteers had been awake for more than 36 hours. "We have got plenty of supplies, especially tarpaulins, and whatever happens tonight we will be able to cope," he said.

"Today we have also been helping a lot of old people who cannot get their cars started."

Electricity supplies were cut to northern beaches consumers for up to 15 hours in the aftermath of Wednesday night's storm.

A Sydney Electricity spokesman said the area from Dee Why to Palm Beach was the worst affected in Sydney, with supplies cut to more than 24 000 homes and businesses.

Electricity supplies in some suburbs went out as early as 9.30pm on Wednesday and were not restored until yesterday afternoon.

Supplies were cut to areas of Balgowlah, Belrose, Curl Curl, Davidson, Fairlight, Harbord, Mona Vale, Newport and Palm Beach.

In other reports of damage, a large tree fell across Arnhem Rd, Allambie Heights, and a tree fell across a power line in Karinya Cres, Belrose. At Allambie Heights a 20m gum tree fell across Ian Bennett's backyard about 2am

● To Page 2

NARRABEEN | COLLAROY | NARRABEEN | NARRABEEN NORTH | WARRIEWOOD | NARRABEEN LAKEFRONT RESERVE | NARRABEEN PENINSULA

15 April 1994

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Our Brookvale branch is now open every Saturday, from 9.00am to 2.00pm.

If you're a member you can come in and make a claim, ask about your cover or membership, browse through MBF's range of discounted books and videos, get your weekend movie tickets at a 40% discount and much more.

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Come in and see us at Warringah Mall and enquire about joining.

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ABOVE: Tree damaged . . . Mardi Greenstein inspects damage to her boyfriend's car in Whistler St, Manly
INSET: Mechanic Ian Cradock at the Newport service station

70-knot winds cause havoc

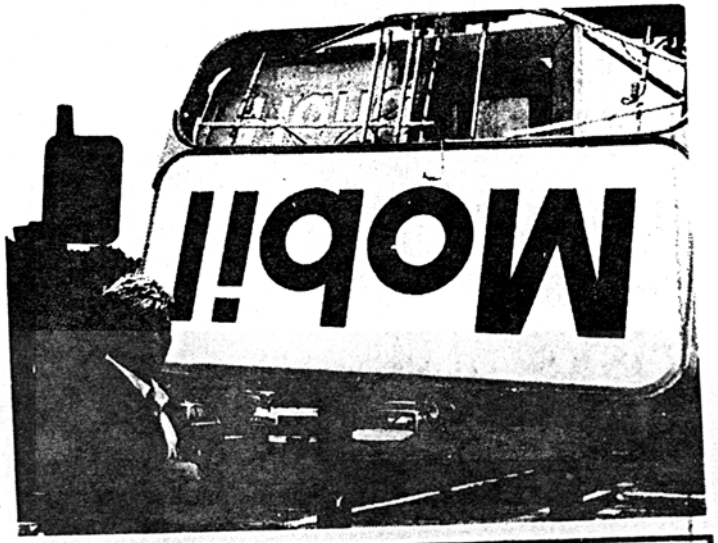
● *From Page 1*

yesterday at the height of the storm.

"The tree was not rotten – it was obvious all the wet soil had loosened up around its roots," Mr Bennett said.

Brian Greenfield, of Allambie Heights, said the force of the wind had snapped off the 15m tree which fell across Arnhem Rd. A Falcon station wagon parked in Whistler St, Manly, had major damage to the windscreen and roof when a tree fell across it.

Manly resident Elaine Salmons said part of a fig tree had fallen across power lines in Griffin St, Manly, only weeks after residents had asked Manly Council to trim the tree.



Freighter wins wild seas battle

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Violent storms threaten homes

Flooding, blackouts

by SHERIDEN KELLY

Emergency teams worked throughout the night to restore power to thousands of Manly-Warringah homes blacked out during the weekend deluge.

Countless northern beaches homes were without power on Sunday as torrential rain continued to fall across the State.

Sydney Electricity crews worked around the clock over the weekend to restore power to homes in Newport, Careel Bay, Balgowlah, Narrabeen, Belrose and west Dee Why.

Three hundred homes were blacked out late Saturday after freak winds blew tree bark onto equipment at a Mona Vale power station.

Electricity workers were also forced to make major repairs after a tree crashed into high voltage mains at Bilgola.

Emergency service crews, including the SES, fire brigade and police were stretched to the limit coping with flooding, road accidents, fallen trees and broken power lines.

Flood waters threatened homes in the suburbs of Newport, Beacon Hill, Cromer, Elanora Heights, Mona Vale, Warriewood, Frenchs Forest, Narrabeen and Palm Beach.

SES and bush fire brigade crews were on stand-by ready to evacuate residents along The Esplanade, Narrabeen late Sunday as flood waters rose dangerously high.

Water flooded the Woolworths carpark at Narrabeen on Sunday while the Killarney Squash Courts were also threatened by rising waters.

The Wakehurst Parkway was re-opened to traffic yesterday after flooding forced police to close the road several times over the weekend.

The Oxford Falls causeway on the southern side of Wakehurst Parkway was still partially under water early yesterday and police warned motorists to avoid the roadway or approach with extreme caution.

Falling trees caused havoc throughout Manly-Warringah, crushing cars and destroying roof tops.

The occupants of a Clareville home were evacuated early yesterday morning when a large tree threatened the house and nearby power lines.

A tree branch fell onto the roof of a parked car at Mona Vale yesterday morning while three vehicles were crushed by a fallen tree in Hilltop Road, Clareville early yesterday.

Manly Council workers were also kept busy yesterday clearing a tree which fell onto a home in Addison Road, Manly on Sunday night.

Bush Fire Controller Keith Simpson said they received 109 calls for help on Sunday alone with more calls coming in yesterday as the mop-up began.

Mr Simpson said emergency teams were busy yesterday clearing power lines, trees and tarping roof tops.

"Any strong wind in the next 48 hours will create severe problems for emergency workers," Mr Simpson said.

The Broken Bay Water Police were on alert yesterday waiting for flood waters to hit from the Hawkesbury River.

● continues on page 2

□ Ian Shiach and the storm-borne yabbie that ventured into his home. Picture: Ros Cannon.

Look who has just nipped in!

The weekend's deluge brought more than the usual flooding to one Frenchs Forest home.

Ian and Brad Shiach were surprised to find "a dirty big yabbie" in their garage, which had been swamped with water.

But how the creek-dwelling crayfish had happened upon the Shiach's home was a mystery, Ian said. In 20 years of living in the Forest area, he had never seen a yabbie near his house.

"I can't think of a creek in the area. We are on the low side of the hill, but I wouldn't have a clue where he came from. As an estate agent I've heard of a few strange things, but this is the funniest thing I've ever seen."

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...of women
see page 10

11 Feb 1992

was brought in last month to clear the company's debts. A total of 633 employees from the chain's 35 stores will be retrenched. Final sales to clear remaining stock will begin on Thursday.

Receiver Brian Silvia said the decision to shut the remaining stores had been made after the collapse of talks with a potential buyer of the chain, and the failure of suppliers to provide stock. "To limit future losses, I had no option but to close down operations," he said.

Action by the unsecured creditors of the company was under way in the Supreme Court yesterday.

□ Storms

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13 Nov 1984

Worst electrical storm for years

BY DOUG RYAN

Emergency services were clearing up yesterday after widespread damage by the worst electrical storm to hit Manly-Warringah for many years.

Three houses were seriously damaged, requiring the help of the State Emergency Service, and 33 000 households lost power for an hour or more.

Residents were again mopping up after the third major storm in less than a week.

Damage to property, power lines, power stations and roads is expected to run into hundreds of thousands of dollars.

A spokesman for Sydney County Council said power was severely disrupted after lightning damaged a high-voltage switch and distribution centre at Seaforth and a transformer in Taiyul Street, North Narrabeen.

Power was off for about an hour in most of the 33 000 houses but some properties were without light for up to five hours.

Warringah Shire Council staff, members of six voluntary bushfire brigades and the State Emergency Service quickly went into action after distress calls about 8 pm on Sunday.

They were kept busy until 3 am helping residents secure roofs smashed by trees and lightning, unchoking drains and propping up buildings in danger of collapse.

Sandbags were used to ward off floodwaters from houses in Narraweena, Forestville, Belrose, Mona Vale and Beacon Hill.

About $10 000 damage was caused when part of a driveway gave away and bricks and rubble slammed into a neighbor's house in Kavalta Circuit, Belrose.

Owner Roger Coulson said his car nearly slid off a concrete slab and down the hill.

He and rescuers managed to edge the vehicle forward by lifting it until it was safe to drive clear.

Mr Coulson said about 4 m of retaining wall collapsed after being weakened by rain.

A family of six were watching the lightning when a 20 m tree crashed on to the roof of their lounge in Curraweela Street, Forestville.

They are Bryan Wildash, his wife Gwen, and their children, Chris, 17, Michael, 15, Scott, 14, and Sandra, 12.

"We were lucky that the tree didn't punch a hole in the ceiling," Mr Wildash said yesterday.

He said a heavy beam stopped the tree from crashing into the lounge.

Traffic was chaotic after power failures knocked out light signals and floodwaters marooned vehicles.

The fire brigade was also kept busy attending to fire alarm calls.

Above: Mrs Diane Coulson, of Kavalta Circuit, Belrose, and her daughter, Brooke, 2, standing in the car port above where a retaining wall collapsed and crashed into a neighbor's house.

Below: This huge tree crashed on to a house in Curraweela Street, Forestville, when blown over by strong winds.

Big names opposing restaurant

Actor Jack Thompson believes the unique charm of the delicate Palm Beach environment will be challenged by developments such as the proposed restaurant complex in Ocean Road.

Thompson, who grew up on the Peninsula, is one of a number of notable Australians who have lent their voices to the mounting opposition to the proposed restaurant.

Others who have pledged support to groups trying to persuade Warringah Shire Council to overturn last week's decision approving the application include:

Authors Morris West, Tom Keneally, Alex Buzo, actor Brian Brown and his wife Rachell Ward, Wendy Weir, wife of celebrated film director Peter Weir, and Lady Spender.

Australia's foremost restaurant critic, Leo Schofield, has also entered the fray.

"Commercially, the proposed development is the dumbest thing imaginable," says Schofield, whose comments will be included in a file containing more than 300 signatures of people objecting to the restaurant.

It will be presented to the council when it considers a rescission motion tonight.

SAVE YOU MONEY ON BLUEBIRD

Louise is following in

Woman

A P P E N D I X C

Pit and Pipe Network Details

The tables on the following 19 pages contain Warringah Council's 1994 stormwater pit asset data that were used to create the hydraulic model.

NODE NUMBER	EASTING	NORTHING	STREET	SUBURB	PIT_TYPE	LINTEL	X_FALL	PIT_DEPTH	GRATE_RL	INVERT
120370-0	333898.52	6265655.39	Haigh Avenue	Belrose	DGGP	2.700	2.000	1.040	139.256	138.216
120372-0	333845.84	6265616.71	Haigh Avenue	Belrose	DGGP	2.690	4.000	1.030	142.796	141.766
120371-0	333848.91	6265626.82	Haigh Avenue	Belrose	JP	0.000	0.000	1.140	142.170	141.030
120409-0	333946.62	6265576.12	Birrong Avenue	Belrose	DGGP	2.020	3.000	0.900	0.000	-0.900
120410-0	333944.32	6265582.07	Birrong Avenue	Belrose	DGGP	2.040	3.000	1.070	0.000	-1.070
120411-0	334054.85	6265632.92	Birrong Avenue	Belrose	DGGP	2.070	4.000	1.010	135.183	134.173
120414-0	334068.18	6265645.80	Birrong Avenue	Belrose	DGGP	2.060	3.000	0.940	134.612	133.672
120412-0	334057.29	6265626.45	Birrong Avenue	Belrose	DGGP	3.300	0.000	0.880	135.365	134.485
120413-0	334068.58	6265621.34	Birrong Avenue	Belrose	DGGP	2.060	3.000	0.570	135.743	135.173
120395-0	334081.87	6265555.89	Wingara Grove	Belrose	DGGP	2.070	2.000	1.090	139.142	138.052
120395-1	334126.11	6265557.27	Wingara Grove	Belrose	LBOX	0.000	0.000	0.000	0.000	0.000
120286-1	334158.12	6265546.77	Coora Avenue	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120989-0	334145.62	6265520.21	Glen Street	Belrose	JP	0.000	0.000	1.670	138.779	137.109
120990-0	334146.20	6265540.82	Glen Street	Belrose	JUNCTION	0.000	0.000	0.000	0.000	0.000
120991-0	334144.20	6265555.67	Glen Street	Belrose	JUNCTION	0.000	0.000	0.000	0.000	0.000
120286-0	334228.96	6265583.79	Coora Avenue	Belrose	DGGP	2.180	5.000	1.020	0.000	-1.020
120288-0	334239.12	6265569.98	Coora Avenue	Belrose	DGGP	2.780	1.000	1.080	0.000	-1.080
120287-0	334243.93	6265581.51	Coora Avenue	Belrose	DGGP	2.800	0.000	1.000	142.539	141.539
120285-0	334265.92	6265601.58	Yarrabin Street	Belrose	DGGP	2.020	1.000	1.460	0.000	-1.460
120282-0	334320.08	6265615.81	Yarrabin Street	Belrose	DGGP	1.540	4.000	1.170	0.000	-1.170
120283-0	334332.60	6265610.41	Palona Place	Belrose	DGGP	1.560	0.000	0.900	146.431	145.531
120284-0	334336.58	6265612.73	Yarrabin Street	Belrose	DGGP	1.570	0.000	0.700	146.487	145.787
120394-0	334067.57	6265537.75	Wingara Grove	Belrose	DGGP	2.070	4.000	1.060	139.976	138.916
120393-0	334062.48	6265525.16	Wingara Grove	Belrose	DGGP	2.070	2.000	0.980	140.655	139.675
120392-0	334073.89	6265518.20	Wingara Grove	Belrose	DGGP	2.070	3.000	0.870	140.989	140.119
120396-0	334011.58	6265510.13	Pindrie Place	Belrose	JP	0.000	0.000	1.530	0.000	-1.530
120289-0	334189.89	6265517.49	Marina Place	Belrose	DGGP	1.580	0.000	0.960	141.146	140.186
120298-2	334161.34	6265498.71	Coora Avenue	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120289-1	334166.96	6265500.22	Marina Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120202-1	334253.23	6265428.86	Lowanna Street	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120298-1	334181.81	6265477.33	Coora Avenue	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120298-0	334211.02	6265464.79	Coora Avenue	Belrose	DGGP	2.160	0.000	1.940	142.505	140.565
120297-0	334240.48	6265466.77	Coora Avenue	Belrose	DGGP	0.000	2.000	1.940	0.000	-1.940
120296-0	334264.29	6265496.81	Opala Street	Belrose	DGGP	2.790	3.000	1.130	144.687	143.557
120295-0	334286.25	6265507.99	Opala Street	Belrose	DGGP	1.560	3.000	0.980	146.126	145.146
120299-0	334231.01	6265457.79	Coora Avenue		DGGP	0.000	0.000	2.090	143.305	141.215
120202-0	334314.31	6265420.19	Lowanna Street	Belrose	DGGP	1.550	0.000	0.730	0.000	-0.730
120203-0	334338.60	6265400.70	Lowanna Street	Belrose	DGGP	1.600	2.000	1.050	148.418	147.368
120204-0	334344.42	6265392.19	Lowanna Street	Belrose	DGGP	2.200	2.000	1.140	0.000	-1.140
120984-0	334253.45	6265417.41	Glen Street	Belrose	DGGP	0.000	2.000	2.060	0.000	-2.060
120983-0	334266.28	6265406.19	Glen Street	Belrose	DGGP	0.000	2.000	1.550	0.000	-1.550
120982-0	334280.49	6265382.40	Glen Street	Belrose	DGGP	0.000	0.000	2.060	0.000	-2.060

NODE NUMBER	EASTING	NORTHING	STREET	SUBURB	PIT_TYPE	LINTEL	X_FALL	PIT_DEPTH	GRATE_RL	INVERT
120314-0	334277.34	6265367.45	Glenrose Place	Belrose	LBOX	0.930	0.000	1.200	0.000	-1.200
120313-0	334255.81	6265354.99	Glenrose Place	Belrose	DGGP	0.000	0.000	1.430	0.000	-1.430
120981-0	334289.26	6265361.21	Glen Street	Belrose	JP	0.000	0.000	2.600	149.858	147.258
120980-0	334310.10	6265332.55	Glen Street	Belrose	JP	0.000	0.000	2.500	0.000	-2.500
120225-0	334304.97	6265312.67	Glen Street	Belrose	DGGP	0.900	0.000	2.650	153.018	150.368
120227-0	334297.92	6265310.55	Glen Street	Belrose	JP	0.000	0.000	0.890	0.000	-0.890
120228-0	334288.29	6265305.20	Glen Street	Belrose	DGGP	2.000	1.000	0.710	0.000	-0.710
120226-0	334328.64	6265318.13	Glen Street	Belrose	DGGP	1.560	1.000	1.360	153.005	151.645
120223-0	334338.48	6265306.27	Glen Street	Belrose	OUTLET	0.000	0.000	0.000	0.000	0.000
120224-0	334315.27	6265302.82	Glen Street	Belrose	DGGP	0.000	0.000	1.750	0.000	-1.750
120223-1	334318.55	6265310.37	Glen Street	Belrose	JUNCTION	0.000	0.000	0.000	0.000	0.000
120317-0	334298.78	6265296.24	Glen Street	Belrose	DGGP	2.240	1.000	1.340	0.000	-1.340
120315-0	334242.07	6265265.34	Glenrose Place	Belrose	DGGP	2.000	1.000	1.280	0.000	-1.280
120316-0	334240.63	6265250.99	Glenrose Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120318-0	334242.00	6265239.55	Glen Street	Belrose	LBOX	1.300	0.000	0.750	0.000	153.270
120320-0	334233.35	6265242.25	Glen Street	Belrose	DGGP	0.000	2.000	0.570	0.000	-0.570
120321-0	334227.86	6265230.11	Glen Street	Belrose	DGGP	0.000	2.000	0.920	0.000	-0.920
120319-0	334238.25	6265226.30	Glen Street	Belrose	LBOX	0.770	0.000	1.400	0.000	155.090
120333-0	334096.18	6265184.41	Glen Street	Belrose	DGGP	0.000	5.000	1.340	157.502	156.162
120332-0	334107.17	6265189.95	Glen Street	Belrose	DGGP	2.020	3.000	1.320	0.000	-1.320
120327-0	334132.10	6265204.19	Glen Street	Belrose	DGGP	2.020	2.000	1.270	0.000	-1.270
120326-0	334154.94	6265217.15	Glen Street	Belrose	DGGP	2.020	1.000	1.430	0.000	-1.430
120325-0	334190.49	6265236.26	Glen Street	Belrose	DGGP	2.020	1.000	1.400	0.000	-1.400
120323-0	334218.25	6265252.44	Glen Street	Belrose	DGGP	2.020	1.000	1.380	0.000	-1.380
120322-0	334221.85	6265254.56	Glen Street	Belrose	DGGP	0.000	0.000	1.440	0.000	-1.440
120324-0	334207.10	6265236.58	Glen Street	Belrose	DGGP	0.000	1.000	0.000	0.000	0.000
120331-0	334129.91	6265169.76	Glen Street	Belrose	DGGP	0.000	0.000	0.880	0.000	-0.880
120330-0	334129.67	6265181.79	Glen Street	Belrose	DGGP	0.000	0.000	0.800	0.000	-0.800
120329-0	334129.54	6265188.66	Glen Street	Belrose	DGGP	0.000	0.000	0.920	0.000	-0.920
120328-0	334131.13	6265195.00	Glen Street	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120336-0	334042.22	6265111.91	Glen Street	Belrose	DGGP	0.000	0.000	1.300	0.000	-1.300
120337-0	334046.90	6265106.27	Glen Street	Belrose	DGGP	0.000	0.000	0.580	0.000	-0.580
120335-0	334048.22	6265156.72	Blackbutts Road	Frenchs Forest	DGGP	2.640	4.000	1.030	0.000	-1.030
120334-0	334066.88	6265169.69	Glen Street	Belrose	DGGP	2.020	1.000	1.410	0.000	-1.410
120338-0	334048.36	6265179.07	Lockwood Avenue	Belrose	DGGP	0.000	0.000	0.740	0.000	-0.740
120339-0	334011.90	6265196.38	Lockwood Avenue	Belrose	DGGP	1.560	1.000	0.720	158.589	157.869
120341-0	333990.16	6265206.48	Lockwood Avenue	Belrose	DGGP	1.570	0.000	0.880	158.806	157.926
120340-0	333992.48	6265194.60	Lockwood Avenue	Belrose	DGGP	1.560	0.000	0.630	0.000	-0.630
120342-0	333943.11	6265228.60	Lockwood Avenue	Belrose	DGGP	1.560	1.000	0.870	0.000	-0.870
120307-0	334074.84	6265349.76	Glenrose Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120305-0	334083.65	6265311.11	Glenrose Place	Belrose	LBOX	0.120	0.000	0.000	0.000	0.000
120306-0	334082.19	6265296.05	Glenrose Place	Belrose	DGGP	2.480	0.000	0.670	0.000	-0.670

NODE NUMBER	EASTING	NORTHING	STREET	SUBURB	PIT_TYPE	LINTEL	X_FALL	PIT_DEPTH	GRATE_RL	INVERT
120303-0	334105.06	6265279.03	Glenrose Place	Belrose	SGGP	0.940	0.000	0.870	0.000	-0.870
120302-0	334115.02	6265270.76	Glenrose Place	Belrose	DGGP	2.020	0.000	1.030	151.466	150.436
120301-1	334121.68	6265272.37	Glenrose Place	Belrose	DGGP	0.000	0.000	0.000	150.936	0.000
120301-2	334129.54	6265276.32	Glenrose Place	Belrose	DGGP	2.050	0.000	0.000	0.000	0.000
120301-3	334134.90	6265279.84	Glenrose Place	Belrose	DGGP	1.030	0.000	0.000	150.760	0.000
120301-0	334145.43	6265284.68	Glenrose Place	Belrose	DGGP	0.000	0.000	0.940	0.000	-0.940
120309-2	334152.24	6265288.22	Glenrose Place	Belrose	DGGP	0.000	0.000	0.000	0.000	0.000
120309-0	334120.83	6265342.06	Glenrose Place	Belrose	LBOX	0.400	0.000	0.000	0.000	0.000
120309-1	334158.19	6265277.47	Glenrose Place	Belrose	DGGP	0.000	0.000	0.000	0.000	0.000
120309-3	334146.33	6265297.86	Glenrose Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120309-4	334140.41	6265307.49	Glenrose Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120308-0	334106.02	6265367.56	Glenrose Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120300-0	334087.60	6265282.97	Glenrose Place	Belrose	DGGP	2.580	2.000	1.210	0.000	-1.210
120979-0	334051.75	6265299.46	Ashworth Avenue	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120978-0	334057.89	6265278.95	Ashworth Avenue	Belrose	DGGP	0.000	2.000	0.910	0.000	-0.910
120977-0	334026.15	6265310.16	Ashworth Avenue	Belrose	DGGP	1.980	0.000	0.720	152.391	151.671
120389-0	334069.30	6265398.93	Wallina Avenue	Belrose	DGGP	1.810	0.000	1.180	0.000	-1.180
120310-0	334104.25	6265399.61	Glenrose Place	Belrose	DGGP	1.000	0.000	1.050	0.000	-1.050
120311-0	334095.65	6265399.44	Glenrose Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120391-0	334103.70	6265427.68	Wingara Grove	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120390-0	334101.75	6265498.69	Wingara Grove	Belrose	LBOX	0.900	0.000	0.850	0.000	-0.850
120988-0	334154.58	6265492.84	Glen Street	Belrose	JP	0.000	0.000	1.700	0.000	-1.700
120987-0	334171.43	6265451.34	Glen Street	Belrose	JP	0.000	0.000	1.690	0.000	-1.690
120986-0	334194.55	6265411.10	Glen Street	Belrose	JP	0.000	0.000	1.810	0.000	-1.810
120312-1	334177.11	6265394.72	Glenrose Place	Belrose	LBOX	0.000	0.000	0.000	0.000	0.000
120312-0	334185.44	6265378.84	Glenrose Place	Belrose	DGGP	2.000	0.000	0.000	0.000	0.000
120985-0	334210.15	6265404.53	Glen Street	Belrose	DGGP	0.000	2.000	1.850	0.000	-1.850
120397-0	333999.76	6265501.18	Pindrie Place	Belrose	DGGP	2.030	2.000	1.580	144.275	142.695
120398-0	333985.35	6265480.41	Pindrie Place	Belrose	DGGP	2.030	0.000	1.470	145.228	143.758
120399-0	333996.99	6265469.70	Pindrie Place	Belrose	DGGP	2.030	4.000	1.030	145.977	144.947
120400-0	333960.03	6265478.76	Kyeema Parade	Belrose	DGGP	0.000	2.000	1.350	0.000	-1.350
120401-0	333933.60	6265479.85	Kyeema Parade	Belrose	DGGP	2.640	1.000	1.050	147.144	146.094
120312-2	334172.41	6265430.81	Glenrose Place	Belrose	LBOX	0.780	0.000	0.000	144.008	0.000
120403-0	333847.26	6265467.30	Ashworth Avenue	Belrose	DGGP	2.030	2.000	1.150	152.058	150.908
120402-0	333857.08	6265478.27	Kyeema Parade	Belrose	JP	0.000	0.000	0.000	150.977	0.000
120405-0	333851.70	6265415.57	Ashworth Avenue	Belrose	DGGP	2.690	0.000	1.030	153.879	152.849
120404-0	333852.14	6265428.43	Ashworth Avenue	Belrose	DGGP	2.640	0.000	1.180	153.782	152.602
120406-0	333839.94	6265412.33	Ashworth Avenue	Belrose	DGGP	1.520	5.000	0.610	154.358	153.748
120407-0	333816.00	6265386.25	Ashworth Avenue	Belrose	DGGP	2.740	5.000	0.900	0.000	-0.900
120408-0	333885.30	6265386.16	Ashworth Avenue	Belrose	DGGP	3.270	2.000	0.990	154.542	153.552
120773-0	334325.10	6266293.22	Tanami Close	Belrose	DGGP	2.070	4.000	0.900	0.000	152.040
120774-0	334327.18	6266267.32	Tanami Close	Belrose	DGGP	2.070	0.000	1.510	0.000	150.340

NODE NUMBER	EASTING	NORTHING	STREET	SUBURB	PIT_TYPE	LINTEL	X_FALL	PIT_DEPTH	GRATE_RL	INVERT
120002-0	334519.20	6266274.17	Stratham Place	Belrose	DGGP	2.450	3.000	1.620	0.000	150.900
120003-0	334535.77	6266241.87	Stratham Place	Belrose	DGGP	2.690	7.000	1.610	0.000	148.900
120004-0	334528.48	6266246.14	Stratham Place	Belrose	DGGP	2.690	7.000	0.830	148.801	147.971
120005-0	334552.11	6266201.82	Stratham Place	Belrose	DGGP	0.000	0.000	1.930	141.560	139.630
120006-0	334550.84	6266185.95	Stratham Place	Belrose	DGGP	2.690	1.000	1.680	140.358	138.678
120029-0	334535.18	6266163.41	Trentbridge Road	Belrose	DGGP	2.000	3.000	1.980	139.132	137.152
120022-0	334432.38	6266242.01	Stirling Place	Belrose	DGGP	3.200	1.000	0.910	155.621	154.711
120023-0	334443.50	6266236.06	Stirling Place	Belrose	DGGP	3.260	3.000	0.960	155.112	154.152
120024-0	334456.53	6266202.66	Stirling Place	Belrose	DGGP	3.270	7.000	1.270	0.000	-1.270
120025-0	334464.49	6266148.05	Stirling Place	Belrose	DGGP	3.260	11.000	1.200	0.000	140.530
120026-0	334457.70	6266142.23	Stirling Place	Belrose	DGGP	3.260	11.000	1.160	139.766	138.606
120027-0	334449.55	6266127.78	Trentbridge Road	Belrose	DGGP	2.060	4.000	0.910	138.425	137.515
120028-0	334443.39	6266117.75	Trentbridge Road	Belrose	DGGP	2.000	5.000	0.890	0.000	136.640
120016-0	334389.48	6266165.31	Henley Close	Belrose	DGGP	2.000	8.000	0.890	0.000	-0.890
120017-0	334386.03	6266149.47	Henley Close	Belrose	DGGP	2.000	8.000	0.950	0.000	-0.950
120018-0	334401.84	6266113.22	Henley Close	Belrose	DGGP	2.000	7.000	0.740	0.000	134.660
120019-0	334408.08	6266116.00	Henley Close	Belrose	DGGP	2.000	4.000	0.880	0.000	134.710
120020-0	334396.89	6266101.72	Trentbridge Road	Belrose	DGGP	0.000	4.000	0.830	0.000	133.420
120015-0	334371.26	6266090.13	Trentbridge Road	Belrose	DGGP	2.000	3.000	1.120	0.000	130.690
120021-0	334375.82	6266083.90	Trentbridge Road	Belrose	DGGP	2.030	4.000	1.330	0.000	131.050
120014-0	334348.72	6266077.20	Trentbridge Road	Belrose	DGGP	2.000	0.000	0.830	0.000	130.330
120012-0	334326.30	6266104.39	Trentbridge Road	Belrose	DGGP	0.000	3.000	0.890	133.605	132.715
120010-0	334322.50	6266111.42	Trentbridge Road	Belrose	DGGP	2.020	5.000	0.830	134.137	133.307
120009-0	334316.27	6266127.57	Trentbridge Road	Belrose	DGGP	2.020	6.000	0.840	0.000	136.080
120011-0	334313.07	6266114.31	Trentbridge Road	Belrose	DGGP	2.020	0.000	0.800	134.694	133.894
120014-1	334352.50	6266041.64	Trentbridge Road	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120028-1	334456.13	6266090.91	Trentbridge Road	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120125-1	334431.34	6266060.23	Kew Close	Belrose	HEADWALL	0.000	0.000	0.000	0.000	0.000
120014-2	334336.90	6266033.90	Trentbridge Road	Belrose	HEADWALL	0.000	0.000	0.000	0.000	0.000
120028-2	334462.50	6266077.90	Trentbridge Road	Belrose	HEADWALL	0.000	0.000	0.000	0.000	0.000
120125-0	334462.38	6266033.95	Kew Close	Belrose	DGGP	2.000	0.000	0.620	132.817	132.197
120032-0	334517.81	6266153.61	Trentbridge Road	Belrose	DGGP	2.060	1.000	0.900	0.000	138.600
120033-0	334517.24	6266146.51	Trentbridge Road	Belrose	DGGP	2.060	0.000	1.080	0.000	138.300
120030-0	334530.49	6266136.11	Trentbridge Road	Belrose	DGGP	2.060	1.000	1.840	136.888	135.048
120034-0	334541.02	6266150.35	Pringle Avenue	Belrose	DGGP	2.700	2.000	0.690	0.000	137.800
120035-0	334540.98	6266128.77	Pringle Avenue	Belrose	DGGP	1.800	0.000	1.790	0.000	136.630
120123-0	334536.99	6266101.83	Pringle Avenue	Belrose	DGGP	3.300	1.000	1.010	0.000	137.800
120037-0	334546.77	6266115.31	Hews Parade	Belrose	DGGP	3.290	4.000	1.100	0.000	136.900
120124-0	334528.59	6266108.79	Pringle Avenue	Belrose	DGGP	3.200	0.000	1.170	0.000	136.600
120031-0	334529.54	6266125.03	Pringle Avenue	Belrose	DGGP	0.000	0.000	0.000	136.784	0.000
120031-1	334519.64	6266110.08	Pringle Avenue	Belrose	HEADWALL	0.000	0.000	0.000	0.000	0.000
120007-0	334636.82	6266212.33	Lynette Place	Belrose	DGGP	2.690	0.000	1.010	0.000	140.500

NODE NUMBER	EASTING	NORTHING	STREET	SUBURB	PIT_TYPE	LINTEL	X_FALL	PIT_DEPTH	GRATE_RL	INVERT
120008-0	334632.40	6266205.97	Lynette Place	Belrose	DGGP	2.700	0.000	1.140	0.000	140.360
120008-1	334627.46	6266190.49	Lynette Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120008-2	334596.57	6266158.82	Lynette Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120038-0	334600.86	6266110.07	Hews Parade	Belrose	DGGP	2.690	4.000	1.110	0.000	139.400
120039-0	334654.87	6266103.91	Hews Parade	Belrose	DGGP	2.690	5.000	1.110	144.777	143.667
120001-0	334564.90	6266203.69	Stratham Place	Belrose	DGGP	2.690	0.000	0.900	141.055	140.155
120976-0	334581.40	6266217.69	Pringle Avenue			0.000	0.000	0.000	141.401	0.000
120036-0	334549.82	6266132.54	Pringle Avenue	Belrose	LBOX	1.040	0.000	0.000	0.000	0.000
120122-0	334531.81	6266048.32	Pringle Avenue	Belrose	DGGP	0.900	0.000	0.950	0.000	137.100
120121-0	334545.77	6266025.70	Devere Avenue	Belrose	DGGP	2.000	5.000	0.900	0.000	138.000
120120-0	334576.89	6266011.30	Devere Avenue	Belrose	DGGP	2.000	3.000	1.060	0.000	140.900
120119-0	334594.92	6266014.75	The Vale	Belrose	DGGP	2.900	0.000	0.960	0.000	141.700
120117-0	334603.55	6266000.94	Devere Avenue	Belrose	DGGP	2.000	3.000	1.000	0.000	142.000
120118-0	334610.82	6265991.27	Devere Avenue	Belrose	DGGP	2.900	4.000	0.880	0.000	142.600
120116-0	334657.22	6265980.20	Devere Avenue	Belrose	DGGP	2.000	2.000	0.870	144.566	143.696
120115-0	334675.48	6265985.60	Devere Avenue	Belrose	DGGP	2.000	2.000	0.900	0.000	145.900
120040-0	334730.79	6266098.09	Hews Parade	Belrose	DGGP	2.020	3.000	0.870	149.651	148.781
120041-0	334741.68	6266106.29	Hews Parade	Belrose	DGGP	2.690	2.000	0.800	150.012	149.212
120851-3	334701.66	6266267.62	Pringle Avenue	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120049-0	334738.64	6266251.77	Pembroke Place	Belrose	DGGP	2.690	0.000	1.380	144.486	143.106
120051-0	334768.40	6266264.33	Pembroke Place	Belrose	DGGP	3.300	2.000	1.530	145.619	144.089
120050-0	334758.18	6266257.84	Pembroke Place	Belrose	DGGP	3.850	4.000	1.320	145.067	143.747
120048-0	334745.05	6266248.93	Pembroke Place	Belrose	DGGP	2.700	0.000	1.250	144.671	143.421
120047-0	334743.66	6266232.85	Pembroke Place	Belrose	DGGP	2.690	0.000	0.850	145.004	144.154
120046-0	334739.83	6266189.95	Pembroke Place	Belrose	DGGP	3.300	2.000	0.780	0.000	146.200
120044-0	334749.41	6266174.48	Chatham Close	Belrose	DGGP	2.690	0.000	0.980	0.000	147.000
120045-0	334734.36	6266140.38	Pembroke Place	Belrose	DGGP	2.690	1.000	0.690	0.000	147.300
120043-0	334765.67	6266175.52	Chatham Close	Belrose	DGGP	2.000	4.000	0.700	147.893	147.193
120042-0	334771.22	6266181.80	Chatham Close	Belrose	DGGP	2.060	4.000	0.980	148.268	147.288
120013-0	334351.31	6266084.00	Trentbridge Road	Belrose	DGGP	2.000	0.000	0.740	0.000	130.550
120108-0	334347.63	6265820.34	Elm Avenue	Belrose	DGGP	2.000	2.000	0.870	138.753	137.883
120109-0	334355.29	6265809.91	Elm Avenue	Belrose	DGGP	2.000	2.000	1.030	0.000	-1.030
120110-0	334358.21	6265801.26	Haigh Avenue	Belrose	DGGP	2.000	0.000	0.730	0.000	-0.730
120111-0	334415.70	6265802.36	Haigh Avenue	Belrose	DGGP	1.700	1.000	0.610	140.191	139.581
120112-0	334426.13	6265797.62	Haigh Avenue	Belrose	DGGP	1.700	1.000	0.630	140.271	139.641
120113-0	334434.97	6265798.05	Haigh Avenue	Belrose	DGGP	1.700	0.000	0.690	140.381	139.691
120114-0	334443.24	6265802.82	Haigh Avenue	Belrose	DGGP	1.720	1.000	0.530	140.405	139.875
120133-0	334504.34	6265788.70	Pringle Avenue	Belrose	DGGP	2.000	2.000	0.930	141.344	140.414
120132-0	334495.62	6265802.91	Pringle Avenue	Belrose	DGGP	2.000	0.000	0.960	140.911	139.951
120131-0	334501.51	6265821.29	Pringle Avenue	Belrose	DGGP	1.600	4.000	1.280	0.000	-1.280
120129-0	334503.98	6265852.00	Pringle Avenue	Belrose	DGGP	1.600	5.000	0.880	138.352	137.472
120130-0	334495.81	6265863.36	Birru Place	Belrose	DGGP	1.600	0.000	0.960	137.411	136.451

NODE NUMBER	EASTING	NORTHING	STREET	SUBURB	PIT_TYPE	LINTEL	X_FALL	PIT_DEPTH	GRATE_RL	INVERT
120128-0	334506.68	6265880.72	Pringle Avenue	Belrose	DGGP	1.600	4.000	0.760	136.321	135.561
120127-0	334505.25	6265904.15	Pringle Avenue	Belrose	DGGP	0.000	0.000	1.760	0.000	-1.760
120126-0	334517.05	6265897.38	Pringle Avenue	Belrose	DGGP	3.200	0.000	1.800	0.000	-1.800
120127-1	334509.24	6265906.56	Pringle Avenue	Frenchs Forest	HEADWALL	0.000	0.000	0.000	135.186	0.000
120240-0	334523.65	6265903.19	Pringle Avenue	Frenchs Forest	HEADWALL	0.000	0.000	0.000	0.000	0.000
120144-0	334590.14	6265831.68	Kapunda Place	Belrose	DGGP	2.800	2.000	1.630	136.829	135.199
120145-0	334617.93	6265810.49	Kapunda Place	Belrose	DGGP	2.800	1.000	1.930	0.000	-1.930
120146-0	334614.86	6265802.14	Kapunda Place	Belrose	DGGP	2.200	3.000	0.970	0.000	-0.970
120147-0	334640.88	6265787.60	Kapunda Place	Belrose	DGGP	2.800	2.000	2.330	138.521	136.191
120139-0	334543.64	6265707.22	Pringle Avenue	Belrose	DGGP	0.000	2.000	0.930	145.516	144.586
120140-0	334541.80	6265710.97	Pringle Avenue	Belrose	DGGP	1.500	0.000	0.880	145.311	144.431
120141-0	334555.98	6265702.51	Pringle Avenue	Belrose	DGGP	2.800	4.000	1.020	0.000	144.910
120142-0	334577.22	6265689.48	Everton Road	Belrose	DGGP	1.500	0.000	0.690	146.480	145.790
120143-0	334568.81	6265676.83	Pringle Avenue	Belrose	DGGP	2.800	1.000	0.940	147.478	146.538
120138-0	334565.06	6265662.98	Pringle Avenue	Belrose	DGGP	0.000	5.000	0.670	148.281	147.611
120137-0	334576.04	6265640.59	Northam Street	Belrose	DGGP	2.000	5.000	0.760	149.968	149.208
120136-0	334588.01	6265616.59	Northam Street	Belrose	DGGP	3.000	4.000	0.850	0.000	151.020
120134-0	334544.67	6265616.78	Northam Street	Belrose	DGGP	2.400	0.000	0.650	0.000	150.600
120148-0	334695.04	6265743.37	Kapunda Place	Belrose	DGGP	1.610	2.000	2.190	0.000	-2.190
120149-0	334707.51	6265741.64	Kapunda Place	Belrose	DGGP	1.600	1.000	1.850	0.000	-1.850
120150-0	334704.25	6265735.69	Kapunda Place	Belrose	DGGP	1.600	3.000	1.160	0.000	-1.160
120177-0	334681.81	6265686.02	Everton Road	Belrose	DGGP	2.800	0.000	1.420	0.000	146.130
120176-0	334681.23	6265679.50	Everton Road	Belrose	DGGP	2.800	0.000	1.100	0.000	147.220
120178-0	334658.76	6265681.86	Everton Road	Belrose	DGGP	2.000	0.000	0.720	145.959	145.239
120149-1	334735.25	6265776.03	Kapunda Place	Belrose	HEADWALL	0.000	0.000	1.300	0.000	-1.300
120151-0	334753.09	6265695.76	Kapunda Place	Belrose	DGGP	1.600	6.000	2.250	144.534	142.284
120152-0	334753.27	6265672.94	Kapunda Place	Belrose	DGGP	1.600	1.000	1.420	146.122	144.702
120153-0	334745.38	6265662.13	Pusan Place	Belrose	DGGP	2.200	5.000	0.890	146.785	145.895
120154-0	334736.86	6265669.67	Pusan Place	Belrose	DGGP	1.900	1.000	0.840	146.308	145.468
120174-0	334696.96	6265589.74	Pusan Place	Belrose	DGGP	2.000	0.000	1.000	0.000	151.880
120175-0	334695.62	6265605.27	Pusan Place	Belrose	DGGP	1.550	10.000	1.440	0.000	148.070
120135-0	334578.73	6265622.63	Northam Street	Belrose	DGGP	2.400	0.000	0.870	151.180	150.310
120275-0	334487.91	6265605.68	Northam Street	Belrose	DGGP	2.400	0.000	0.680	0.000	150.140
120272-0	334491.85	6265579.66	Yarrabin Street	Belrose	DGGP	3.060	3.000	0.940	0.000	150.710
120273-0	334474.62	6265588.04	Yarrabin Street	Belrose	DGGP	2.440	3.000	0.920	151.386	150.466
120274-0	334467.56	6265603.36	Yarrabin Street	Belrose	DGGP	0.000	2.000	1.000	0.000	149.710
120276-0	334462.29	6265632.55	Yarrabin Street	Belrose	DGGP	1.800	3.000	0.870	149.677	148.807
120277-0	334446.46	6265646.70	Yarrabin Street	Belrose	DGGP	1.840	0.000	0.930	0.000	147.970
120281-0	334408.83	6265630.83	Yarrabin Street	Belrose	DGGP	1.560	0.000	0.780	148.257	147.477
120280-0	334402.70	6265623.72	Kiah Place	Belrose	DGGP	1.570	2.000	1.060	148.206	147.146
120279-0	334392.90	6265624.30	Yarrabin Street	Belrose	DGGP	1.560	2.000	1.020	148.044	147.024
120278-0	334377.11	6265630.38	Yarrabin Street	Belrose	DGGP	1.540	2.000	1.200	147.671	146.471

NODE NUMBER	EASTING	NORTHING	STREET	SUBURB	PIT_TYPE	LINTEL	X_FALL	PIT_DEPTH	GRATE_RL	INVERT
120052-0	334817.80	6266265.82	Pembroke Place	Belrose	DGGP	2.070	1.000	0.940	147.906	146.966
120066-0	334902.10	6266233.28	Muraban Place	Belrose	DGGP	2.200	0.000	1.090	156.283	155.193
120067-0	334900.63	6266169.60	Hal Hammond Place	Belrose	DGGP	2.000	0.000	0.660	159.965	159.305
120065-0	334947.52	6266290.04	Munnumba Avenue	Belrose	DGGP	2.630	3.000	1.460	0.000	155.500
120064-0	334941.83	6266290.17	Munnumba Avenue	Belrose	DGGP	2.800	3.000	1.900	0.000	155.000
120066-1	334910.18	6266239.41	Muraban Place	Belrose	JP	0.000	0.000	2.710	0.000	155.910
120067-2	334902.32	6266208.50	Hal Hammond Place	Belrose	JP	0.000	0.000	1.710	0.000	158.120
120067-1	334906.82	6266179.71	Hal Hammond Place	Belrose	JP	0.000	0.000	1.530	0.000	160.560
120068-3	335000.54	6266288.29	Stroud Place	Belrose	JP	0.000	0.000	1.140	0.000	158.580
120053-0	334868.33	6266292.29	Pembroke Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120064-1	334899.40	6266291.58	Munnumba Avenue	Belrose	DGGP	0.000	0.000	1.240	0.000	152.460
120068-2	335020.90	6266253.69	Stroud Place	Belrose	JP	0.000	0.000	1.670	0.000	160.580
120080-1	335078.46	6266263.99	Knightsbridge Avenue	Belrose	JP	0.000	0.000	1.180	0.000	162.780
120068-1	335030.09	6266253.86	Stroud Place	Belrose	DGGP	0.000	3.000	1.010	0.000	161.230
120068-0	335035.38	6266251.34	Stroud Place	Belrose	DGGP	0.000	0.000	1.090	0.000	161.400
120069-1	335020.45	6266249.06	Stroud Place	Belrose	DGGP	0.000	3.000	1.130	160.922	159.792
120069-0	335022.03	6266211.93	Stroud Place	Belrose	DGGP	2.000	2.000	1.090	0.000	162.400
120070-0	335017.56	6266173.67	Stroud Place	Belrose	DGGP	3.200	2.000	1.080	0.000	164.400
120071-0	335029.71	6266154.90	Stroud Place	Belrose	DGGP	0.000	2.000	1.000	0.000	165.500
120072-0	335041.38	6266152.51	Stroud Place	Belrose	DGGP	2.000	2.000	1.040	165.408	164.368
120073-0	335072.12	6266149.64	Stroud Place	Belrose	DGGP	3.200	3.000	1.030	166.277	165.247
120074-0	335082.59	6266139.42	Stroud Place	Belrose	DGGP	2.000	3.000	1.260	167.107	165.847
120075-0	335088.24	6266140.27	Knightsbridge Avenue	Belrose	DGGP	2.630	1.000	1.040	0.000	167.500
120077-0	335115.85	6266151.59	Oxford Close	Belrose	DGGP	3.210	1.000	0.990	0.000	168.000
120076-0	335107.01	6266147.45	Oxford Close	Belrose	DGGP	3.200	1.000	0.930	0.000	167.800
120083-0	335100.96	6266215.91	Knightsbridge Avenue	Belrose	DGGP	2.600	0.000	0.820	0.000	164.900
120082-0	335113.36	6266226.13	Tudor Close	Belrose	DGGP	2.600	0.000	0.980	0.000	164.400
120080-0	335112.54	6266259.83	Knightsbridge Avenue	Belrose	DGGP	2.600	0.000	0.960	163.658	162.698
120081-0	335118.88	6266257.31	Knightsbridge Avenue	Belrose	DGGP	2.000	0.000	0.830	163.660	162.830
120079-0	335114.04	6266245.70	Knightsbridge Avenue	Belrose	DGGP	2.600	1.000	0.870	163.847	162.977
120078-0	335121.60	6266231.85	Tudor Close	Belrose	DGGP	3.200	3.000	0.680	164.613	163.933
121001-0	335239.88	6266235.83	Forest Way	Belrose	DGGP	1.800	3.000	1.150	0.000	168.560
120062-7	335146.50	6265998.09	Hews Parade	Belrose	DGGP	0.000	1.000	0.600	0.000	-0.600
120062-6	335142.24	6265998.32	Hews Parade	Belrose	DGGP	0.000	1.000	0.550	0.000	-0.550
120062-8	335100.39	6265955.57	Hews Parade	Belrose	GSIP	0.000	0.000	1.800	0.000	-1.800
120062-5	335109.80	6266001.63	Hews Parade	Belrose	GSIP	0.000	0.000	1.880	0.000	-1.880
120062-4	335120.60	6266053.91	Hews Parade	Belrose	GSIP	0.000	0.000	1.830	0.000	-1.830
120062-3	335118.87	6266060.64	Hews Parade	Belrose	DGGP	2.000	1.000	1.910	169.430	167.520
120062-2	335043.86	6266067.47	Hews Parade	Belrose	DGGP	2.000	1.000	1.220	167.459	166.239
120062-0	334983.83	6266072.92	Hews Parade	Belrose	DGGP	2.600	4.000	0.920	163.431	162.511
120063-0	334965.07	6266086.81	Hews Parade	Belrose	DGGP	3.200	3.000	0.750	162.203	161.453
120058-0	334949.56	6266076.89	Hews Parade	Belrose	DGGP	2.070	4.000	0.990	0.000	161.500

NODE NUMBER	EASTING	NORTHING	STREET	SUBURB	PIT_TYPE	LINTEL	X_FALL	PIT_DEPTH	GRATE_RL	INVERT
120059-0	334957.04	6266075.49	Hews Parade	Belrose	DGGP	0.000	3.000	1.070	161.625	160.555
120060-0	334965.29	6266061.17	Andove Street	Belrose	DGGP	2.020	0.000	0.690	0.000	162.700
120061-0	334971.59	6266059.46	Andove Street	Belrose	DGGP	2.070	0.000	0.670	162.039	161.369
120057-0	334901.77	6266082.02	Hews Parade	Belrose	DGGP	3.860	3.000	0.800	159.276	158.476
120055-0	334872.61	6266084.78	Hews Parade	Belrose	DGGP	2.620	4.000	1.210	157.864	156.654
120056-0	334889.17	6266072.71	Hews Parade	Belrose	DGGP	2.640	0.000	0.820	158.395	157.575
120054-0	334793.00	6266092.63	Hews Parade	Belrose	DGGP	2.000	4.000	0.880	0.000	152.600
120084-0	334952.23	6265870.93	Andove Street	Belrose	DGGP	4.400	1.000	0.830	161.168	160.338
120085-0	334948.03	6265834.28	Andove Street	Belrose	DGGP	3.800	1.000	1.180	0.000	-1.180
120086-0	334957.29	6265826.86	Andove Street	Belrose	DGGP	3.800	0.000	1.000	0.000	-1.000
120087-0	334956.43	6265820.26	Andove Street	Belrose	DGGP	3.200	0.000	0.960	0.000	-0.960
120088-0	334946.65	6265810.36	Andove Street	Belrose	DGGP	2.000	1.000	1.210	0.000	-1.210
120089-0	334944.19	6265782.67	Andove Street	Belrose	DGGP	3.200	1.000	1.210	0.000	-1.210
120090-0	334937.67	6265784.79	Andove Street	Belrose	DGGP	2.600	1.000	1.590	0.000	-1.590
120091-0	334922.52	6265776.16	Willow Tree Crescent	Belrose	DGGP	2.000	2.000	1.550	0.000	-1.550
120092-0	334892.41	6265800.52	Willow Tree Crescent	Belrose	DGGP	2.600	2.000	1.540	0.000	-1.540
120093-0	334892.98	6265791.89	Willow Tree Crescent	Belrose	DGGP	2.600	3.000	0.970	0.000	-0.970
120096-0	334867.16	6265836.02	Willow Tree Crescent	Belrose	DGGP	2.600	0.000	0.920	0.000	-0.920
120094-0	334879.56	6265810.68	Willow Tree Crescent	Belrose	DGGP	2.600	1.000	1.670	0.000	-1.670
120095-0	334860.64	6265831.62	Willow Tree Crescent	Belrose	DGGP	2.600	0.000	1.550	0.000	-1.550
120097-0	334868.71	6265855.17	Willow Tree Crescent	Belrose	DGGP	2.600	6.000	0.760	0.000	-0.760
120095-1	334823.36	6265835.93	Willow Tree Crescent	Belrose	HEADWALL	0.000	0.000	0.000	0.000	0.000
120101-0	334942.73	6265761.99	Willow Tree Crescent	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120100-0	334943.09	6265770.58	Willow Tree Crescent	Belrose	DGGP	2.000	0.000	1.150	0.000	-1.150
120098-0	334953.59	6265749.89	Willow Tree Crescent	Belrose	DGGP	5.000	5.000	1.230	0.000	-1.230
120099-0	335010.37	6265718.24	Willow Tree Crescent	Belrose	DGGP	3.200	4.000	1.130	0.000	-1.130
120102-0	334945.54	6265748.99	Willow Tree Crescent	Belrose	DGGP	3.800	3.000	1.260	0.000	-1.260
120235-0	335168.87	6265714.30	Forest Way	Belrose	DGGP	2.000	2.000	0.730	0.000	-0.730
120233-0	335156.68	6265653.80	Forest Way	Belrose	DGGP	0.000	1.000	0.650	169.381	168.731
120234-0	335171.55	6265660.66	Forest Way	Belrose	LBOX	0.660	0.000	0.000	0.000	0.000
120232-0	335155.64	6265645.92	Forest Way	Belrose	DGGP	1.970	0.000	0.840	0.000	-0.840
120231-0	335134.33	6265647.69	Forest Way	Belrose	DGGP	1.970	0.000	1.020	169.472	168.452
120237-0	335136.47	6265658.81	Forest Way	Belrose	DGGP	2.000	4.000	0.800	169.337	168.537
120238-0	335146.71	6265710.13	Forest Way	Belrose	DGGP	2.000	1.000	0.800	170.591	169.791
120239-0	335115.30	6265650.38	Forest Way	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120163-3	335021.91	6265660.38	Forest Glen Crescent	Belrose	HEADWALL	0.000	0.000	0.000	0.000	0.000
120163-2	335026.55	6265601.84	Forest Glen Crescent	Belrose	HEADWALL	0.000	0.000	0.000	0.000	0.000
120163-1	335027.26	6265587.85	Forest Glen Crescent	Belrose	HEADWALL	0.000	0.000	0.000	0.000	0.000
120163-0	335010.94	6265559.05	Forest Glen Crescent	Belrose	DGGP	2.000	2.000	1.550	0.000	-1.550
120162-0	334936.52	6265575.74	Forest Glen Crescent	Belrose	DGGP	2.000	4.000	0.980	0.000	-0.980
120161-0	334913.89	6265574.59	Forest Glen Crescent	Belrose	DGGP	3.200	0.000	1.010	0.000	-1.010
120160-0	334905.64	6265591.08	Forest Glen Crescent	Belrose	DGGP	2.200	6.000	1.880	0.000	-1.880

NODE NUMBER	EASTING	NORTHING	STREET	SUBURB	PIT_TYPE	LINTEL	X_FALL	PIT_DEPTH	GRATE_RL	INVERT
120158-0	334869.60	6265612.72	Forest Glen Crescent	Belrose	DGGP	2.000	2.000	0.970	157.370	156.400
120159-0	334868.57	6265605.82	Forest Glen Crescent	Belrose	DGGP	2.000	3.000	0.850	157.370	156.520
120157-0	334825.08	6265619.85	Forest Glen Crescent	Belrose	DGGP	2.000	6.000	0.930	0.000	-0.930
120155-0	334812.63	6265652.74	Forest Glen Crescent	Belrose	DGGP	2.000	5.000	1.840	149.598	147.758
120156-0	334818.75	6265654.95	Forest Glen Crescent	Belrose	DGGP	2.000	3.000	1.230	0.000	-1.230
120156-1	334829.79	6265661.91	Forest Glen Crescent	Belrose	HEADWALL	0.000	0.000	0.000	0.000	0.000
120294-0	334362.71	6265524.22	Opala Street	Belrose	DGGP	1.560	1.000	1.000	0.000	-1.000
120293-0	334369.66	6265516.69	Opala Street	Belrose	DGGP	1.560	2.000	0.870	148.997	148.127
120292-0	334381.50	6265509.19	Opala Street	Belrose	DGGP	1.560	2.000	1.010	0.000	-1.010
120291-0	334391.89	6265499.09	Opala Street	Belrose	DGGP	1.560	0.000	0.860	0.000	-0.860
120290-0	334394.73	6265475.36	Opala Street	Belrose	DGGP	1.550	0.000	0.780	150.314	149.534
120205-0	334393.44	6265385.00	Lowanna Street	Belrose	DGGP	0.460	2.000	1.080	151.165	150.085
120206-0	334395.63	6265378.38	Lowanna Street	Belrose	DGGP	1.550	5.000	1.010	0.000	-1.010
120207-0	334449.15	6265371.29	Lowanna Street	Belrose	DGGP	2.060	2.000	1.010	0.000	-1.010
120208-0	334487.22	6265370.13	Lowanna Street	Belrose	DGGP	2.070	2.000	0.800	0.000	-0.800
120213-1	334450.92	6265529.66	Jilliby Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120211-1	334470.62	6265493.89	Yarrabin Street	Belrose	JP	0.000	0.000	0.700	0.000	153.340
120212-0	334454.05	6265519.77	Jilliby Place	Belrose	DGGP	1.780	0.000	0.930	152.225	151.295
120213-0	334471.19	6265532.84	Jilliby Place	Belrose	DGGP	2.410	0.000	0.770	152.544	151.774
120211-0	334538.15	6265503.62	Yarrabin Street	Belrose	DGGP	2.000	2.000	0.860	156.043	155.183
120210-0	334545.05	6265505.16	Yarrabin Street	Belrose	DGGP	2.000	5.000	0.750	0.000	155.380
120209-0	334596.01	6265404.68	Yarrabin Street	Belrose	DGGP	2.000	0.000	0.930	158.647	157.717
120220-0	334434.19	6265303.20	Glen Street	Belrose	DGGP	2.000	5.000	0.990	0.000	-0.990
120222-0	334373.96	6265302.24	Glen Street	Belrose	DGGP	2.060	2.000	1.640	0.000	-1.640
120221-0	334434.57	6265294.38	Glen Street	Belrose	DGGP	2.600	2.000	1.460	0.000	-1.460
120219-0	334534.88	6265288.62	Glen Street	Belrose	DGGP	2.000	1.000	1.010	0.000	-1.010
120218-0	334514.17	6265283.06	Glen Street	Belrose	DGGP	2.600	2.000	1.910	0.000	-1.910
120215-0	334573.39	6265274.42	Glen Street	Belrose	DGGP	2.600	1.000	1.710	0.000	-1.710
120216-0	334577.24	6265241.82	Glen Street	Belrose	JP	0.000	0.000	0.800	0.000	-0.800
120214-0	334585.90	6265272.71	Glen Street	Belrose	DGGP	2.600	1.000	1.700	0.000	-1.700
120198-0	334635.31	6265265.57	Glen Street	Belrose	DGGP	2.500	1.000	1.700	0.000	-1.700
120200-0	334627.52	6265275.77	Glen Street	Belrose	DGGP	0.000	1.000	1.110	0.000	-1.110
120201-0	334643.06	6265282.55	Glen Street	Belrose	DGGP	2.000	0.000	1.060	0.000	-1.060
120199-0	334650.39	6265272.64	Glen Street	Belrose	DGGP	2.000	1.000	1.000	0.000	-1.000
120197-0	334677.39	6265259.47	Glen Street	Belrose	DGGP	2.560	1.000	1.620	0.000	-1.620
120217-0	334588.85	6265215.14	Glen Street	Belrose	LBOX	0.000	0.000	0.770	0.000	-0.770
120195-0	334722.46	6265209.61	Pringle Avenue	Frenchs Forest	JP	0.000	0.000	1.350	0.000	-1.350
120196-0	334758.96	6265244.96	Glen Street	Belrose	DGGP	0.000	0.000	0.850	0.000	-0.850
120194-0	334759.94	6265207.63	Pringle Avenue	Frenchs Forest	DGGP	3.840	1.000	1.170	0.000	-1.170
120173-0	334778.09	6265261.39	Glen Street	Belrose	DGGP	2.000	2.000	0.000	0.000	0.000
120172-0	334825.66	6265272.13	Glen Street	Belrose	SGGP	0.000	0.000	0.900	0.000	153.170
120171-0	334832.93	6265284.77	Glen Street	Belrose	DGGP	2.800	1.000	1.000	165.120	164.120

NODE NUMBER	EASTING	NORTHING	STREET	SUBURB	PIT_TYPE	LINTEL	X_FALL	PIT_DEPTH	GRATE_RL	INVERT
120170-0	334839.68	6265288.29	Glen Street	Belrose	DGGP	2.800	1.000	0.910	165.204	164.294
120169-0	334849.88	6265288.10	Glen Street	Belrose	DGGP	2.000	2.000	0.720	0.000	-0.720
120193-0	334771.40	6265203.10	Pringle Avenue	Frenchs Forest	LBOX	1.820	0.000	1.030	0.000	-1.030
120168-1	334805.43	6265197.06	Evelyn Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120168-0	334834.19	6265212.89	Evelyn Place	Belrose	DGGP	1.900	1.000	0.900	0.000	-0.900
120167-0	334850.79	6265221.79	Evelyn Place	Belrose	DGGP	1.800	1.000	0.770	0.000	-0.770
120164-0	335022.64	6265541.22	Forest Glen Crescent	Belrose	DGGP	2.000	6.000	0.890	0.000	-0.890
120165-0	335030.01	6265522.46	Forest Glen Crescent	Belrose	DGGP	2.000	3.000	0.880	170.215	169.335
120166-0	335044.08	6265430.80	Forest Glen Crescent	Belrose	DGGP	2.000	0.000	0.730	172.003	171.273
120186-0	334705.59	6265521.93	Kapyong Street	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120189-1	334689.29	6265478.76	Kapyong Street	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120182-0	334807.50	6265525.81	Kapyong Street	Belrose	JP	0.000	0.000	0.850	0.000	-0.850
120181-0	334823.55	6265524.02	Kapyong Street	Belrose	JP	0.000	0.000	0.850	0.000	-0.850
120180-0	334826.51	6265513.10	Kapyong Street	Belrose	JP	0.000	0.000	0.700	0.000	-0.700
120183-0	334791.66	6265523.86	Kapyong Street	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120184-0	334787.08	6265522.01	Kapyong Street	Belrose	DGGP	1.550	3.000	0.730	159.649	158.919
120185-0	334709.87	6265510.03	Kapyong Street	Belrose	DGGP	1.550	1.000	0.960	157.976	157.016
120187-0	334702.33	6265515.52	Kapyong Street	Belrose	DGGP	1.550	0.000	1.020	0.000	-1.020
120188-0	334691.17	6265507.18	Kapyong Street	Belrose	DGGP	1.550	0.000	0.740	157.824	157.084
120189-0	334672.79	6265462.58	Kapyong Street	Belrose	DGGP	1.560	2.000	0.530	0.000	134.370
120190-0	334692.74	6265421.35	Kapyong Street	Belrose	DGGP	1.540	2.000	0.690	0.000	-0.690
120191-0	334704.85	6265416.57	Hawea Place	Belrose	DGGP	2.000	1.000	0.740	161.944	161.204
120192-0	334707.65	6265410.33	Hawea Place	Belrose	DGGP	2.000	0.000	0.770	162.028	161.258
120179-0	334855.58	6265493.54	Kapyong Street	Belrose	LBOX	1.740	0.000	1.050	0.000	-1.050
120897-1	334811.92	6266799.47	Kulalye Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120268-1	334218.91	6265903.88	Winani Close	Belrose	HEADWALL	0.000	0.000	0.860	0.000	-0.860
120304-0	334085.73	6265297.26	Glenrose Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000
120268-2	334137.57	6265939.00	Winani Close	Belrose	CREEK	0.000	0.000	0.000	0.000	0.000
120236-0	335138.08	6265551.32	Forest Way	Belrose	DGGP	3.280	3.000	0.710	0.000	-0.710
120095-2	334727.35	6265784.62	Willow Tree Crescent	Belrose	CREEK	0.000	0.000	0.000	0.000	0.000
BBC001-0	335109.97	6265857.68	Andove Street			0.000	0.000	0.000	0.000	0.000
ADV001-0	334940.93	6265810.88	Andove Street			0.000	0.000	0.000	0.000	0.000
120162.1	334944.53	6265508.01	Forest Glen Crescent			0.000	0.000	0.000	0.000	0.000
120062-1	334994.09	6266057.14	Hews Parade			0.000	0.000	0.000	0.000	0.000
	334347.53	6266457.63	Windrush Avenue			0.000	0.000	0.000	0.000	0.000
120789-0	333959.61	6266209.90	Calool Crescent	Belrose	HEADWALL	0.000	0.000	0.000	0.000	0.000
120712-0	334113.11	6265179.18	Blackbutts Road			0.000	0.000	0.830	0.000	-0.830
120711-0	334121.32	6265169.03	Blackbutts Road			0.000	0.000	0.940	0.000	-0.940
120710-0	334131.24	6265151.63	Blackbutts Road			0.000	0.000	1.840	0.000	-1.840
120713-0	334120.64	6265144.95	Blackbutts Road			0.000	0.000	0.000	0.000	0.000
120714-0	334102.61	6265129.69	Blackbutts Road			0.000	0.000	0.720	0.000	-0.720
120715-0	334141.53	6265131.60	Blackbutts Road			0.000	0.000	0.760	0.000	-0.760

NODE NUMBER	EASTING	NORTHING	STREET	SUBURB	PIT_TYPE	LINTEL	X_FALL	PIT_DEPTH	GRATE_RL	INVERT
120716-0	334161.27	6265126.67	Blackbutts Road			0.000	0.000	1.000	159.882	158.882
120718-0	334236.25	6265092.75	Blackbutts Road			0.000	0.000	0.000	0.000	0.000
120717-0	334174.64	6265113.82	Blackbutts Road			0.000	0.000	0.880	160.276	159.396
GSC004-0	334240.64	6265335.50	Glenrose Place			0.000	0.000	0.000	0.000	0.000
GSC005-0	334250.24	6265328.75	Glenrose Place			0.000	0.000	0.000	0.000	0.000
GSC001-0	334243.95	6265405.19	Glenrose Place			0.000	0.000	0.000	0.000	0.000
GSC003-0	334182.79	6265367.45	Glenrose Place			0.000	0.000	0.000	0.000	0.000
GSC002-0	334219.53	6265393.82	Glenrose Place			0.000	0.000	0.000	0.000	0.000
	334525.84	6266128.13	Pringle Avenue			0.000	0.000	0.000	0.000	0.000
120031-2	334522.00	6266123.68	Pringle Avenue			0.000	0.000	0.000	0.000	0.000
120012-1	334334.64	6266090.51	Trentbridge Road			0.000	0.000	0.000	0.000	0.000
120015-1	334367.82	6266087.64	Trentbridge Road			0.000	0.000	0.000	0.000	0.000
120975-0	334662.96	6266302.17	Pringle Avenue			0.000	0.000	0.000	143.674	0.000
120230-0	335120.98	6265579.40	Forest Way			0.000	0.000	0.000	171.418	0.000
120934-1	334966.83	6266693.78	Neridah Avenue			0.000	0.000	0.000	0.000	0.000
120300-1	334093.05	6265282.76	Ashworth Avenue			0.000	0.000	0.000	0.000	0.000
KIAH01-0	334403.11	6265596.64	Kiah Place			0.000	0.000	0.000	0.000	0.000
120825-A	334907.24	6266509.02	Lyndale Place			0.000	0.000	0.000	0.000	0.000
120825-B	334895.74	6266495.73	Lyndale Place			0.000	0.000	0.000	152.320	0.000
BBC002-0	335049.92	6265863.52	Andove Street			0.000	0.000	0.000	0.000	0.000
LYN001-0	334959.25	6266488.05	Lyndale Place	Belrose		2.000	0.000	0.000	0.000	-0.950
LYN009-0	334890.78	6266485.36	Lyndale Place	Belrose		2.000	0.000	0.000	0.000	-0.770
LYN006-0	334892.13	6266490.18	Lyndale Place	Belrose		2.000	0.000	0.000	0.000	0.750
LYN004-0	334917.63	6266494.61	Lyndale Place	Belrose		2.000	0.000	0.000	0.000	-2.100
LYN003-0	334931.60	6266494.16	Lyndale Place	Belrose		2.000	0.000	0.000	0.000	-2.530
LYN005-0	334916.34	6266489.62	Lyndale Place	Belrose		2.500	0.000	0.000	0.000	-2.200
LYN002-0	334931.34	6266489.08	Lyndale Place	Belrose		2.000	0.000	0.000	0.000	-2.570
LYN007-0	334895.52	6266494.27	Lyndale Place	Belrose		0.000	0.000	0.000	0.000	0.000
LYN011-0	334894.71	6266481.29	Lyndale Place	Belrose		0.000	0.000	0.000	0.000	0.000
LYN008-0	334894.84	6266489.59	Lyndale Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000
LYN010-0	334894.84	6266484.74	Lyndale Place	Belrose	JP	0.000	0.000	0.000	0.000	0.000

The tables on the following 10 pages contain Warringah Council's 1994 stormwater pipe asset data that were used to create the hydraulic model.

ID	U_EASTING	U_NORTHING	D_EASTING	D_NORTHING	LINE_NUMBE	FROM_PIT	TO_PIT	PIPE_SHAPE	TYPE_NO	PIPE_DIAMETER	DIAMETER	LENGTH	US_INVERT	DS_INVERT	BOX_WIDTH	BOX_TYPE	BOX_HEIGHT	CHANNEL_BA	CHANNEL	STREAM_BAS	STREAM_HEI	KG_LENGTH	SIDE_SLOPE
938	334890.72	6266954.50	334905.42	6266929.12	103681	120938-0	120939-0	Circular	1	R375	0.375	26.300	170.560	169.830	0.000		0.000	0.000	0.000	0.000	0.000		0.000
940	334910.24	6266940.67	334905.42	6266929.12	114031	120940-0	120939-0	Circular	1	R375	0.375	6.600	170.700	169.830	0.000		0.000	0.000	0.000	0.000	0.000		0.000
937	334885.50	6266940.18	334905.42	6266929.12	103680	120937-0	120939-0	Circular	1	R375	0.375	20.000	170.200	169.830	0.000		0.000	0.000	0.000	0.000	0.000		0.000
936	334849.61	6266923.45	334885.50	6266940.18	103679	120936-0	120937-0	Circular	1	R375	0.375	36.500	171.240	170.200	0.000		0.000	0.000	0.000	0.000	0.000		0.000
939	334905.42	6266929.12	334939.43	6266877.51	103682	120939-0	120941-0	Circular	1	R450	0.450	62.000	169.830	167.780	0.000		0.000	0.000	0.000	0.000	0.000		0.000
942	334945.15	6266890.01	334939.43	6266877.51	103684	120942-0	120941-0	Circular	1	R375	0.375	6.600	167.960	167.780	0.000		0.000	0.000	0.000	0.000	0.000		0.000
941	334939.43	6266877.51	334973.84	6266828.21	103683	120941-0	120943-0	Circular	1	R450	0.450	51.600	167.770	165.950	0.000		0.000	0.000	0.000	0.000	0.000		0.000
944	334980.07	6266837.97	334973.84	6266828.21	103686	120944-0	120943-0	Circular	1	R375	0.375	6.600	166.230	166.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
943	334973.84	6266828.21	334980.04	6266816.42	103685	120943-0	120945-0	Circular	1	R525	0.525	5.300	165.930	165.680	0.000		0.000	0.000	0.000	0.000	0.000		0.000
945	334980.04	6266816.42	334994.25	6266792.86	103687	120945-0	120946-0	Circular	1	R525	0.525	26.300	165.680	164.300	0.000		0.000	0.000	0.000	0.000	0.000		0.000
947	334997.63	6266807.14	334994.25	6266792.86	114032	120947-0	120946-0	Circular	1	R750	0.750	9.400	164.630	164.240	0.000		0.000	0.000	0.000	0.000	0.000		0.000
965	335018.99	6266840.55	334997.63	6266807.14	103703	120965-0	120947-0	Circular	1	R750	0.750	50.000	165.820	164.560	0.000		0.000	0.000	0.000	0.000	0.000		0.000
966	335027.32	6266836.13	335018.99	6266840.55	103704	120966-0	120965-0	Circular	1	R750	0.750	12.100	166.230	165.840	0.000		0.000	0.000	0.000	0.000	0.000		0.000
964	335027.20	6266842.54	335027.32	6266836.13	114033	120964-0	120966-0	Circular	1	R600	0.600	5.000	167.750	166.510	0.000		0.000	0.000	0.000	0.000	0.000		0.000
946	334994.25	6266792.86	335008.49	6266767.01	103688	120946-0	120950-0	Circular	1	R900	0.900	46.500	163.980	163.610	0.000		0.000	0.000	0.000	0.000	0.000		0.000
950	335008.49	6266767.01	335022.28	6266741.61	103694	120950-0	120951-0	Circular	1	R900	0.900	27.000	162.470	162.370	0.000		0.000	0.000	0.000	0.000	0.000		0.000
948	334993.13	6266779.08	334996.99	6266769.07	103692	120948-0	120949-0	Circular	1	R375	0.375	6.200	163.140	163.070	0.000		0.000	0.000	0.000	0.000	0.000		0.000
949	334996.99	6266769.07	335008.49	6266767.01	103693	120949-0	120950-0	Circular	1	R375	0.375	13.100	163.040	162.740	0.000		0.000	0.000	0.000	0.000	0.000		0.000
951	335022.28	6266741.61	335029.99	6266722.50	103695	120951-0	120953-0	Circular	1	R900	0.900	16.300	162.370	161.700	0.000		0.000	0.000	0.000	0.000	0.000		0.000
953	335029.99	6266722.50	335019.54	6266717.71	103697	120953-0	120957-0	Circular	1	R900	0.900	8.000	161.640	161.590	0.000		0.000	0.000	0.000	0.000	0.000		0.000
957	335019.54	6266717.71	334975.50	6266695.31	114045	120957-0	120957-1	Circular	1	R900	0.900	67.000	161.590	161.130	0.000		0.000	0.000	0.000	0.000	0.000		0.000
957-1	334975.50	6266695.31	334968.82	6266685.56	113639	120957-1	120958-0	Circular	1	R900	0.900	11.900	159.890	159.590	0.000		0.000	0.000	0.000	0.000	0.000		0.000
934	334916.20	6266728.08	334966.83	6266693.78	103677	120934-0	120934-1	Circular	1	R600	0.600	65.000	162.040	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
958	334968.82	6266685.56	334983.12	6266657.42	103689	120958-0	120961-0	Circular	1	R1200	1.200	70.000	158.960	158.050	0.000		0.000	0.000	0.000	0.000	0.000		0.000
961	334983.12	6266657.42	334990.75	6266641.97	103690	120961-0	120962-0	Circular	1	R1200	1.200	15.000	157.950	157.420	0.000		0.000	0.000	0.000	0.000	0.000		0.000
962-0B	334990.75	6266641.97	334988.38	6266598.39	115007	120962-0	120963-0	Circular	1	R825	0.825	20.000	157.410	155.280	0.000		0.000	0.000	0.000	0.000	0.000		0.000
962-0A	334990.75	6266641.97	334988.38	6266598.39	103691	120962-0	120963-0	Circular	1	R825	0.825	20.000	157.410	155.280	0.000		0.000	0.000	0.000	0.000	0.000		0.000
933	334905.01	6266737.49	334916.20	6266728.08	103676	120933-0	120934-0	Circular	1	R600	0.600	6.200	162.210	162.040	0.000		0.000	0.000	0.000	0.000	0.000		0.000
931	334911.14	6266752.28	334905.01	6266737.49	114030	120931-0	120933-0	Circular	1	R600	0.600	20.000	162.640	162.340	0.000		0.000	0.000	0.000	0.000	0.000		0.000
932	334918.21	6266766.18	334911.14	6266752.28	103675	120932-0	120931-0	Circular	1	R375	0.375	6.400	163.050	162.760	0.000		0.000	0.000	0.000	0.000	0.000		0.000
929	334899.11	6266781.85	334911.14	6266752.28	103673	120929-0	120931-0	Circular	1	R600	0.600	47.000	165.670	162.700	0.000		0.000	0.000	0.000	0.000	0.000		0.000
928	334894.79	6266791.85	334899.11	6266781.85	103672	120928-0	120929-0	Circular	1	R600	0.600	2.000	165.840	165.780	0.000		0.000	0.000	0.000	0.000	0.000		0.000
930	334899.56	6266806.15	334894.79	6266791.85	103674	120930-0	120928-0	Circular	1	R375	0.375	9.900	166.260	165.950	0.000		0.000	0.000	0.000	0.000	0.000		0.000
924	334695.69	6266942.01	334707.59	6266895.48	103668	120924-0	120920-0	Circular	1	R375	0.375	50.000	178.750	177.350	0.000		0.000	0.000	0.000	0.000	0.000		0.000
921	334687.16	6266885.46	334707.59	6266895.48	103666	120921-0	120920-0	Circular	1	R375	0.375	16.600	177.850	177.370	0.000		0.000	0.000	0.000	0.000	0.000		0.000
923	334661.72	6266873.51	334667.90	6266886.00	114029	120923-0	120922-0	Circular	1	R375	0.375	13.600	178.610	178.420	0.000		0.000	0.000	0.000	0.000	0.000		0.000
920	334707.59	6266895.48	334732.36	6266894.58	103665	120920-0	120919-0	Circular	1	R450	0.450	21.400	177.300	176.050	0.000		0.000	0.000	0.000	0.000	0.000		0.000
919	334732.36	6266894.58	334750.35	6266888.98	103664	120919-0	120917-0	Circular	1	R450	0.450	26.300	176.090	174.620	0.000		0.000	0.000	0.000	0.000	0.000		0.000
918	334747.34	6266878.38	334750.35	6266888.98	103663	120918-0	120917-0	Circular	1	R375	0.375	6.400	174.740	174.680	0.000		0.000	0.000	0.000	0.000	0.000		0.000
917	334750.35	6266888.98	334770.09	6266887.52	103662	120917-0	120916-0	Circular	1	R450	0.450	16.400	174.570	173.790	0.000		0.000	0.000	0.000	0.000	0.000		0.000
916	334770.09	6266887.52	334797.80	6266900.44	103661	120916-0	120914-0	Circular	1	R450	0.450	27.000	173.770	172.560	0.000		0.000	0.000	0.000	0.000	0.000		0.000
914	334797.80	6266900.44	334817.74	6266888.91	103659	120914-0	120915-0	Circular	1	R525	0.525	25.000	172.350	171.690	0.000		0.000	0.000	0.000	0.000	0.000		0.000
912	334802.15	6266912.44	334817.74	6266888.91	103657	120912-0	120915-0	Circular	1	R375	0.375	35.000	173.150	171.820	0.000		0.000	0.000	0.000	0.000	0.000		0.000
913	334808.32	6266925.39	334802.15	6266912.44	103658	120913-0	120912-0	Circular	1	R375	0.375	8.000	173.420	173.100	0.000		0.000	0.000	0.000	0.000	0.000		0.000
911	334779.22	6266960.13	334802.15	6266912.44	103656	120911-0	120912-0	Circular	1	R375	0.375	49.900	174.660	173.110	0.000		0.000	0.000	0.000	0.000	0.000		0.000
915	334817.74	6266888.91	334867.94	6266829.37	103660	120915-0	120926-0	Circular	1	R600	0.600	75.000	171.620	168.560	0.000		0.000	0.000	0.000	0.000	0.000		0.000
925	334836.89	6266846.64	334867.94	6266829.37	103669	120925-0	120926-0	Circular	1	R375	0.375	23.800	169.620	168.790	0.000		0.000	0.000	0.000	0.000	0.000		0.000
927	334866.20	6266848.13	334867.94	6266829.37	103671	120927-0	120926-0	Circular	1	R375	0.375	9.300	169.200	168.710	0.000		0.000	0.000	0.000	0.000	0.000		0.000
926	334867.94	6266829.37	334884.87	6266807.24	103670	120926-0	120926-1	Circular	1	R600	0.600	29.600	168.540	167.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
926-2	334884.87	6266807.24	334880.88	6266800.28	103924	120926-1	120926-2	Rectangular	3	BC45120	0.000	8.000	167.000	166.720	1.200	BC45120	0.450	0.000	0.000	0.000	0.000		0.000
926-3	334880.88	6266800.28	334867.89	6266784.45	103925	120926-2	120926-3	Circular	1	R750	0.750	26.000	166.720	166.540	0.000		0.000	0.000	0.000	0.000	0.000		0.000
893-2A	334867.89	6266784.45	334830.67	6266765.85	103926	120926-3	120893-2	Circular	1	R750	0.750	41.000	166.540	166.100	0.000		0.000	0.000	0.000	0.000	0.000		0.000
893-1B	334828.30	6266769.92	334830.67	6266765.85	115006	120893-1	120893-2	Circular	1	R450	0.450	3.500	169.430	166.400	0.000		0.000	0.000	0.000	0.000	0.000		0.000
893-1A	334828.30	6266769.92	334830.67	6266765.85	103644	120893-1	120893-2	Circular	1	R450	0.450	3.500	169.430	166.400	0.000		0.000	0.000	0.000	0.000	0.000		0.000
893-A	334823.11	6266777.17	334828.30	6266769.92	103631	120893-0	120893-1	Circular	1	R450	0.450	3.000	169.440	169.430	0.000		0.000	0.000	0.000	0.000	0.000		0.000
893-B	334823.11	6266777.17	334828.30	6266769.92	115005	120893-0	120893-1	Circular	1	R450	0.450	3.000	169.440	169.430	0.000		0.000	0.000	0.000	0.000	0.000		0.000
893-2	334830.67	6266765.85	334827.59	6266758.92	103645	120893-2	120893-3	Circular	1	R750	0.750	5.000	166.100	165.750	0.000		0.000	0.000	0.000	0.000	0.000		0.000
892	334788.32	6266750.82	334828.30	6266769.92	103630	120892-0	120893-1	Circular	1	R450	0.450	44.500	170.570	169.520	0.000		0.000	0.000	0.000	0.000	0.000		0.000
891	334761.84	6266745.72	334788.32	6266750.82	103629	120891-0	120892-0	Circular	1	R375	0.375	26.800	171.740	170.630	0.000		0.000	0.000	0.000	0.000	0.000		0.000
890	334724.60	6266727.58	334761.84	6266745.72	103628	120890-0	120891-0	Circular	1	R375	0.375	34.100	172.300	171.730	0.000		0.000	0.000	0.000	0.000	0.000		0.000
889	334686.45	6266709.43	334724.60	6266727.58	103627	120889-0	120890-0	Circular	1	R375	0.375	63.500	172.950	172.360	0.000		0.000	0.000	0.000	0.000	0.000		0.000
894	334835.53	6266751.28	334879.60	6266724.62	103632	120894-0	120935-0	Circular	1	R450	0.450	75.000	-0.800	164.780	0.000		0.000	0.000	0.000	0.000	0.000		0.000
935	334879.60	6266724.62	334905.01	6266737.49	103678	120935-0	120933-0	Circular	1	R600	0.600	31.000	164.310	163.130	0.000		0.000	0.000	0.000	0.000	0.000		0.000
893-3	334827.59	6266758.92	334861.00	6266690.34	103646	120893-3	120893-4	Circular	1	R750	0.750	78.000	165.750	165.390	0.000		0.000	0.000	0.000	0.000	0.000		0.000
893-4	334861.00	6266690.34	334893.97	6266621.31	103647	120893-4	120893-5	Circular	1	R750	0.750	78.000	165.390	162.540	0.000		0.000	0.000	0.000	0.000	0.000		0.000
954	335033.48	6266707.90	335019.54	6266717.71	103698	120954-0	120957-0	Circular	1	R375	0.375	20.000	161.700	161.590	0.000		0.000	0.000	0.000	0.000	0.000		0.000
955	335041.30	6266682.84	335033.48	6266707.90	103699	120955-0	120954-0	Circular	1	R375	0.375	22.600	161.920	161.770	0.000		0.000	0.000	0.000	0.000	0.000		0.000
956	335053.27	6266679.86	335041.30	6266682.84	103700	120956-0	120955-0	Circular	1	R375	0.375	6.900	161.970	161.920	0.000		0.000	0.000	0.000	0.000	0.000		0.000
959	335058.62	6266663.93	335047.68	6266660.96	103701	120959-0	120960-0	Circular	1	R375	0.375	6.100	161.500	161.470	0.000		0.000	0.000	0.000	0.000	0.000		0.000
960	335047.68	6266660.96	334983.12	6266657.42	103702	120960-0	120961-0	Circular	1	R375	0.375	60.000	161.440	158.830	0.000		0.000	0.000	0.000	0.000	0.000		0.000
893-5	334893.97	6266621.31	334925.00	6266557.73	103648	120893-5	120893-6	Circular	1	R750	0.750	73.500	162.540	154.910	0.000		0.000	0.000	0.000	0.000	0.000		0.000
893-6	334925.00	6266557.73	334930.76	6266544.09	103649	120893-6	120893-7	Circular	1	R750	0.750	11.500	154.510	153.910	0.000		0.000	0.000	0.000	0.000	0.000		0.000
893-7C	334930.76	6266544.09	334941.90	6266536.97	115197	120893-7	120825-0	Circular	1	R525	0.525	13.000	153.880	153.330	0.000		0.000	0.000	0.000	0.000	0.000		0.000
893-7B	334930.76	6266544.09	334941.90	6266536.97	114220	120893-7	120825-0	Circular	1	R525	0.525	13.000	153.880	153.330	0.000		0.000	0.000	0.000	0.000	0.000		0.000
893-7A	334930.76	6266544.09	334941.90	6266536.97	115196	120893-7	120825-0	Circular	1	R525	0.525	13.000	153.880	153.330	0.000		0.000	0.000	0.000	0.000	0.000		0.000
824-2	334942.65	6266553.52	334941.90	6266536.97	115002	120824-0	120825-0	Circular	1	R1050	1.050	13.000	154.030	153.710	0.000		0.000	0.000	0.000	0.000	0.000		0.000
824-1	334942.65	6266553.52	334941.90	6266536.97	103567	120824-0	120825-0	Circular	1	R1050	1.050	13.000	154.030	153.710	0.000		0.000	0.000	0.000	0.000	0.000		0.000
826-2	334947.47	6266557.25	334942.65	6266553.52	115004	120826-0	120824-0	Circular	1	R900	0.900	6.000	154.230	154.030	0.000		0.000	0.000	0.000	0.000	0.000		0.000
826-1	334947.47	6266557.25	334942.65	6266553.52	103569	120826-0	120824-0	Circular	1	R900	0.900	6.000	154.230	154.030	0.000		0.000	0.000	0.000	0.000	0.000		0.000
963-1	334953.19	6266569.74	334947.47	6266557.25	115157	120963-1	120826-0	Circular	1	R900	0.900	17.500	154.400	154.230	0.000		0.000	0.000	0.000	0.000	0.000		0.000
963-0B	334988.38	6266598.39	334953.19	6266569.74	103905	120963-0	120963-1	Circular	1	R900	0.900	40.000	155.260	154.400	0.000		0.000	0.000	0.000	0.000	0.000		0.000
963-0A	334988.38	6266598.39	334953.19	6266569.74	115009	120963-0	120963-1	Circular	1	R900	0.900	40.000	155.260	154.400	0.000		0.000	0.000	0.000	0.000	0.000		0.000
823	334917.32	6266552.08	334930.76	6266544.09	114022	120823-0	120893-7	Circular	1	R675	0.675	13.000	154.710	153.950	0.000		0.000	0.000	0.000	0.000	0.000		0.000
825-X	334941.90	6266536.97	334937.92	6266529.56	103568	120825-0	120825-1	Circular	1	R1050	1.050	5.000	153.710	153.330	0.000		0.000	0.000	0.000	0.000	0.000		0.000

ID	U_EASTING	U_NORTHING	D_EASTING	D_NORTHING	LINE_NUMBE	FROM_PIT	TO_PIT	PIPE_SHAPE	TYPE_NO	PIPE_DIAMETER	DIAMETER	LENGTH	US_INVERT	DS_INVERT	BOX_WIDTH	BOX_TYPE	BOX_HEIGHT	CHANNEL_BA	CHANNEL	STREAM_BAS	STREAM_HEI	KG_LENGTH	SIDE_SLOPE
825-Y	334941.90	6266536.97	334937.92	6266529.56	115003	120825-0	120825-1	Circular	1	R1050	1.050	5.000	153.710	153.330	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1001	335232.02	6266242.47	335216.60	6266318.14	101852	121001-0	121003-0	Circular	1	R375	0.375	85.000	168.560	167.060	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1002	335198.42	6266310.00	335216.60	6266318.14	101853	121002-0	121003-0	Circular	1	R375	0.375	25.000	167.300	167.060	0.000		0.000	0.000	0.000	0.000	0.000		0.000
nnnn	335216.60	6266318.14	335199.42	6266400.32	101854	121003-0	121005-0	Circular	1	R375	0.375	80.000	167.060	165.640	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1004	335181.25	6266391.72	335199.42	6266400.32	101855	121004-0	121005-0	Circular	1	R375	0.375	25.000	166.020	165.640	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1005	335199.42	6266400.32	335182.47	6266470.13	101856	121005-0	121007-0	Circular	1	R450	0.450	80.000	165.640	164.370	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1006	335163.80	6266463.81	335182.47	6266470.13	101857	121006-0	121007-0	Circular	1	R375	0.375	25.000	164.720	164.370	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1007	335182.47	6266470.13	335168.36	6266536.32	101858	121007-0	121008-0	Circular	1	R450	0.450	64.000	164.370	163.560	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1008	335168.36	6266536.32	335165.86	6266547.28	101859	121008-0	121014-0	Circular	1	R450	0.450	10.000	163.560	163.360	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1014	335165.86	6266547.28	335143.58	6266537.67	101864	121014-0	121017-0	Circular	1	R525	0.525	8.700	163.360	163.710	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1015	335143.64	6266558.30	335143.58	6266537.67	101865	121015-0	121017-0	Circular	1	R375	0.375	1.000	163.770	163.650	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1016	335151.17	6266524.53	335143.58	6266537.67	101866	121016-0	121017-0	Circular	1	R375	0.375	13.000	163.280	163.630	0.000		0.000	0.000	0.000	0.000	0.000		0.000
829	335002.91	6266534.95	334941.90	6266536.97	103571	120829-0	120825-0	Circular	1	R375	0.375	69.300	157.920	153.770	0.000		0.000	0.000	0.000	0.000	0.000		0.000
828	335074.92	6266532.68	335002.91	6266534.95	103570	120828-0	120829-0	Circular	1	R375	0.375	56.200	159.990	157.920	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1013	335163.80	6266558.69	335165.86	6266547.28	101863	121013-0	121014-0	Circular	1	R375	0.375	10.000	163.600	163.360	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1012	335149.29	6266621.22	335163.80	6266558.69	113904	121012-0	121013-0	Circular	1	R375	0.375	60.000	164.430	163.600	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1011	335128.98	6266629.07	335149.29	6266621.22	101862	121011-0	121012-0	Circular	1	R375	0.375	25.300	164.650	164.430	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1010	335138.12	6266630.17	335128.98	6266629.07	101861	121010-0	121011-0	Circular	1	R375	0.375	12.200	166.750	166.540	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1009	335120.89	6266667.88	335128.98	6266629.07	101860	121009-0	121011-0	Circular	1	R375	0.375	59.900	166.450	164.860	0.000		0.000	0.000	0.000	0.000	0.000		0.000
896	334726.95	6266819.31	334750.40	6266815.64	103634	120896-0	120897-0	Circular	1	R375	0.375	19.400	174.350	173.780	0.000		0.000	0.000	0.000	0.000	0.000		0.000
895	334694.24	6266804.01	334726.95	6266819.31	103633	120895-0	120896-0	Circular	1	R375	0.375	47.200	176.010	174.370	0.000		0.000	0.000	0.000	0.000	0.000		0.000
867-3	334515.06	6266305.02	334519.26	6266277.59	113630	120867-3	120002-0	Circular	1	R900	0.900	28.000	0.000	151.280	0.000		0.000	0.000	0.000	0.000	0.000		0.000
867-2	334498.88	6266311.58	334515.06	6266305.02	113629	120867-2	120867-3	Circular	1	R900	0.900	15.400	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
867-1	334499.36	6266334.05	334498.88	6266311.58	103643	120867-1	120867-2	Circular	1	R900	0.900	23.200	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
867-0	334482.61	6266347.48	334499.36	6266334.05	103607	120867-0	120867-1	Circular	1	R900	0.900	24.400	156.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
866	334477.34	6266358.83	334482.61	6266347.48	103606	120866-0	120867-0	Circular	1	R375	0.375	6.200	157.400	156.760	0.000		0.000	0.000	0.000	0.000	0.000		0.000
865	334482.96	6266376.36	334482.61	6266347.48	103605	120865-0	120867-0	Circular	1	R825	0.825	29.600	157.400	156.360	0.000		0.000	0.000	0.000	0.000	0.000		0.000
868	334419.52	6266361.83	334482.61	6266347.48	103608	120868-0	120867-0	Circular	1	R375	0.375	42.000	157.800	156.530	0.000		0.000	0.000	0.000	0.000	0.000		0.000
869?	334501.42	6266393.68	334482.96	6266376.36	114025	120869-0	120865-0	Circular	1	R375	0.375	17.000	159.230	158.190	0.000		0.000	0.000	0.000	0.000	0.000		0.000
863	334528.62	6266385.96	334504.37	6266383.20	103603	120863-0	120864-0	Circular	1	R375	0.375	22.900	159.000	158.720	0.000		0.000	0.000	0.000	0.000	0.000		0.000
864	334504.37	6266383.20	334482.96	6266376.36	103604	120864-0	120865-0	Circular	1	R375	0.375	18.100	158.600	158.130	0.000		0.000	0.000	0.000	0.000	0.000		0.000
817-3	334529.32	6266396.97	334528.62	6266385.96	113642	120817-3	120863-0	Circular	1	R375	0.375	14.900	0.000	159.190	0.000		0.000	0.000	0.000	0.000	0.000		0.000
817-2	334530.62	6266424.50	334529.32	6266396.97	113641	120817-2	120817-3	Circular	1	R375	0.375	25.900	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
817-1	334563.29	6266441.18	334530.62	6266424.50	103639	120817-1	120817-2	Circular	1	R375	0.375	38.900	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
817	334572.37	6266446.39	334563.29	6266441.18	103561	120817-0	120817-1	Circular	1	R375	0.375	50.000	-0.970	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
816	334585.56	6266451.69	334572.37	6266446.39	103560	120816-0	120817-0	Circular	1	R375	0.375	6.400	-0.660	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
875	334465.12	6266469.06	334463.17	6266451.61	103614	120875-0	120876-0	Circular	1	R600	0.600	7.900	161.720	161.190	0.000		0.000	0.000	0.000	0.000	0.000		0.000
876	334463.17	6266451.61	334452.01	6266411.97	103615	120876-0	120871-0	Circular	1	R675	0.675	45.000	161.190	160.190	0.000		0.000	0.000	0.000	0.000	0.000		0.000
871	334452.01	6266411.97	334472.51	6266395.41	103610	120871-0	120870-0	Circular	1	R750	0.750	37.400	159.700	158.770	0.000		0.000	0.000	0.000	0.000	0.000		0.000
870	334472.51	6266395.41	334482.96	6266376.36	103609	120870-0	120865-0	Circular	1	R750	0.750	12.900	158.800	157.760	0.000		0.000	0.000	0.000	0.000	0.000		0.000
975	334655.01	6266297.65	334576.62	6266217.06	103712	120975-0	120976-0	Circular	1	R600	0.600	116.200	142.350	140.340	0.000		0.000	0.000	0.000	0.000	0.000		0.000
974	334687.34	6266332.20	334655.01	6266297.65	103711	120974-0	120975-0	Circular	1	R600	0.600	48.600	147.000	142.430	0.000		0.000	0.000	0.000	0.000	0.000		0.000
858	334712.51	6266357.89	334687.34	6266332.20	103598	120858-0	120974-0	Circular	1	R450	0.450	11.600	148.600	147.110	0.000		0.000	0.000	0.000	0.000	0.000		0.000
857	334702.02	6266355.40	334712.51	6266357.89	114024	120857-0	120858-0	Circular	1	R450	0.450	17.700	148.100	148.600	0.000		0.000	0.000	0.000	0.000	0.000		0.000
854	334693.04	6266392.81	334692.03	6266374.00	103595	120854-0	120855-0	Circular	1	R375	0.375	19.500	155.700	154.300	0.000		0.000	0.000	0.000	0.000	0.000		0.000
853	334681.95	6266397.63	334693.04	6266392.81	103594	120853-0	120854-0	Circular	1	R375	0.375	6.900	156.900	155.950	0.000		0.000	0.000	0.000	0.000	0.000		0.000
862	334679.33	6266366.87	334693.17	6266362.56	103602	120862-0	120856-0	Circular	1	R375	0.375	14.000	153.900	151.710	0.000		0.000	0.000	0.000	0.000	0.000		0.000
860	334663.79	6266365.20	334679.33	6266366.87	103600	120860-0	120862-0	Circular	1	R375	0.375	10.400	155.400	154.210	0.000		0.000	0.000	0.000	0.000	0.000		0.000
861	334657.55	6266355.91	334663.79	6266365.20	103601	120861-0	120860-0	Circular	1	R375	0.375	6.900	156.900	155.460	0.000		0.000	0.000	0.000	0.000	0.000		0.000
859	334638.16	6266362.87	334663.79	6266365.20	103599	120859-0	120860-0	Circular	1	R375	0.375	23.000	157.900	155.460	0.000		0.000	0.000	0.000	0.000	0.000		0.000
973	334748.90	6266395.73	334712.51	6266357.89	103710	120973-0	120858-0	Circular	1	R450	0.450	59.700	152.700	148.600	0.000		0.000	0.000	0.000	0.000	0.000		0.000
972	334767.77	6266415.80	334748.90	6266395.73	103709	120972-0	120973-0	Circular	1	R450	0.450	15.000	152.900	152.700	0.000		0.000	0.000	0.000	0.000	0.000		0.000
970	334775.64	6266435.67	334767.77	6266415.80	103707	120970-0	120972-0	Circular	1	R450	0.450	18.600	153.400	152.920	0.000		0.000	0.000	0.000	0.000	0.000		0.000
971	334757.88	6266453.20	334775.64	6266435.67	103708	120971-0	120970-0	Circular	1	R375	0.375	21.100	154.200	153.590	0.000		0.000	0.000	0.000	0.000	0.000		0.000
969	334787.11	6266434.97	334775.64	6266435.67	103706	120969-0	120970-0	Circular	1	R375	0.375	12.000	153.600	153.570	0.000		0.000	0.000	0.000	0.000	0.000		0.000
968	334834.25	6266485.85	334787.11	6266434.97	103705	120968-0	120969-0	Circular	1	R375	0.375	73.200	154.700	153.630	0.000		0.000	0.000	0.000	0.000	0.000		0.000
851-1	334815.49	6266318.64	334731.05	6266300.03	113698	120851-1	120851-2	Circular	1	R1500	1.500	101.300	144.030	141.850	0.000		0.000	0.000	0.000	0.000	0.000		0.000
851-2	334731.05	6266300.03	334701.66	6266267.62	113640	120851-2	120851-3	Circular	1	R1500	1.500	49.200	141.850	141.460	0.000		0.000	0.000	0.000	0.000	0.000		0.000
851	334851.91	6266355.55	334815.49	6266318.64	103592	120851-0	120851-1	Circular	1	R1500	1.500	56.800	144.650	144.030	0.000		0.000	0.000	0.000	0.000	0.000		0.000
850	334856.26	6266367.55	334851.91	6266355.55	103591	120850-0	120851-0	Circular	1	R1500	1.500	6.300	144.950	144.650	0.000		0.000	0.000	0.000	0.000	0.000		0.000
849	334879.66	6266366.63	334856.26	6266367.55	103590	120849-0	120850-0	Circular	1	R525	0.525	26.000	146.700	145.830	0.000		0.000	0.000	0.000	0.000	0.000		0.000
852	334804.22	6266356.00	334856.26	6266367.55	103593	120852-0	120850-0	Circular	1	R375	0.375	51.100	146.900	145.430	0.000		0.000	0.000	0.000	0.000	0.000		0.000
842-1	334870.12	6266409.07	334856.26	6266367.55	114027	120842-1	120850-0	Circular	1	R1500	1.500	42.100	146.350	144.950	0.000		0.000	0.000	0.000	0.000	0.000		0.000
825-2	334891.10	6266461.74	334870.12	6266409.07	103641	120825-2	120842-1	Circular	1	R1500	1.500	57.000	147.860	146.930	0.000		0.000	0.000	0.000	0.000	0.000		0.000
842	334881.99	6266411.60	334870.12	6266409.07	103583	120842-0	120842-1	Circular	1	R375	0.375	17.100	148.800	147.720	0.000		0.000	0.000	0.000	0.000	0.000		0.000
844	334896.50	6266420.13	334885.03	6266420.37	103585	120844-0	120843-0	Circular	1	R375	0.375	12.300	149.100	148.590	0.000		0.000	0.000	0.000	0.000	0.000		0.000
843	334885.03	6266420.37	334881.99	6266411.60	103584	120843-0	120842-0	Circular	1	R375	0.375	14.300	148.600	147.720	0.000		0.000	0.000	0.000	0.000	0.000		0.000
841	334911.85	6266408.05	334881.99	6266411.60	114023	120841-0	120842-0	Circular	1	R375	0.375	31.400	149.600	148.080	0.000		0.000	0.000	0.000	0.000	0.000		0.000
840	334944.87	6266407.78	334911.85	6266408.05	103582	120840-0	120841-0	Circular	1	R375	0.375	22.100	151.200	149.600	0.000		0.000	0.000	0.000	0.000	0.000		0.000
845	334936.43	6266393.40	334911.85	6266408.05	103586	120845-0	120841-0	Circular	1	R375	0.375	16.400	151.000	149.620	0.000		0.000	0.000	0.000	0.000	0.000		0.000
848	334957.65	6266363.10	334879.66	6266366.63	103589	120848-0	120849-0	Circular	1	R525	0.525	70.200	153.600	146.860	0.000		0.000	0.000	0.000	0.000	0.000		0.000
847	334955.27	6266343.80	334957.65	6266363.10	103588	120847-0	120848-0	Circular	1	R375	0.375	14.000	154.700	153.720	0.000		0.000	0.000	0.000	0.000	0.000		0.000
846	334982.74	6266345.72	334955.27	6266343.80	103587	120846-0	120847-0	Circular	1	R375	0.375	13.300	155.200	154.840	0.000		0.000	0.000	0.000	0.000	0.000		0.000
836	335022.31	6266338.23	334957.65	6266363.10	103578	120836-0	120848-0	Circular	1	R525	0.525	69.400	156.400	153.620	0.000		0.000	0.000	0.000	0.000	0.000		0.000
835	335026.70	6266347.94	335022.31	6266338.23	103577	120835-0	120836-0	Circular	1	R450	0.450	6.400	156.700	156.620	0.000		0.000	0.000	0.000	0.000	0.000		0.000
837	335062.02	6266346.79	335026.70	6266347.94	103579	120837-0	120835-0	Circular	1	R375	0.375	41.900	161.600	156.800	0.000		0.000	0.000	0.000	0.000	0.000		0.000
839	335113.88	6266343.67	335062.02	6266346.79	103581	120839-0	120837-0	Circular	1	R375	0.375	38.700	163.800	161.910	0.000		0.000	0.000	0.000	0.000	0.000		0.000
838	335125.07	6266357.18	335113.88	6266343.67	103580	120838-0	120839-0	Circular	1	R375	0.375	22.000	165.000	164.280	0.000		0.000	0.000	0.000	0.000	0.000		0.000
834	335034.53	6266369.64	335026.70	6266347.94	103576	120834-0	120835-0	Circular	1	R450	0.450	13.500	158.400	156.900	0.000		0.000	0.000	0.000	0.000	0.000		0.000
833	335044.62	6266369.37	335034.53	6266369.64	103575	120833-0	120834-0	Circular	1	R375	0.375	6.400	158.700	158.530	0.000		0.000	0.000	0.000	0.000	0.000		0.000
832	335052.18	6266428.65	335034.53	6266369.64	103574	120832-0	120834-0	Circular	1	R375	0.375	75.700	159.500	158.740	0.000		0.000	0.000	0.000	0.000	0.000		0.000
831	335064.57	6266451.35	335052.18	6266428.65	103573	120831-0	120832-0	Circular	1	R375	0.375	18.800	160.000	159.520	0.000		0.000	0.000	0.000	0.000	0.000		0.000
830	335054.79	6266459.87	335064.57	6266451.35	103572	120830-0	120831-0	Circular	1	R375	0.375	9.800	160.180	160.130	0.000		0.000	0.000	0.000	0.000	0.000		0.000
822	334864.57	6266553.81	334917.32	6266552.08	103566	120822-0	120823-0	Circular	1	R675	0.675	76.500	156.580	154.810	0.000		0.000	0.000	0.000	0.000	0.000		0.000

ID	U_EASTING	U_NORTHING	D_EASTING	D_NORTHING	LINE_NUMBE	FROM_PIT	TO_PIT	PIPE_SHAPE	TYPE_NO	PIPE_DIAMETER	DIAMETER	LENGTH	US_INVERT	DS_INVERT	BOX_WIDTH	BOX_TYPE	BOX_HEIGHT	CHANNEL_BA	CHANNEL	STREAM_BAS	STREAM_HEI	KG_LENGTH	SIDE_SLOPE
822-1	334851.92	6266567.78	334864.57	6266553.81	113041	120822-1	120822-0	Circular	1	R300	0.300	4.900	158.190	157.080	0.000		0.000	0.000	0.000	0.000	0.000		0.000
821	334830.61	6266555.45	334864.57	6266553.81	103565	120821-0	120822-0	Circular	1	R675	0.675	21.400	158.280	156.730	0.000		0.000	0.000	0.000	0.000	0.000		0.000
820	334791.63	6266556.07	334830.61	6266555.45	103564	120820-0	120821-0	Circular	1	R675	0.675	24.300	159.880	158.200	0.000		0.000	0.000	0.000	0.000	0.000		0.000
820-1	334784.04	6266569.67	334791.63	6266556.07	113040	120820-1	120820-0	Circular	1	R375	0.375	0.000	0.000	160.120	0.000		0.000	0.000	0.000	0.000	0.000		0.000
819	334753.10	6266557.61	334791.63	6266556.07	103563	120819-0	120820-0	Circular	1	R525	0.525	44.200	162.120	159.940	0.000		0.000	0.000	0.000	0.000	0.000		0.000
819-1	334740.01	6266571.11	334753.10	6266557.61	113039	120819-1	120819-0	Circular	1	R375	0.375	6.900	163.040	162.400	0.000		0.000	0.000	0.000	0.000	0.000		0.000
818	334743.27	6266544.59	334753.10	6266557.61	103562	120818-0	120819-0	Circular	1	R525	0.525	15.000	162.580	162.150	0.000		0.000	0.000	0.000	0.000	0.000		0.000
813	334688.23	6266546.73	334743.27	6266544.59	103555	120813-0	120818-0	Circular	1	R525	0.525	48.000	164.340	163.720	0.000		0.000	0.000	0.000	0.000	0.000		0.000
812	334662.98	6266548.54	334688.23	6266546.73	103554	120812-0	120813-0	Circular	1	R525	0.525	25.000	167.060	164.360	0.000		0.000	0.000	0.000	0.000	0.000		0.000
809	334658.62	6266560.83	334662.98	6266548.54	114021	120809-0	120812-0	Circular	1	R525	0.525	10.200	167.760	167.070	0.000		0.000	0.000	0.000	0.000	0.000		0.000
814-2	334627.70	6266547.85	334662.98	6266548.54	103558	120814-2	120812-0	Circular	1	R375	0.375	23.000	168.210	167.170	0.000		0.000	0.000	0.000	0.000	0.000		0.000
814-1	334620.93	6266542.21	334627.70	6266547.85	103557	120814-1	120814-2	Circular	1	R375	0.375	12.000	168.470	168.250	0.000		0.000	0.000	0.000	0.000	0.000		0.000
814	334620.42	6266521.13	334620.93	6266542.21	103556	120814-0	120814-1	Circular	1	R375	0.375	15.000	168.740	168.470	0.000		0.000	0.000	0.000	0.000	0.000		0.000
815	334610.31	6266522.76	334620.42	6266521.13	103559	120815-0	120814-0	Circular	1	R375	0.375	6.100	168.780	168.770	0.000		0.000	0.000	0.000	0.000	0.000		0.000
805	334625.58	6266562.02	334658.62	6266560.83	103548	120805-0	120809-0	Circular	1	R375	0.375	30.000	169.100	167.790	0.000		0.000	0.000	0.000	0.000	0.000		0.000
808	334645.90	6266578.46	334649.76	6266567.99	103551	120808-0	120807-0	Circular	1	R375	0.375	5.000	168.780	168.420	0.000		0.000	0.000	0.000	0.000	0.000		0.000
810	334667.25	6266588.50	334649.76	6266567.99	103552	120810-0	120807-0	Circular	1	P225	0.225	27.200	168.790	168.450	0.000		0.000	0.000	0.000	0.000	0.000		0.000
811	334666.83	6266633.86	334667.25	6266588.50	103553	120811-0	120810-0	Circular	1	P225	0.225	40.000	169.920	168.800	0.000		0.000	0.000	0.000	0.000	0.000		0.000
806	334633.24	6266569.04	334649.76	6266567.99	103549	120806-0	120807-0	Circular	1	R450	0.450	9.000	168.530	168.370	0.000		0.000	0.000	0.000	0.000	0.000		0.000
884	334611.63	6266643.34	334633.24	6266569.04	103623	120884-0	120806-0	Circular	1	R375	0.375	78.000	172.870	168.670	0.000		0.000	0.000	0.000	0.000	0.000		0.000
883	334603.73	6266649.14	334611.63	6266643.34	103622	120883-0	120884-0	Circular	1	R375	0.375	10.000	174.060	173.150	0.000		0.000	0.000	0.000	0.000	0.000		0.000
882	334599.41	6266659.14	334603.73	6266649.14	103621	120882-0	120883-0	Circular	1	R375	0.375	6.000	174.530	174.060	0.000		0.000	0.000	0.000	0.000	0.000		0.000
885	334604.71	6266669.33	334611.63	6266643.34	103624	120885-0	120884-0	Circular	1	R375	0.375	23.500	175.160	172.880	0.000		0.000	0.000	0.000	0.000	0.000		0.000
886	334590.39	6266722.23	334604.71	6266669.33	103625	120886-0	120885-0	Circular	1	R375	0.375	45.700	177.610	175.160	0.000		0.000	0.000	0.000	0.000	0.000		0.000
887	334579.67	6266755.48	334590.39	6266722.23	114026	120887-0	120886-0	Circular	1	R375	0.375	45.000	178.990	177.660	0.000		0.000	0.000	0.000	0.000	0.000		0.000
888	334591.89	6266763.51	334579.67	6266755.48	103626	120888-0	120887-0	Circular	1	R375	0.375	10.600	179.120	179.020	0.000		0.000	0.000	0.000	0.000	0.000		0.000
898	334562.03	6266814.27	334579.67	6266755.48	103636	120898-0	120887-0	Circular	1	R375	0.375	55.500	180.950	179.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
899	334547.06	6266829.56	334562.03	6266814.27	103637	120899-0	120898-0	Circular	1	R375	0.375	23.400	181.930	181.050	0.000		0.000	0.000	0.000	0.000	0.000		0.000
900	334555.60	6266837.98	334547.06	6266829.56	103638	120900-0	120899-0	Circular	1	R375	0.375	5.900	182.610	182.150	0.000		0.000	0.000	0.000	0.000	0.000		0.000
881	334527.94	6266657.30	334516.69	6266646.09	103619	120881-0	120879-0	Circular	1	R375	0.375	13.400	175.760	175.340	0.000		0.000	0.000	0.000	0.000	0.000		0.000
880	334510.83	6266664.76	334516.69	6266646.09	103620	120880-0	120879-0	Circular	1	R375	0.375	15.000	175.770	175.340	0.000		0.000	0.000	0.000	0.000	0.000		0.000
879	334516.69	6266646.09	334486.17	6266636.78	103618	120879-0	120878-0	Circular	1	R375	0.375	24.900	175.340	174.580	0.000		0.000	0.000	0.000	0.000	0.000		0.000
877	334489.04	6266653.80	334486.17	6266636.78	103616	120877-0	120878-0	Circular	1	R375	0.375	15.000	174.800	174.510	0.000		0.000	0.000	0.000	0.000	0.000		0.000
878	334486.17	6266636.78	334466.99	6266585.53	103617	120878-0	120878-1	Circular	1	R375	0.375	58.400	174.460	171.520	0.000		0.000	0.000	0.000	0.000	0.000		0.000
878-1	334466.99	6266585.53	334476.50	6266567.83	113131	120878-1	120802-0	Circular	1	R375	0.375	24.100	171.520	170.230	0.000		0.000	0.000	0.000	0.000	0.000		0.000
801	334438.90	6266568.48	334476.50	6266567.83	103543	120801-0	120802-0	Circular	1	R375	0.375	32.300	170.200	170.110	0.000		0.000	0.000	0.000	0.000	0.000		0.000
803	334463.82	6266559.79	334474.51	6266552.21	103545	120803-0	120804-0	Circular	1	R375	0.375	7.800	169.890	169.370	0.000		0.000	0.000	0.000	0.000	0.000		0.000
802	334476.50	6266567.83	334474.51	6266552.21	103544	120802-0	120804-0	Circular	1	R600	0.600	15.000	169.490	169.190	0.000		0.000	0.000	0.000	0.000	0.000		0.000
804	334474.51	6266552.21	334472.53	6266513.25	103546	120804-0	120804-1	Circular	1	R600	0.600	38.700	169.110	165.880	0.000		0.000	0.000	0.000	0.000	0.000		0.000
804-2	334465.40	6266502.08	334465.12	6266469.06	113132	120804-2	120875-0	Circular	1	R600	0.600	35.600	164.430	161.860	0.000		0.000	0.000	0.000	0.000	0.000		0.000
771	334318.18	6266316.79	334327.87	6266296.69	103511	120771-0	120773-0	Circular	1	R375	0.375	28.000	-0.800	152.040	0.000		0.000	0.000	0.000	0.000	0.000		0.000
770	334300.48	6266354.49	334318.18	6266316.79	103510	120770-0	120771-0	Circular	1	R375	0.375	42.800	-1.950	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
772	334303.42	6266321.54	334318.18	6266316.79	103512	120772-0	120771-0	Circular	1	R375	0.375	8.200	-0.830	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
778	334221.85	6266319.96	334247.38	6266262.47	103520	120778-0	120779-0	Circular	1	R375	0.375	66.000	-1.140	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
793	334143.09	6266292.30	334168.88	6266232.87	103532	120793-0	120794-0	Circular	1	R450	0.450	83.200	144.210	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
769	334199.46	6266411.20	334149.30	6266421.23	103516	120769-0	120768-0	Circular	1	R375	0.375	47.000	160.250	153.900	0.000		0.000	0.000	0.000	0.000	0.000		0.000
768	334149.30	6266421.23	334122.47	6266410.17	103509	120768-0	120767-0	Circular	1	R375	0.375	30.400	153.830	148.180	0.000		0.000	0.000	0.000	0.000	0.000		0.000
767	334122.47	6266410.17	334103.38	6266402.01	103508	120767-0	120765-0	Circular	1	R375	0.375	14.000	148.180	147.160	0.000		0.000	0.000	0.000	0.000	0.000		0.000
765	334103.38	6266402.01	334098.99	6266391.84	103506	120765-0	120764-0	Circular	1	R375	0.375	17.000	147.080	146.740	0.000		0.000	0.000	0.000	0.000	0.000		0.000
764	334098.99	6266391.84	334143.09	6266292.30	103505	120764-0	120793-0	Circular	1	R525	0.525	80.500	146.710	145.230	0.000		0.000	0.000	0.000	0.000	0.000		0.000
762	334085.54	6266423.67	334098.99	6266391.84	103503	120762-0	120764-0	Circular	1	R525	0.525	27.600	147.250	147.710	0.000		0.000	0.000	0.000	0.000	0.000		0.000
763	334067.57	6266428.36	334085.54	6266423.67	103504	120763-0	120762-0	Circular	1	R450	0.450	15.400	-1.010	147.280	0.000		0.000	0.000	0.000	0.000	0.000		0.000
787	333986.29	6266293.85	333969.02	6266286.19	103528	120787-0	120788-0	Circular	1	R450	0.450	30.000	-1.210	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
777	334004.50	6266300.62	333986.29	6266293.85	103519	120777-0	120787-0	Circular	1	R375	0.375	25.000	-0.970	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
784	334047.25	6266294.12	334025.68	6266295.99	103525	120784-0	120785-0	Circular	1	R375	0.375	29.000	-0.960	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
785	334025.68	6266295.99	334006.53	6266290.58	103526	120785-0	120786-0	Circular	1	R375	0.375	12.000	-0.930	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
786	334006.53	6266290.58	333986.29	6266293.85	103527	120786-0	120787-0	Circular	1	R375	0.375	20.000	-0.980	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
776	333999.76	6266308.32	334004.50	6266300.62	103518	120776-0	120777-0	Circular	1	R375	0.375	24.000	-0.910	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
775	334014.37	6266382.41	333999.76	6266308.32	103517	120775-0	120776-0	Circular	1	R375	0.375	70.000	-0.890	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
761	334070.21	6266457.74	334085.54	6266423.67	114018	120761-0	120762-0	Circular	1	R525	0.525	48.300	-1.580	147.310	0.000		0.000	0.000	0.000	0.000	0.000		0.000
800	334078.71	6266468.91	334070.21	6266457.74	103538	120800-0	120761-0	Circular	1	R375	0.375	6.400	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
759	334056.30	6266489.56	334070.21	6266457.74	103501	120759-0	120761-0	Circular	1	R375	0.375	44.300	-0.980	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
760	334039.27	6266492.90	334056.30	6266489.56	103502	120760-0	120759-0	Circular	1	R375	0.375	11.200	-0.920	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
758	334036.64	6266534.57	334056.30	6266489.56	103500	120758-0	120759-0	Circular	1	R375	0.375	52.100	-1.580	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
757	334026.09	6266558.19	334036.64	6266534.57	103499	120757-0	120758-0	Circular	1	R375	0.375	25.800	-2.100	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
752	334043.08	6266580.53	334026.09	6266558.19	103494	120752-0	120757-0	Circular	1	R375	0.375	16.800	-1.650	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
751	334046.97	6266592.52	334043.08	6266580.53	103493	120751-0	120752-0	Circular	1	R375	0.375	8.500	-1.170	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
753	334099.68	6266569.25	334043.08	6266580.53	103495	120753-0	120752-0	Circular	1	R375	0.375	78.200	-1.130	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
754	334114.08	6266582.82	334099.68	6266569.25	103496	120754-0	120753-0	Circular	1	R375	0.375	12.200	-0.930	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
756	334177.89	6266578.10	334166.23	6266564.58	103498	120756-0	120755-0	Circular	1	R375	0.375	16.000	-1.160	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
755	334166.23	6266564.58	334099.68	6266569.25	103497	120755-0	120753-0	Circular	1	R375	0.375	61.800	-0.900	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
799	334145.53	6266497.71	334078.71	6266468.91	103537	120799-0	120800-0	Circular	1	R375	0.375	18.300	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
798	334151.44	6266523.95	334145.53	6266497.71	103536	120798-0	120799-0	Circular	1	R375	0.375	11.600	-0.970	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
797	334154.43	6266535.01	334151.44	6266523.95	103535	120797-0	120798-0	Circular	1	R375	0.375	6.200	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
796	334218.64	6266509.67	334154.43	6266535.01	114020	120796-0	120797-0	Circular	1	R375	0.375	51.600	-0.810	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
872	334398.40	6266434.77	334452.01	6266411.97	103611	120872-0	120871-0	Circular	1	R375	0.375	54.000	161.900	160.390	0.000		0.000	0.000	0.000	0.000	0.000		0.000
873	334387.50	6266453.35	334398.40	6266434.77	103612	120873-0	120872-0	Circular	1	R375	0.375	19.500	162.900	162.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
874	334360.93	6266452.38	334398.40	6266434.77	103613	120874-0	120872-0	Circular	1	R375	0.375	29.500	164.800	161.940	0.000		0.000	0.000	0.000	0.000	0.000		0.000
386	333968.86	6265791.79	333991.14	6265795.66	103110	120386-0	120387-0	Circular	1	R375	0.375	20.000	-1.020	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
387	333991.14	6265795.66	334016.09	6265809.32	103111	120387-0	120388-0	Circular	1	R375	0.375	23.000	-0.930	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
388	334016.09	6265809.32	334049.38	6265835.75	103112	120388-0	120388-1	Circular	1	R375	0.375	40.000	-0.930	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
354/1	334065.48	6265832.62	334057.97	6265835.92	103126	120354-1	120354-2	Circular	1	R450	0.450	10.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
354	334080.15	6265844.37	334065.48	6265832.62	103080	120354-0	120354-1	Circular	1	R375	0.375	20.000	-0.790	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
355	334108.16	6265847.78	334080.15	6265844.37	103081	120355-0	120354-0	Circular	1	R375	0.375	30.000	-1.030	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000

ID	U_EASTING	U_NORTHING	D_EASTING	D_NORTHING	LINE_NUMBE	FROM_PIT	TO_PIT	PIPE_SHAPE	TYPE_NO	PIPE_DIAMETER	DIAMETER	LENGTH	US_INVERT	DS_INVERT	BOX_WIDTH	BOX_TYPE	BOX_HEIGHT	CHANNEL_BA	CHANNEL	STREAM_BAS	STREAM_HEI	KG_LENGTH	SIDE_SLOPE
356	334144.82	6265848.49	334108.16	6265847.78	103082	120356-0	120355-0	Circular	1	R375	0.375	28.000	-0.940	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
357	334169.76	6265832.93	334144.82	6265848.49	103083	120357-0	120356-0	Circular	1	R375	0.375	29.000	-0.800	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
358	334184.14	6265800.54	334169.76	6265832.93	103084	120358-0	120357-0	Circular	1	R375	0.375	41.000	-0.730	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
268	334242.41	6265868.72	334218.91	6265903.88	102618	120268-0	120286-1	Circular	1	R375	0.375	45.000	-1.210	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
269	334236.85	6265859.45	334242.41	6265868.72	102619	120269-0	120268-0	Circular	1	R375	0.375	9.000	-0.900	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
267	334260.34	6265859.90	334242.41	6265868.72	102617	120267-0	120268-0	Circular	1	R375	0.375	21.000	-0.770	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
108	334351.55	6265820.23	334333.66	6265861.32	102426	120108-0	120107-0	Circular	1	R375	0.375	38.500	137.810	135.510	0.000		0.000	0.000	0.000	0.000	0.000		0.000
106	334338.65	6265870.01	334333.90	6265877.94	102424	120106-0	120105-0	Circular	1	R375	0.375	6.200	134.350	134.220	0.000		0.000	0.000	0.000	0.000	0.000		0.000
105	334333.90	6265877.94	334323.53	6265881.18	102423	120105-0	120104-0	Circular	1	R375	0.375	12.300	134.220	133.930	0.000		0.000	0.000	0.000	0.000	0.000		0.000
107	334333.66	6265861.32	334323.53	6265881.18	102425	120107-0	120104-0	Circular	1	R375	0.375	26.900	135.510	133.880	0.000		0.000	0.000	0.000	0.000	0.000		0.000
104	334323.53	6265881.18	334311.51	6265910.17	113944	120104-0	120103-0	Circular	1	R375	0.375	29.000	133.860	132.090	0.000		0.000	0.000	0.000	0.000	0.000		0.000
103	334311.51	6265910.17	334283.39	6265971.51	102422	120103-0	120266-0	Circular	1	R525	0.525	71.100	131.890	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
266	334283.39	6265971.51	334269.01	6266003.89	102616	120266-0	120264-0	Circular	1	R525	0.525	31.100	-1.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
263	334285.34	6265989.31	334269.01	6266003.89	102613	120263-0	120264-0	Circular	1	R375	0.375	21.000	-0.790	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
264	334269.01	6266003.89	334250.44	6266045.36	102614	120264-0	120265-0	Circular	1	R525	0.525	48.500	-0.820	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
265	334250.44	6266045.36	334231.52	6266046.14	102615	120265-0	120997-0	Circular	1	R600	0.600	14.800	-1.720	122.930	0.000		0.000	0.000	0.000	0.000	0.000		0.000
996	334249.74	6266052.22	334231.52	6266046.14	103903	120996-0	120997-0	Rectangular	3	BC150360	0.000	15.000	122.800	122.500	3.700	BC150360	1.400	0.000	0.000	0.000	0.000		0.000
254-1	334137.53	6266017.96	334130.98	6266030.44	102605	120254-0	120254-1	Circular	1	R375	0.375	10.000	-0.880	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
255	334228.39	6266059.83	334231.52	6266046.14	102606	120255-0	120997-0	Circular	1	R1050	1.050	5.000	123.240	122.920	0.000		0.000	0.000	0.000	0.000	0.000		0.000
256	334239.02	6266072.64	334228.39	6266059.83	102607	120256-0	120255-0	Circular	1	R1050	1.050	11.000	123.840	123.240	0.000		0.000	0.000	0.000	0.000	0.000		0.000
257	334222.27	6266109.56	334239.02	6266072.64	102608	120257-0	120256-0	Circular	1	R675	0.675	45.100	-1.100	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
258	334215.06	6266126.62	334222.27	6266109.56	102609	120258-0	120257-0	Circular	1	R675	0.675	18.100	-1.470	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
259	334205.51	6266146.49	334215.06	6266126.62	102610	120259-0	120258-0	Circular	1	R600	0.600	26.800	-1.140	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
252-1B	334080.14	6266022.01	334072.86	6266013.84	115183	120252-0	120252-1	Rectangular	3	BC180210	0.000	2.000	0.000	0.000	2.100	BC180210	1.800	0.000	0.000	0.000	0.000		0.000
252-1C	334080.14	6266022.01	334072.86	6266013.84	115182	120252-0	120252-1	Rectangular	3	BC180210	0.000	2.000	0.000	0.000	2.100	BC180210	1.800	0.000	0.000	0.000	0.000		0.000
252-1A	334080.14	6266022.01	334072.86	6266013.84	101702	120252-0	120252-1	Rectangular	3	BC150420	0.000	2.000	0.000	0.000	3.950	BC150420	1.550	0.000	0.000	0.000	0.000		0.000
252-C	334092.56	6266031.98	334080.14	6266022.01	102604	120253-0	120252-0	Rectangular	3	BC150420	0.000	7.600	0.000	0.000	3.950	BC150420	1.550	0.000	0.000	0.000	0.000		0.000
252-B	334092.56	6266031.98	334080.14	6266022.01	115185	120253-0	120252-0	Rectangular	3	BC180210	0.000	7.550	0.000	0.000	2.100	BC180210	1.800	0.000	0.000	0.000	0.000		0.000
252-A	334092.56	6266031.98	334080.14	6266022.01	115184	120253-0	120252-0	Rectangular	3	BC180210	0.000	7.550	0.000	0.000	2.100	BC180210	1.800	0.000	0.000	0.000	0.000		0.000
253-C	334099.96	6266034.42	334092.56	6266031.98	115186	120253-1	120253-0	Rectangular	3	BC180210	0.000	5.000	0.000	0.000	2.100	BC180210	1.800	0.000	0.000	0.000	0.000		0.000
253-B	334099.96	6266034.42	334092.56	6266031.98	115187	120253-1	120253-0	Rectangular	3	BC180210	0.000	5.000	0.000	0.000	2.100	BC180210	1.800	0.000	0.000	0.000	0.000		0.000
253-A	334099.96	6266034.42	334092.56	6266031.98	102654	120253-1	120253-0	Rectangular	3	BC150420	0.000	5.000	0.000	0.000	3.950	BC150420	1.550	0.000	0.000	0.000	0.000		0.000
251	334069.63	6266032.12	334080.14	6266022.01	101701	120251-0	120252-0	Circular	1	R450	0.450	8.000	-1.120	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
249	334061.68	6266058.32	334069.63	6266032.12	101700	120249-0	120251-0	Circular	1	R450	0.450	38.900	-1.150	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
250	334061.68	6266058.32	334039.40	6266084.25	113895	120250-0	120249-0	Circular	1	R375	0.375	17.500	-1.120	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
248	334032.28	6266126.22	334061.68	6266058.32	101699	120248-0	120249-0	Circular	1	R375	0.375	16.200	-0.800	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
247	334013.40	6266169.41	334032.28	6266126.22	101698	120247-0	120248-0	Circular	1	R375	0.375	22.000	-1.010	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
241-1	334127.16	6266069.44	334131.89	6266042.49	101691	120241-0	120241-1	Circular	1	R375	0.375	34.000	-1.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
242	334120.44	6266100.71	334127.16	6266069.44	101693	120242-0	120241-0	Circular	1	R375	0.375	31.200	-0.900	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
243	334122.94	6266120.25	334120.44	6266100.71	101694	120243-0	120242-0	Circular	1	R375	0.375	12.600	-0.990	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
244	334113.58	6266144.42	334122.94	6266120.25	101695	120244-0	120243-0	Circular	1	R375	0.375	30.300	-0.700	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
245	334077.81	6266216.49	334113.58	6266144.42	101696	120245-0	120244-0	Circular	1	R375	0.375	80.000	-1.130	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
246	334019.00	6266190.72	334013.40	6266169.41	101697	120246-0	120247-0	Circular	1	R375	0.375	20.000	-1.010	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
260	334211.54	6266160.35	334205.51	6266146.49	113959	120260-0	120259-0	Circular	1	R450	0.450	12.700	-1.210	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
261	334207.37	6266168.87	334211.54	6266160.35	102611	120261-0	120260-0	Circular	1	R450	0.450	7.300	-1.230	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
262	334194.69	6266172.64	334205.51	6266146.49	102612	120262-0	120259-0	Circular	1	R450	0.450	22.600	-0.910	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
795	334181.49	6266203.32	334194.69	6266172.64	103534	120795-0	120262-0	Circular	1	R450	0.450	32.000	-0.910	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
794	334168.88	6266232.87	334181.49	6266203.32	103533	120794-0	120795-0	Circular	1	R450	0.450	35.000	-0.960	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
780	334232.90	6266270.79	334247.38	6266262.47	103521	120780-0	120779-0	Circular	1	R375	0.375	7.900	-1.030	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
779	334247.38	6266262.47	334274.90	6266202.84	114019	120779-0	120781-0	Circular	1	R375	0.375	71.300	-1.100	143.420	0.000		0.000	0.000	0.000	0.000	0.000		0.000
781	334274.90	6266202.84	334276.70	6266198.29	103522	120781-0	120782-0	Circular	1	R375	0.375	1.000	143.420	143.360	0.000		0.000	0.000	0.000	0.000	0.000		0.000
782	334276.70	6266198.29	334254.53	6266189.26	103523	120782-0	120783-0	Circular	1	R450	0.450	15.100	143.360	142.140	0.000		0.000	0.000	0.000	0.000	0.000		0.000
783	334254.53	6266189.26	334207.37	6266168.87	103524	120783-0	120261-0	Circular	1	R450	0.450	15.200	142.140	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
791	333991.16	6266223.27	333980.35	6266218.76	103530	120791-0	120790-0	Circular	1	R375	0.375	6.000	-0.920	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
790	333980.35	6266218.76	333959.61	6266209.90	103529	120790-0	120789-0	Circular	1	R375	0.375	47.000	-1.140	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
792	333988.45	6266244.70	333991.16	6266223.27	103531	120792-0	120791-0	Circular	1	R375	0.375	25.000	-0.860	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
774-1	334311.81	6266219.60	334274.90	6266202.84	115589	120774-1	120781-0	Circular	1	R450	0.450	8.200	148.000	147.690	0.000		0.000	0.000	0.000	0.000	0.000		0.000
372	333847.28	6265620.40	333855.63	6265633.16	103097	120372-0	120371-0	Circular	1	R375	0.375	21.000	-1.030	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
371	333855.63	6265633.16	333897.64	6265652.88	103096	120371-0	120370-0	Circular	1	R375	0.375	46.000	-1.140	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
370	333897.64	6265652.88	333919.82	6265661.91	103095	120370-0	120369-0	Circular	1	R375	0.375	20.000	-1.040	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
369	333919.82	6265661.91	333950.48	6265676.26	103094	120369-0	120368-0	Circular	1	R375	0.375	35.000	-1.170	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
368	333950.48	6265676.26	334018.09	6265706.22	103093	120368-0	120367-0	Circular	1	R375	0.375	77.000	-1.140	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
367	334018.09	6265706.22	334043.65	6265717.60	103092	120367-0	120365-0	Circular	1	R375	0.375	24.000	-0.810	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
366	334029.62	6265702.43	334043.65	6265717.60	103091	120366-0	120365-0	Circular	1	R375	0.375	18.000	-0.970	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
365	334043.65	6265717.60	334056.70	6265724.16	103089	120365-0	120364-0	Circular	1	R450	0.450	21.000	-0.840	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
364	334056.70	6265724.16	334063.55	6265754.66	103090	120364-0	120995-0	Circular	1	R450	0.450	14.000	-1.050	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
362	334070.57	6265747.92	334063.55	6265754.66	103088	120362-0	120995-0	Circular	1	R750	0.750	5.000	-1.400	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
363	334076.23	6265750.90	334070.57	6265747.92	113988	120363-0	120362-0	Circular	1	R375	0.375	13.000	-0.650	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
361	334089.06	6265739.67	334070.57	6265747.92	103087	120361-0	120362-0	Circular	1	R675	0.675	22.000	-1.150	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
994-2	334094.52	6265694.52	334070.57	6265747.92	103729	120994-0	120362-0	Circular	1	R1200	1.200	55.400	-2.020	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
994-1	334094.52	6265694.52	334070.57	6265747.92	115008	120994-0	120362-0	Circular	1	R1200	1.200	55.400	-2.020	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
993	334109.41	6265665.01	334094.52	6265694.52	103728	120993-0	120994-0	Circular	1	R1650	1.650	34.800	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
360	334129.94	6265758.81	334089.06	6265739.67	103086	120360-0	120361-0	Circular	1	R675	0.675	38.000	-1.360	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
359	334156.32	6265757.60	334129.94	6265758.81	103085	120359-0	120360-0	Circular	1	R675	0.675	24.000	-1.200	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
351	334162.22	6265749.12	334156.32	6265757.60	103077	120351-0	120359-0	Circular	1	R525	0.525	13.000	-0.900	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
350	334171.99	6265747.59	334162.22	6265749.12	103076	120350-0	120351-0	Circular	1	R450	0.450	7.000	-0.890	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
349	334179.87	6265754.63	334171.99	6265747.59	103075	120349-0	120350-0	Circular	1	R450	0.450	11.000	-0.940	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
352	334176.64	6265714.45	334162.22	6265749.12	103078	120352-0	120351-0	Circular	1	R450	0.450	35.000	-1.040	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
353	334194.05	6265673.54	334176.64	6265714.45	103079	120353-0	120352-0	Circular	1	R450	0.450	44.000	-0.900	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
348	334225.82	6265749.22	334179.87	6265754.63	113987	120348-0	120349-0	Circular	1	R450	0.450	44.000	-0.910	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
347	334234.40	6265749.95	334225.82	6265749.22	103074	120347-0	120348-0	Circular	1	R450	0.450	11.000	-0.710	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
346	334251.42	6265758.31	334234.40	6265749.95	103073	120346-0	120347-0	Circular	1	R450	0.450	17.000	136.340	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
270-3	334257.19	6265756.70	334251.42	6265758.31	110828	120270-3	120346-0	Circular	1	R375	0.375	6.100	136.560	136.400	0.000		0.000	0.000	0.000	0.000	0.000		0.000
345	334315.60	6265787.63	334251.42	6265758.31	103072	120345-0	120346-0	Circular	1	R375	0.375	77.000	-0.910	136.350	0.000		0.000	0.000	0.000	0.000	0.000		0.000

ID	U_EASTING	U_NORTHING	D_EASTING	D_NORTHING	LINE_NUMBE	FROM_PIT	TO_PIT	PIPE_SHAPE	TYPE_NO	PIPE_DIAMETER	DIAMETER	LENGTH	US_INVERT	DS_INVERT	BOX_WIDTH	BOX_TYPE	BOX_HEIGHT	CHANNEL_BA	CHANNEL	STREAM_BAS	STREAM_HEI	KG_LENGTH	SIDE_SLOPE
270-2	334264.26	6265723.65	334257.19	6265756.70	110827	120270-2	120270-3	Circular	1	R375	0.375	37.900	138.630	136.990	0.000		0.000	0.000	0.000	0.000	0.000		0.000
270-1	334283.57	6265696.47	334264.26	6265723.65	110826	120270-1	120270-2	Circular	1	R375	0.375	33.700	140.380	138.700	0.000		0.000	0.000	0.000	0.000	0.000		0.000
270	334280.32	6265686.66	334283.57	6265696.47	102620	120270-0	120270-1	Circular	1	R375	0.375	8.000	140.860	140.390	0.000		0.000	0.000	0.000	0.000	0.000		0.000
271	334314.06	6265690.19	334283.57	6265696.47	102621	120271-0	120270-1	Circular	1	R375	0.375	32.000	142.230	140.390	0.000		0.000	0.000	0.000	0.000	0.000		0.000
992	334135.49	6265620.25	334109.41	6265665.01	103727	120992-0	120993-0	Circular	1	R1650	1.650	74.900	-2.350	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
284	334338.49	6265612.16	334332.92	6265603.46	102633	120284-0	120283-0	Circular	1	R375	0.375	4.000	-0.700	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
283	334332.92	6265603.46	334320.08	6265615.81	102632	120283-0	120282-0	Circular	1	R375	0.375	13.000	-0.900	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
282	334320.08	6265615.81	334265.92	6265601.58	102631	120282-0	120285-0	Circular	1	R600	0.600	54.000	-1.170	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
278	334377.11	6265630.38	334320.08	6265615.81	102628	120278-0	120282-0	Circular	1	R600	0.600	60.000	-1.200	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
285	334265.92	6265601.58	334226.76	6265582.48	102634	120285-0	120286-0	Circular	1	R600	0.600	41.000	-1.460	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
287	334246.27	6265581.15	334226.76	6265582.48	102636	120287-0	120286-0	Circular	1	R375	0.375	15.000	-1.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
288	334241.88	6265570.74	334226.76	6265582.48	102637	120288-0	120286-0	Circular	1	R375	0.375	17.000	-1.080	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
286	334226.76	6265582.48	334158.12	6265546.77	102635	120286-0	120286-1	Circular	1	R600	0.600	90.000	-1.020	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
294	334362.71	6265524.22	334287.21	6265508.59	102643	120294-0	120295-0	Circular	1	R375	0.375	75.000	-1.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
295	334287.21	6265508.59	334260.01	6265492.60	113961	120295-0	120296-0	Circular	1	R375	0.375	24.000	-0.980	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
296	334260.01	6265492.60	334239.86	6265468.14	102644	120296-0	120297-0	Circular	1	R450	0.450	36.000	-1.130	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
297	334239.86	6265468.14	334207.29	6265463.50	102645	120297-0	120298-0	Circular	1	R450	0.450	28.000	-1.940	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
298	334207.29	6265463.50	334181.81	6265477.33	102646	120298-0	120298-1	Circular	1	R1200	1.200	60.000	-1.940	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
298-1	334181.81	6265477.33	334161.34	6265498.71	102648	120298-1	120298-2	Circular	1	R1200	1.200	30.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
289-1	334168.79	6265498.85	334161.34	6265498.71	102650	120289-1	120298-2	Circular	1	R375	0.375	7.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
289	334189.12	6265514.14	334168.79	6265498.85	102638	120289-0	120289-1	Circular	1	R375	0.375	7.000	-0.960	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
298-2	334161.34	6265498.71	334149.49	6265518.53	102649	120298-2	120989-0	Circular	1	R1200	1.200	25.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
988	334154.58	6265492.84	334149.49	6265518.53	103723	120988-0	120989-0	Circular	1	R1500	1.500	31.900	-1.700	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
987	334171.43	6265451.34	334154.58	6265492.84	103722	120987-0	120988-0	Circular	1	R1500	1.500	56.500	-1.690	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
989	334149.49	6265518.53	334146.20	6265540.82	103724	120989-0	120990-0	Circular	1	R1650	1.650	28.500	-1.670	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
286/1	334158.12	6265546.77	334146.20	6265540.82	102651	120286-1	120990-0	Circular	1	R600	0.600	15.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
990	334146.20	6265540.82	334144.20	6265555.67	103725	120990-0	120991-0	Circular	1	R1650	1.650	14.400	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
395-1	334125.29	6265555.31	334144.20	6265555.67	103133	120395-1	120991-0	Circular	1	R675	0.675	15.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
991	334144.20	6265555.67	334135.49	6265620.25	103726	120991-0	120992-0	Circular	1	R1650	1.650	65.700	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
395	334084.11	6265551.65	334125.29	6265555.31	103119	120395-0	120395-1	Circular	1	R600	0.600	40.000	-1.090	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
394	334063.79	6265535.78	334084.11	6265551.65	103118	120394-0	120395-0	Circular	1	R600	0.600	23.000	-1.060	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
393	334065.76	6265522.63	334063.79	6265535.78	103117	120393-0	120394-0	Circular	1	R375	0.375	13.000	-0.980	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
392	334072.76	6265516.47	334065.76	6265522.63	103116	120392-0	120393-0	Circular	1	R375	0.375	13.000	-0.870	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
396	334011.58	6265510.13	334063.79	6265535.78	103120	120396-0	120394-0	Circular	1	R450	0.450	57.000	-1.530	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
414	334071.43	6265644.22	334109.41	6265665.01	103160	120414-0	120993-0	Circular	1	R525	0.525	50.000	-0.940	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
411	334056.14	6265634.76	334071.43	6265644.22	113993	120411-0	120414-0	Circular	1	R525	0.525	17.000	-1.010	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
412	334058.65	6265623.35	334056.14	6265634.76	103158	120412-0	120411-0	Circular	1	R375	0.375	6.000	-0.880	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
413	334066.79	6265617.77	334058.65	6265623.35	103159	120413-0	120412-0	Circular	1	R375	0.375	12.000	-0.570	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
410	333944.26	6265583.31	334056.14	6265634.76	103157	120410-0	120411-0	Circular	1	R375	0.375	118.000	-1.070	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
397	333998.61	6265498.98	334011.58	6265510.13	103121	120397-0	120396-0	Circular	1	R450	0.450	19.000	-1.580	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
398	333989.83	6265478.76	333998.61	6265498.98	103122	120398-0	120397-0	Circular	1	R450	0.450	25.000	-1.470	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
399	333995.71	6265470.86	333989.83	6265478.76	103123	120399-0	120398-0	Circular	1	R375	0.375	17.000	-1.030	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
400	333960.03	6265478.76	333989.83	6265478.76	103124	120400-0	120398-0	Circular	1	R450	0.450	20.000	-1.350	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
401	333931.97	6265478.21	333960.03	6265478.76	113990	120401-0	120400-0	Circular	1	R375	0.375	30.000	-1.050	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
389	334069.30	6265398.93	334095.65	6265399.44	103113	120389-0	120311-0	Circular	1	R375	0.375	30.000	-1.180	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
311	334095.65	6265399.44	334104.25	6265399.61	103008	120311-0	120310-0	Circular	1	R375	0.375	5.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
310	334104.25	6265399.61	334103.70	6265427.68	113982	120310-0	120391-0	Circular	1	R600	0.600	40.000	-1.050	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
391	334103.70	6265427.68	334101.75	6265498.69	103115	120391-0	120390-0	Circular	1	R600	0.600	65.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
390	334101.75	6265498.69	334149.49	6265518.53	103114	120390-0	120989-0	Circular	1	R600	0.600	45.000	-0.850	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
308	334106.02	6265367.56	334104.25	6265399.61	103006	120308-0	120310-0	Circular	1	R600	0.600	35.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
309	334120.83	6265342.06	334106.02	6265367.56	103007	120309-0	120308-0	Circular	1	R375	0.375	30.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
309-4	334140.41	6265307.49	334120.83	6265342.06	113753	120309-4	120309-0	Circular	1	R375	0.375	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
307	334074.84	6265349.76	334106.02	6265367.56	103005	120307-0	120308-0	Circular	1	R525	0.525	33.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
305	334084.23	6265309.26	334074.84	6265349.76	103003	120305-0	120307-0	Circular	1	R375	0.375	38.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
306	334082.19	6265296.05	334084.23	6265309.26	103004	120306-0	120305-0	Circular	1	R375	0.375	15.000	-0.670	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
300	334087.60	6265282.97	334095.53	6265287.71	102944	120300-0	120300-1	Circular	1	R375	0.375	7.000	-1.210	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
379	334025.18	6265310.41	334051.75	6265299.46	103714	120977-0	120979-0	Circular	1	R450	0.450	10.000	-0.720	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
979	334051.75	6265299.46	334074.84	6265349.76	103902	120979-0	120307-0	Circular	1	R450	0.450	60.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
978	334057.89	6265278.95	334051.75	6265299.46	103715	120978-0	120979-0	Circular	1	R375	0.375	10.000	-0.910	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
303	334105.40	6265281.02	334095.53	6265287.71	103001	120303-0	120300-1	Circular	1	R375	0.375	7.000	-0.870	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
302	334113.67	6265268.00	334105.40	6265281.02	103000	120302-0	120303-0	Circular	1	R375	0.375	16.000	-1.030	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
301-1	334121.63	6265271.60	334129.54	6265276.32	113754	120301-1	120301-2	Circular	1	P225	0.225	14.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
301-2	334129.54	6265276.32	334138.07	6265280.51	113755	120301-2	120301-3	Circular	1	R300	0.300	13.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
301-3	334138.07	6265280.51	334145.43	6265284.68	113756	120301-3	120301-0	Circular	1	R300	0.300	13.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
301	334145.43	6265284.68	334152.24	6265288.22	102945	120301-0	120309-2	Circular	1	R375	0.375	13.000	-0.940	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
309-1	334158.19	6265277.47	334152.24	6265288.22	113750	120309-1	120309-2	Circular	1	R375	0.375	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
309-2	334152.24	6265288.22	334146.33	6265297.86	113751	120309-2	120309-3	Circular	1	R375	0.375	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
309-3	334146.33	6265297.86	334140.41	6265307.49	113752	120309-3	120309-3	Circular	1	R375	0.375	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
313	334255.81	6265354.99	334277.34	6265367.45	103012	120313-0	120314-0	Circular	1	R450	0.450	25.000	-1.430	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
314	334277.34	6265367.45	334280.49	6265382.40	103013	120314-0	120982-0	Circular	1	R375	0.375	15.000	-1.200	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
312	334185.44	6265378.84	334177.11	6265394.72	103009	120312-0	120312-1	Circular	1	R375	0.375	19.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
982	334280.49	6265382.40	334266.28	6265406.19	103718	120982-0	120983-0	Circular	1	R1350	1.350	34.500	-2.060	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
983	334266.28	6265406.19	334253.45	6265417.41	103719	120983-0	120984-0	Circular	1	R1350	1.350	15.000	-1.550	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
984	334253.45	6265417.41	334210.15	6265404.53	114034	120984-0	120985-0	Circular	1	R1350	1.350	46.600	-2.060	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
985	334210.15	6265404.53	334194.55	6265411.10	103720	120985-0	120986-0	Circular	1	R1500	1.500	9.800	-1.850	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
986	334194.55	6265411.10	334171.43	6265451.34	103721	120986-0	120987-0	Circular	1	R1500	1.500	44.100	-1.810	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
202	334311.85	6265419.68	334253.23	6265428.86	113951	120202-0	120202-1	Circular	1	R450	0.450	45.600	-0.730	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
203	334339.08	6265404.16	334311.85	6265419.68	113954	120203-0	120202-0	Circular	1	R375	0.375	29.000	-1.050	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
205	334391.05	6265388.76	334339.08	6265404.16	102534	120205-0	120203-0	Circular	1	R375	0.375	25.000	-1.080	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
981	334294.70	6265358.61	334280.49	6265382.40	103717	120981-0	120982-0	Circular	1	R1200	1.200	29.400	-2.600	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
312-1	334177.11	6265394.72	334172.28	6265437.03	103010	120312-1	120312-2	Circular	1	R375	0.375	30.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
312-2	334172.28	6265437.03	334171.43	6265451.34	103011	120312-2	120987-0	Circular	1	R375	0.375	20.900	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
980	334310.10	6265332.55	334294.70	6265358.61	103716	120980-0	120981-0	Circular	1	R1200	1.200	22.400	-2.500	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
227	334297.92	6265310.55	334306.94	6265318.16	102593	120227-0	120225-0	Circular	1	R375	0.375	8.000	-0.890	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000

ID	U_EASTING	U_NORTHING	D_EASTING	D_NORTHING	LINE_NUMBE	FROM_PIT	TO_PIT	PIPE_SHAPE	TYPE_NO	PIPE_DIAMETER	DIAMETER	LENGTH	US_INVERT	DS_INVERT	BOX_WIDTH	BOX_TYPE	BOX_HEIGHT	CHANNEL_BA	CHANNEL	STREAM_BAS	STREAM_HEI	KG_LENGTH	SIDE_SLOPE
228	334288.29	6265305.20	334297.92	6265310.55	102594	120228-0	120227-0	Circular	1	R375	0.375	8.000	-0.710	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
317	334298.78	6265296.24	334306.94	6265318.16	103019	120317-0	120225-0	Circular	1	R825	0.825	17.000	-1.340	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
224	334314.65	6265304.56	334318.55	6265310.37	102591	120224-0	120223-1	Circular	1	R1050	1.050	10.000	-1.750	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
223	334339.88	6265303.91	334318.55	6265310.37	116066	120223-0	120223-1	Circular	1	R1050	1.050	42.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
223-1	334318.55	6265310.37	334306.94	6265318.16	102590	120223-1	120225-0	Circular	1	R1050	1.050	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
226	334332.11	6265320.37	334306.94	6265318.16	102592	120226-0	120225-0	Circular	1	R450	0.450	23.000	-1.360	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
220	334434.75	6265306.88	334332.11	6265320.37	102588	120220-0	120226-0	Circular	1	R375	0.375	136.000	-0.990	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
315	334242.07	6265265.34	334298.78	6265296.24	113983	120315-0	120317-0	Circular	1	R825	0.825	52.000	-1.280	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
316	334240.63	6265250.99	334242.07	6265265.34	103014	120316-0	120315-0	Circular	1	R375	0.375	10.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
318	334242.00	6265239.55	334240.63	6265250.99	103020	120318-0	120316-0	Circular	1	R375	0.375	6.500	153.270	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
319	334238.25	6265226.30	334242.00	6265239.55	103021	120319-0	120318-0	Circular	1	R375	0.375	13.900	155.090	153.320	0.000		0.000	0.000	0.000	0.000	0.000		0.000
320	334233.35	6265242.25	334240.63	6265250.99	103022	120320-0	120316-0	Circular	1	R375	0.375	13.000	-0.570	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
321	334227.86	6265230.11	334233.35	6265242.25	103023	120321-0	120320-0	Circular	1	R375	0.375	14.000	-0.920	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
322	334221.09	6265254.04	334242.07	6265265.34	103024	120322-0	120315-0	Circular	1	R825	0.825	36.000	-1.440	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
323	334210.91	6265247.54	334221.09	6265254.04	103025	120323-0	120322-0	Circular	1	R825	0.825	3.000	-1.380	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
324	334207.10	6265236.58	334210.91	6265247.54	103033	120324-0	120323-0	Circular	1	R375	0.375	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
325	334190.49	6265236.26	334210.91	6265247.54	103034	120325-0	120323-0	Circular	1	R825	0.825	22.000	-1.400	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
326	334149.10	6265213.68	334190.49	6265236.26	103035	120326-0	120325-0	Circular	1	R825	0.825	48.000	-1.430	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
327	334132.10	6265204.19	334149.10	6265213.68	103055	120327-0	120326-0	Circular	1	R750	0.750	20.000	-1.270	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
328	334131.13	6265195.00	334132.10	6265204.19	103056	120328-0	120327-0	Circular	1	R375	0.375	10.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
329	334129.54	6265188.66	334131.13	6265195.00	103057	120329-0	120328-0	Circular	1	R375	0.375	8.000	-0.920	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
330	334129.67	6265181.79	334129.54	6265188.66	103058	120330-0	120329-0	Circular	1	R375	0.375	17.000	-0.800	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
331	334129.91	6265169.76	334129.67	6265181.79	103059	120331-0	120330-0	Circular	1	R375	0.375	15.000	-0.880	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
332	334107.17	6265189.95	334132.10	6265204.19	113986	120332-0	120327-0	Circular	1	R750	0.750	32.000	-1.320	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
333	334094.15	6265181.68	334107.17	6265189.95	103060	120333-0	120332-0	Circular	1	R750	0.750	12.000	-1.340	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
334	334066.88	6265169.69	334094.15	6265181.68	103061	120334-0	120333-0	Circular	1	R750	0.750	32.000	-1.410	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
338	334048.36	6265179.07	334066.88	6265169.69	103064	120338-0	120334-0	Circular	1	R750	0.750	25.000	-0.740	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
335	334048.22	6265156.72	334066.88	6265169.69	103069	120335-0	120334-0	Circular	1	R375	0.375	17.000	-1.030	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
336	334042.22	6265111.91	334048.22	6265156.72	103062	120336-0	120335-0	Circular	1	R375	0.375	46.000	-1.300	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
337	334046.90	6265106.27	334042.22	6265111.91	103063	120337-0	120336-0	Circular	1	R375	0.375	5.000	-0.580	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
339	334009.63	6265196.65	334048.36	6265179.07	103065	120339-0	120338-0	Circular	1	R450	0.450	37.000	-0.720	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
340	333992.48	6265194.60	334009.63	6265196.65	103066	120340-0	120339-0	Circular	1	R375	0.375	17.000	-0.630	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
341	333989.40	6265205.43	334009.63	6265196.65	103067	120341-0	120339-0	Circular	1	R375	0.375	23.000	-0.880	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
342	333943.11	6265228.60	333989.40	6265205.43	103068	120342-0	120341-0	Circular	1	R375	0.375	50.000	-0.870	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
403	333850.39	6265467.44	333856.77	6265476.86	103150	120403-0	120402-0	Circular	1	R375	0.375	90.000	-1.150	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
404	333848.41	6265428.56	333850.39	6265467.44	103151	120404-0	120403-0	Circular	1	R375	0.375	39.000	-1.180	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
405	333848.18	6265412.15	333848.41	6265428.56	103152	120405-0	120404-0	Circular	1	R450	0.450	12.000	-1.030	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
406	333838.43	6265407.04	333848.18	6265412.15	103153	120406-0	120405-0	Circular	1	R375	0.375	7.000	-0.610	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
407	333818.65	6265384.07	333838.43	6265407.04	103154	120407-0	120406-0	Circular	1	R375	0.375	23.000	-0.900	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
408	333885.41	6265382.08	333848.18	6265412.15	103155	120408-0	120405-0	Circular	1	R375	0.375	44.000	-0.990	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
115	334678.69	6265985.40	334659.95	6265981.97	102433	120115-0	120116-0	Circular	1	R375	0.375	19.200	144.720	143.750	0.000		0.000	0.000	0.000	0.000	0.000		0.000
116	334659.95	6265981.97	334604.40	6266003.21	102434	120116-0	120117-0	Circular	1	R375	0.375	60.000	143.700	140.060	0.000		0.000	0.000	0.000	0.000	0.000		0.000
118	334616.09	6265986.81	334604.40	6266003.21	113945	120118-0	120117-0	Circular	1	R375	0.375	14.000	140.940	140.100	0.000		0.000	0.000	0.000	0.000	0.000		0.000
117	334604.40	6266003.21	334600.19	6266017.13	102435	120117-0	120119-0	Circular	1	R375	0.375	12.800	140.040	139.420	0.000		0.000	0.000	0.000	0.000	0.000		0.000
119	334600.19	6266017.13	334579.72	6266012.35	102436	120119-0	120120-0	Circular	1	R375	0.375	19.500	139.380	138.500	0.000		0.000	0.000	0.000	0.000	0.000		0.000
120	334579.72	6266012.35	334545.77	6266025.70	102437	120120-0	120121-0	Circular	1	R375	0.375	40.200	138.490	136.350	0.000		0.000	0.000	0.000	0.000	0.000		0.000
121	334545.77	6266025.70	334535.27	6266048.25	102438	120121-0	120122-0	Circular	1	R450	0.450	13.200	136.350	136.110	0.000		0.000	0.000	0.000	0.000	0.000		0.000
122	334535.27	6266048.25	334540.80	6266101.30	102439	120122-0	120123-0	Circular	1	R450	0.450	51.600	136.090	135.520	0.000		0.000	0.000	0.000	0.000	0.000		0.000
123	334540.80	6266101.30	334524.44	6266110.17	102440	120123-0	120124-0	Circular	1	R450	0.450	10.700	135.320	135.060	0.000		0.000	0.000	0.000	0.000	0.000		0.000
124	334524.44	6266110.17	334519.64	6266110.08	115289	120124-0	120031-1	Circular	1	R450	0.450	12.000	135.060	134.900	0.000		0.000	0.000	0.000	0.000	0.000		0.000
35-B	334546.37	6266130.28	334519.64	6266110.08	102357	120035-0	120031-1	Circular	1	R1350	1.350	22.000	136.630	134.660	0.000		0.000	0.000	0.000	0.000	0.000		0.000
35-A	334546.37	6266130.28	334519.64	6266110.08	115000	120035-0	120031-1	Circular	1	R1350	1.350	22.000	136.630	134.620	0.000		0.000	0.000	0.000	0.000	0.000		0.000
36-B	334549.82	6266132.54	334546.37	6266130.28	115001	120036-0	120035-0	Circular	1	R1350	1.350	6.700	136.670	136.630	0.000		0.000	0.000	0.000	0.000	0.000		0.000
36-A	334549.82	6266132.54	334546.37	6266130.28	102358	120036-0	120035-0	Circular	1	R1350	1.350	6.700	136.670	136.630	0.000		0.000	0.000	0.000	0.000	0.000		0.000
38025	334596.57	6266158.82	334549.82	6266132.54	103915	120008-2	120036-0	Circular	1	R1500	1.500	56.700	137.930	136.670	0.000		0.000	0.000	0.000	0.000	0.000		0.000
41	334744.12	6266108.74	334731.26	6266094.92	102362	120041-0	120040-0	Circular	1	R375	0.375	12.700	150.100	148.890	0.000		0.000	0.000	0.000	0.000	0.000		0.000
40	334731.26	6266094.92	334641.40	6266103.24	102361	120040-0	120039-0	Circular	1	R600	0.600	106.700	148.790	141.140	0.000		0.000	0.000	0.000	0.000	0.000		0.000
39	334641.40	6266103.24	334601.07	6266107.28	102360	120039-0	120038-0	Circular	1	R600	0.600	45.200	141.130	138.380	0.000		0.000	0.000	0.000	0.000	0.000		0.000
38	334601.07	6266107.28	334547.60	6266111.93	113940	120038-0	120037-0	Circular	1	R600	0.600	31.300	138.400	136.140	0.000		0.000	0.000	0.000	0.000	0.000		0.000
37	334547.60	6266111.93	334524.44	6266110.17	102359	120037-0	120124-0	Circular	1	R600	0.600	19.200	136.120	136.100	0.000		0.000	0.000	0.000	0.000	0.000		0.000
34	334546.43	6266149.54	334526.21	6266132.08	102356	120034-0	120031-0	Circular	1	R375	0.375	18.000	137.800	134.920	0.000		0.000	0.000	0.000	0.000	0.000		0.000
30	334526.95	6266138.66	334526.21	6266132.08	102351	120030-0	120031-0	Circular	1	R1050	1.050	10.000	135.060	134.250	0.000		0.000	0.000	0.000	0.000	0.000		0.000
33	334517.67	6266143.73	334526.95	6266138.66	102355	120033-0	120030-0	Circular	1	R375	0.375	15.600	136.110	135.880	0.000		0.000	0.000	0.000	0.000	0.000		0.000
32	334518.33	6266154.68	334517.67	6266143.73	102354	120032-0	120033-0	Circular	1	R375	0.375	6.200	136.360	136.150	0.000		0.000	0.000	0.000	0.000	0.000		0.000
29	334530.76	6266168.05	334526.95	6266138.66	113939	120029-0	120030-0	Circular	1	R1050	1.050	27.000	137.000	135.100	0.000		0.000	0.000	0.000	0.000	0.000		0.000
6	334550.89	6266190.32	334530.76	6266168.05	102300	120006-0	120029-0	Circular	1	R1050	1.050	30.000	138.610	137.550	0.000		0.000	0.000	0.000	0.000	0.000		0.000
45	334736.96	6266139.67	334749.41	6266174.48	102366	120045-0	120044-0	Circular	1	R375	0.375	11.100	147.300	147.110	0.000		0.000	0.000	0.000	0.000	0.000		0.000
43	334769.13	6266172.67	334749.41	6266174.48	102364	120043-0	120044-0	Circular	1	R375	0.375	13.300	147.900	147.140	0.000		0.000	0.000	0.000	0.000	0.000		0.000
42	334778.13	6266182.47	334769.13	6266172.67	102363	120042-0	120043-0	Circular	1	R375	0.375	7.500	148.000	147.490	0.000		0.000	0.000	0.000	0.000	0.000		0.000
44	334749.41	6266174.48	334741.18	6266192.70	102365	120044-0	120046-0	Circular	1	R450	0.450	17.200	147.000	146.220	0.000		0.000	0.000	0.000	0.000	0.000		0.000
46	334741.18	6266192.70	334746.51	6266233.92	102367	120046-0	120047-0	Circular	1	R450	0.450	38.100	146.200	145.310	0.000		0.000	0.000	0.000	0.000	0.000		0.000
47	334746.51	6266233.92	334735.26	6266249.46	102368	120047-0	120049-0	Circular	1	R450	0.450	18.500	145.200	144.860	0.000		0.000	0.000	0.000	0.000	0.000		0.000
48	334747.97	6266248.83	334735.26	6266249.46	102369	120048-0	120049-0	Circular	1	R750	0.750	6.400	144.700	144.490	0.000		0.000	0.000	0.000	0.000	0.000		0.000
50	334757.03	6266255.13	334747.97	6266248.83	102371	120050-0	120048-0	Circular	1	R750	0.750	14.700	145.100	144.850	0.000		0.000	0.000	0.000	0.000	0.000		0.000
51	334769.08	6266265.87	334757.03	6266255.13	102372	120051-0	120050-0	Circular	1	R750	0.750	11.600	145.500	145.020	0.000		0.000	0.000	0.000	0.000	0.000		0.000
49	334735.26	6266249.46	334701.66	6266267.62	115288	120049-0	120851-3	Circular	1	R825	0.825	42.000	144.500	142.850	0.000		0.000	0.000	0.000	0.000	0.000		0.000
7	334637.92	6266215.19	334629.84	6266203.22	113935	120007-0	120008-0	Circular	1	R375	0.375	7.100	140.500	140.400	0.000		0.000	0.000	0.000	0.000	0.000		0.000
8	334629.84	6266203.22	334627.46	6266190.49	102301	120008-0	120008-1	Circular	1	R375	0.375	10.000	140.360	139.690	0.000		0.000	0.000	0.000	0.000	0.000		0.000
851-3	334701.66	6266267.62	334627.46	6266190.49	103642	120851-3	120008-1	Circular	1	R1500	1.500	93.300	141.460	138.550	0.000		0.000	0.000	0.000	0.000	0.000		0.000
37994	334627.46	6266190.49	334596.57	6266158.82	103914	120008-1	120008-2	Circular	1	R1500	1.500	54.900	138.550	137.930	0.000		0.000	0.000	0.000	0.000	0.000		0.000
2	334519.26	6266277.59	334538.48	6266243.89	102517	120002-0	120003-0	Circular	1	R900	0.900	38.100	150.900	149.270	0.000		0.000	0.000	0.000	0.000	0.000		0.000
976	334576.62	6266217.06	334563.27	6266206.31	103713	120976-0	120001-0	Circular	1	R600	0.600	21.000	140.320	139.940	0.000		0.000	0.000	0.000	0.000	0.000		0.000
1	334563.27	6266206.31	334550.89	6266190.32	102516	120001-0	120006-0	Circular	1	R600	0.600	20.000	139.940	139.290	0.000		0.000	0.000	0.000	0.000	0.000		0.000
5	334550.70	6266199.93	334550.89	6266190.32	102299	120005-0	120006-0	Circular	1	R900	0.900	15.100	141.100	137.990	0.000		0.000	0.000	0.000	0.000	0.000		0.000

ID	U_EASTING	U_NORTHING	D_EASTING	D_NORTHING	LINE_NUMBE	FROM_PIT	TO_PIT	PIPE_SHAPE	TYPE_NO	PIPE_DIAMETER	DIAMETER	LENGTH	US_INVERT	DS_INVERT	BOX_WIDTH	BOX_TYPE	BOX_HEIGHT	CHANNEL_BA	CHANNEL	STREAM_BAS	STREAM_HEI	KG_LENGTH	SIDE_SLOPE
3	334538.48	6266243.89	334550.70	6266199.93	102518	120003-0	120005-0	Circular	1	R900	0.900	42.100	148.900	141.550	0.000		0.000	0.000	0.000	0.000	0.000		0.000
4	334519.07	6266251.83	334538.48	6266243.89	102519	120004-0	120003-0	Circular	1	R375	0.375	9.500	150.200	149.770	0.000		0.000	0.000	0.000	0.000	0.000		0.000
38014	334456.13	6266090.91	334462.50	6266077.90	113952	120028-1	120028-2	Circular	1	R375	0.375	12.900	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
28	334446.49	6266113.91	334456.13	6266090.91	102350	120028-0	120028-1	Circular	1	R375	0.375	40.000	136.640	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
125	334460.22	6266037.60	334431.34	6266060.23	102442	120125-0	120125-1	Circular	1	R375	0.375	40.000	131.960	129.940	0.000		0.000	0.000	0.000	0.000	0.000		0.000
25	334466.36	6266149.74	334456.08	6266138.16	102347	120025-0	120026-0	Circular	1	R375	0.375	12.000	140.530	138.560	0.000		0.000	0.000	0.000	0.000	0.000		0.000
26	334456.08	6266138.16	334451.44	6266129.32	102348	120026-0	120027-0	Circular	1	R375	0.375	18.000	138.620	137.360	0.000		0.000	0.000	0.000	0.000	0.000		0.000
27	334451.44	6266129.32	334446.49	6266113.91	102349	120027-0	120028-0	Circular	1	R375	0.375	10.000	137.310	136.690	0.000		0.000	0.000	0.000	0.000	0.000		0.000
24	334459.60	6266204.73	334466.36	6266149.74	102346	120024-0	120025-0	Circular	1	R375	0.375	54.300	-1.270	140.560	0.000		0.000	0.000	0.000	0.000	0.000		0.000
23	334449.54	6266227.29	334459.60	6266204.73	102345	120023-0	120024-0	Circular	1	R375	0.375	31.100	-0.960	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
22	334428.24	6266243.07	334449.54	6266227.29	113936	120022-0	120023-0	Circular	1	R375	0.375	11.800	-0.910	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
16	334389.48	6266165.31	334382.73	6266152.92	102309	120016-0	120017-0	Circular	1	R375	0.375	7.500	141.490	140.830	0.000		0.000	0.000	0.000	0.000	0.000		0.000
17	334382.73	6266152.92	334402.39	6266109.11	102310	120017-0	120018-0	Circular	1	R375	0.375	39.100	140.830	134.620	0.000		0.000	0.000	0.000	0.000	0.000		0.000
19	334411.47	6266114.54	334402.39	6266109.11	102312	120019-0	120018-0	Circular	1	R450	0.450	6.200	134.500	134.360	0.000		0.000	0.000	0.000	0.000	0.000		0.000
18	334402.39	6266109.11	334398.14	6266102.47	102311	120018-0	120020-0	Circular	1	R375	0.375	12.500	134.160	133.590	0.000		0.000	0.000	0.000	0.000	0.000		0.000
20	334398.14	6266102.47	334371.26	6266090.13	102313	120020-0	120015-0	Circular	1	R600	0.600	33.100	133.050	130.720	0.000		0.000	0.000	0.000	0.000	0.000		0.000
21	334379.74	6266081.11	334371.26	6266090.13	102314	120021-0	120015-0	Circular	1	R375	0.375	8.700	131.050	130.720	0.000		0.000	0.000	0.000	0.000	0.000		0.000
10	334328.98	6266103.76	334332.62	6266096.83	102303	120010-0	120012-0	Circular	1	R675	0.675	6.400	132.810	132.390	0.000		0.000	0.000	0.000	0.000	0.000		0.000
11	334317.17	6266103.53	334328.98	6266103.76	102304	120011-0	120010-0	Circular	1	R375	0.375	9.300	133.770	133.230	0.000		0.000	0.000	0.000	0.000	0.000		0.000
9	334316.27	6266127.57	334328.98	6266103.76	102302	120009-0	120010-0	Circular	1	R600	0.600	36.600	135.380	132.890	0.000		0.000	0.000	0.000	0.000	0.000		0.000
14	334351.03	6266072.68	334352.50	6266041.64	102307	120014-0	120014-1	Circular	1	R750	0.750	35.000	128.660	126.970	0.000		0.000	0.000	0.000	0.000	0.000		0.000
38000	334352.50	6266041.64	334336.90	6266033.90	113433	120014-1	120014-2	Circular	1	R750	0.750	14.000	126.940	125.850	0.000		0.000	0.000	0.000	0.000	0.000		0.000
13	334351.54	6266091.50	334351.03	6266072.68	102306	120013-0	120014-0	Circular	1	R525	0.525	7.000	130.160	130.040	0.000		0.000	0.000	0.000	0.000	0.000		0.000
279	334390.85	6265621.03	334377.11	6265630.38	113960	120279-0	120278-0	Circular	1	R450	0.450	16.000	-1.020	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
280	334404.41	6265621.29	334390.85	6265621.03	102629	120280-0	120279-0	Circular	1	R375	0.375	9.000	-1.060	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
281	334409.53	6265627.95	334404.41	6265621.29	102630	120281-0	120280-0	Circular	1	R375	0.375	9.000	-0.780	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
277	334446.31	6265649.23	334377.11	6265630.38	102627	120277-0	120278-0	Circular	1	R450	0.450	72.000	-0.930	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
276	334459.37	6265630.23	334446.31	6265649.23	102626	120276-0	120277-0	Circular	1	R375	0.375	20.000	148.770	147.990	0.000		0.000	0.000	0.000	0.000	0.000		0.000
274	334464.29	6265601.88	334459.37	6265630.23	102624	120274-0	120276-0	Circular	1	R375	0.375	27.000	149.710	148.790	0.000		0.000	0.000	0.000	0.000	0.000		0.000
275	334483.97	6265602.71	334464.29	6265601.88	102625	120275-0	120274-0	Circular	1	R375	0.375	20.000	150.140	149.730	0.000		0.000	0.000	0.000	0.000	0.000		0.000
272	334491.85	6265579.66	334477.86	6265579.39	102622	120272-0	120273-0	Circular	1	R375	0.375	9.000	150.710	150.480	0.000		0.000	0.000	0.000	0.000	0.000		0.000
273	334477.86	6265579.39	334464.29	6265601.88	102623	120273-0	120274-0	Circular	1	R375	0.375	18.000	150.460	149.730	0.000		0.000	0.000	0.000	0.000	0.000		0.000
134	334545.04	6265612.20	334573.78	6265618.88	102451	120134-0	120135-0	Circular	1	R375	0.375	32.200	150.610	150.200	0.000		0.000	0.000	0.000	0.000	0.000		0.000
136	334583.93	6265614.71	334573.78	6265618.88	102453	120136-0	120135-0	Circular	1	R375	0.375	9.700	151.030	150.200	0.000		0.000	0.000	0.000	0.000	0.000		0.000
135	334573.78	6265618.88	334573.00	6265636.81	102452	120135-0	120137-0	Circular	1	R375	0.375	17.300	150.200	149.160	0.000		0.000	0.000	0.000	0.000	0.000		0.000
174	334697.79	6265587.16	334695.62	6265608.56	102488	120174-0	120175-0	Circular	1	R525	0.525	15.600	151.020	150.310	0.000		0.000	0.000	0.000	0.000	0.000		0.000
175	334695.62	6265608.56	334681.23	6265673.91	102489	120175-0	120176-0	Circular	1	R600	0.600	46.900	150.280	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
176	334681.23	6265673.91	334682.63	6265691.87	113949	120176-0	120177-0	Circular	1	R675	0.675	6.300	144.100	143.800	0.000		0.000	0.000	0.000	0.000	0.000		0.000
178	334656.22	6265677.80	334681.23	6265673.91	102491	120178-0	120176-0	Circular	1	R375	0.375	21.200	144.980	144.400	0.000		0.000	0.000	0.000	0.000	0.000		0.000
177	334682.63	6265691.87	334702.39	6265733.39	102490	120177-0	120150-0	Circular	1	R675	0.675	9.100	143.790	143.640	0.000		0.000	0.000	0.000	0.000	0.000		0.000
137	334573.00	6265636.81	334559.80	6265663.24	113946	120137-0	120138-0	Circular	1	R375	0.375	24.100	149.140	147.570	0.000		0.000	0.000	0.000	0.000	0.000		0.000
138	334559.80	6265663.24	334540.67	6265702.25	102454	120138-0	120139-0	Circular	1	R375	0.375	48.400	147.570	144.610	0.000		0.000	0.000	0.000	0.000	0.000		0.000
139	334540.67	6265702.25	334538.34	6265709.64	102455	120139-0	120140-0	Circular	1	R450	0.450	3.400	144.600	144.490	0.000		0.000	0.000	0.000	0.000	0.000		0.000
141	334558.13	6265704.33	334540.67	6265702.25	102457	120141-0	120139-0	Circular	1	R450	0.450	11.800	144.890	144.600	0.000		0.000	0.000	0.000	0.000	0.000		0.000
142	334579.06	6265685.49	334558.13	6265704.33	102458	120142-0	120141-0	Circular	1	R375	0.375	24.700	145.710	144.910	0.000		0.000	0.000	0.000	0.000	0.000		0.000
143	334571.37	6265675.72	334558.13	6265704.33	102459	120143-0	120141-0	Circular	1	R375	0.375	29.200	146.580	144.910	0.000		0.000	0.000	0.000	0.000	0.000		0.000
140	334538.34	6265709.64	334498.68	6265792.01	102456	120140-0	120133-0	Circular	1	R450	0.450	86.600	144.490	140.330	0.000		0.000	0.000	0.000	0.000	0.000		0.000
133	334498.68	6265792.01	334486.69	6265800.96	102450	120133-0	120132-0	Circular	1	R450	0.450	15.700	140.330	139.860	0.000		0.000	0.000	0.000	0.000	0.000		0.000
149	334709.60	6265744.90	334693.90	6265742.41	102465	120149-0	120148-0	Circular	1	R525	0.525	9.300	138.380	138.360	0.000		0.000	0.000	0.000	0.000	0.000		0.000
150	334702.39	6265733.39	334693.90	6265742.41	102466	120150-0	120148-0	Circular	1	R900	0.900	26.400	138.970	137.800	0.000		0.000	0.000	0.000	0.000	0.000		0.000
149-1	334735.25	6265776.03	334709.60	6265744.90	102525	120149-1	120149-0	Circular	1	R450	0.450	45.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
151	334753.49	6265693.25	334702.39	6265733.39	102467	120151-0	120150-0	Circular	1	R675	0.675	65.000	142.290	139.660	0.000		0.000	0.000	0.000	0.000	0.000		0.000
153	334748.61	6265651.15	334761.86	6265667.60	113947	120153-0	120152-0	Circular	1	R375	0.375	12.900	145.870	144.650	0.000		0.000	0.000	0.000	0.000	0.000		0.000
154	334736.67	6265657.92	334761.86	6265667.60	102469	120154-0	120152-0	Circular	1	R375	0.375	16.400	145.500	144.650	0.000		0.000	0.000	0.000	0.000	0.000		0.000
148	334693.90	6265742.41	334644.54	6265783.46	102464	120148-0	120147-0	Circular	1	R1050	1.050	51.000	137.800	136.120	0.000		0.000	0.000	0.000	0.000	0.000		0.000
147	334644.54	6265783.46	334619.02	6265813.16	102463	120147-0	120145-0	Circular	1	R1050	1.050	40.000	136.060	135.420	0.000		0.000	0.000	0.000	0.000	0.000		0.000
146	334614.86	6265802.14	334619.02	6265813.16	102462	120146-0	120145-0	Circular	1	R375	0.375	7.300	136.490	136.400	0.000		0.000	0.000	0.000	0.000	0.000		0.000
145	334619.02	6265813.16	334595.00	6265833.70	102461	120145-0	120144-0	Circular	1	R1050	1.050	30.000	135.420	135.040	0.000		0.000	0.000	0.000	0.000	0.000		0.000
144	334595.00	6265833.70	334521.61	6265895.72	102460	120144-0	120126-0	Circular	1	R1050	1.050	100.000	135.040	133.460	0.000		0.000	0.000	0.000	0.000	0.000		0.000
126	334521.61	6265895.72	334505.25	6265904.15	102443	120126-0	120127-0	Circular	1	R1050	1.050	13.600	133.460	133.390	0.000		0.000	0.000	0.000	0.000	0.000		0.000
240	334523.65	6265903.19	334504.29	6265908.50	103029	120240-0	120127-1	Circular	1	R1050	1.050	14.200	133.970	133.450	0.000		0.000	0.000	0.000	0.000	0.000		0.000
128	334503.13	6265877.85	334505.25	6265904.15	102445	120128-0	120127-0	Circular	1	R450	0.450	24.100	135.310	133.960	0.000		0.000	0.000	0.000	0.000	0.000		0.000
130	334495.13	6265861.51	334503.13	6265877.85	102447	120130-0	120128-0	Circular	1	R375	0.375	10.000	136.150	135.480	0.000		0.000	0.000	0.000	0.000	0.000		0.000
129	334500.58	6265851.56	334503.13	6265877.85	102446	120129-0	120128-0	Circular	1	R450	0.450	28.100	137.220	135.310	0.000		0.000	0.000	0.000	0.000	0.000		0.000
131	334498.53	6265822.20	334500.58	6265851.56	102448	120131-0	120129-0	Circular	1	R450	0.450	29.100	138.650	137.220	0.000		0.000	0.000	0.000	0.000	0.000		0.000
132	334486.69	6265800.96	334498.53	6265822.20	102449	120132-0	120131-0	Circular	1	R450	0.450	19.100	139.860	139.080	0.000		0.000	0.000	0.000	0.000	0.000		0.000
114	334443.81	6265800.57	334436.54	6265792.12	102432	120114-0	120113-0	Circular	1	R375	0.375	10.000	139.790	139.610	0.000		0.000	0.000	0.000	0.000	0.000		0.000
113	334436.54	6265792.12	334426.09	6265789.72	102431	120113-0	120112-0	Circular	1	R375	0.375	8.200	139.570	139.560	0.000		0.000	0.000	0.000	0.000	0.000		0.000
112	334426.09	6265789.72	334418.02	6265799.20	102430	120112-0	120111-0	Circular	1	R375	0.375	11.000	139.560	139.500	0.000		0.000	0.000	0.000	0.000	0.000		0.000
111	334418.02	6265799.20	334360.26	6265799.39	102429	120111-0	120110-0	Circular	1	R375	0.375	56.400	139.470	138.690	0.000		0.000	0.000	0.000	0.000	0.000		0.000
110	334360.26	6265799.39	334355.67	6265810.67	102428	120110-0	120109-0	Circular	1	R375	0.375	10.400	138.650	138.470	0.000		0.000	0.000	0.000	0.000	0.000		0.000
109	334355.67	6265810.67	334351.55	6265820.23	102427	120109-0	120108-0	Circular	1	R375	0.375	10.300	138.280	137.810	0.000		0.000	0.000	0.000	0.000	0.000		0.000
162	334935.67	6265572.51	334916.84	6265573.03	102477	120162-0	120161-0	Circular	1	R375	0.375	16.300	162.440	161.220	0.000		0.000	0.000	0.000	0.000	0.000		0.000
161	334916.84	6265573.03	334904.28	6265588.97	102476	120161-0	120160-0	Circular	1	R375	0.375	17.000	161.220	159.650	0.000		0.000	0.000	0.000	0.000	0.000		0.000
162-1	334944.53	6265508.01	334935.67	6265572.51	113953	120162-1	120162-0	Circular	1	R375	0.375	70.000	0.000	162.510	0.000		0.000	0.000	0.000	0.000	0.000		0.000
155	334806.74	6265654.90	334753.49	6265693.25	102470	120155-0	120151-0	Circular	1	R675	0.675	7.000	147.690	142.390	0.000		0.000	0.000	0.000	0.000	0.000		0.000
152	334761.86	6265667.60	334753.49	6265693.25	102468	120152-0	120151-0	Circular	1	R450	0.450	19.900	144.650	142.620	0.000		0.000	0.000	0.000	0.000	0.000		0.000
159	334866.37	6265603.12	334867.45	6265615.38	102474	120159-0	120158-0	Circular	1	R375	0.375	6.500	156.480	156.330	0.000		0.000	0.000	0.000	0.000	0.000		0.000
160	334904.28	6265588.97	334867.45	6265615.38	102475	120160-0	120158-0	Circular	1	R375	0.375	41.300	159.210	156.320	0.000		0.000	0.000	0.000	0.000	0.000		0.000
158	334867.45	6265615.38	334824.50	6265618.93	102473	120158-0	120157-0	Circular	1	R375	0.375	39.900	156.330	153.600	0.000		0.000	0.000	0.000	0.000	0.000		0.000
157	334824.50	6265618.93	334806.74	6265654.90	102472	120157-0	120155-0	Circular	1	R525	0.525	40.000	153.590	147.820	0.000		0.000	0.000	0.000	0.000	0.000		0.000
156-1	334829.79	6265661.91	334822.04	6265655.64	102526	120156-1	120156-0	Circular	1	R525	0.525	20.000	151.120	147.790	0.000		0.000	0.000	0.000	0.000	0.000		0.000
156	334822.04	6265655.64	334806.74	6265654.90	102471	120156-0	120155-0	Circular	1	R525	0.525	6.000	148.260	147.790	0.000		0.000	0.000	0.000	0.000	0.000		0.000
163	335012.02	6265561.31	335027.26	6265587.85	102478	120163-0	120163-1	Circular	1	R375	0.375	33.900	166.310	165.290	0.000		0.000	0.000	0.000	0.000	0.000		0.000

ID	U_EASTING	U_NORTHING	D_EASTING	D_NORTHING	LINE_NUMBE	FROM_PIT	TO_PIT	PIPE_SHAPE	TYPE_NO	PIPE_DIAMETER	DIAMETER	LENGTH	US_INVERT	DS_INVERT	BOX_WIDTH	BOX_TYPE	BOX_HEIGHT	CHANNEL_BA	CHANNEL	STREAM_BAS	STREAM_HEI	KG_LENGTH	SIDE_SLOPE
163-2	335026.55	6265601.84	335021.91	6265660.38	102528	120163-2	120163-3	Circular	1	R450	0.450	55.000	164.740	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
239	335115.30	6265650.38	335021.91	6265660.38	115291	120239-0	120163-3	Circular	1	R525	0.525	130.000	168.350	167.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
23*	335118.10	6265573.87	335130.17	6265651.11	102595	120230-0	120231-0	Circular	1	R375	0.375	68.700	170.420	168.550	0.000		0.000	0.000	0.000	0.000	0.000		0.000
231	335130.17	6265651.11	335115.30	6265650.38	102596	120231-0	120239-0	Circular	1	R525	0.525	2.800	168.380	168.350	0.000		0.000	0.000	0.000	0.000	0.000		0.000
237	335133.09	6265658.17	335130.17	6265651.11	102601	120237-0	120231-0	Circular	1	R375	0.375	11.000	168.590	168.350	0.000		0.000	0.000	0.000	0.000	0.000		0.000
232	335155.64	6265645.92	335130.17	6265651.11	102597	120232-0	120231-0	Circular	1	R450	0.450	20.600	168.590	168.440	0.000		0.000	0.000	0.000	0.000	0.000		0.000
233	335157.20	6265656.01	335155.64	6265645.92	113958	120233-0	120232-0	Circular	1	R375	0.375	8.000	168.770	168.670	0.000		0.000	0.000	0.000	0.000	0.000		0.000
234	335171.55	6265660.66	335157.20	6265656.01	102598	120234-0	120233-0	Circular	1	R300	0.300	6.800	169.220	168.810	0.000		0.000	0.000	0.000	0.000	0.000		0.000
235	335172.41	6265728.94	335157.20	6265656.01	102599	120235-0	120233-0	Circular	1	R375	0.375	6.700	170.200	168.810	0.000		0.000	0.000	0.000	0.000	0.000		0.000
238	335144.72	6265713.09	335133.09	6265658.17	102602	120238-0	120237-0	Circular	1	R375	0.375	51.300	169.810	168.590	0.000		0.000	0.000	0.000	0.000	0.000		0.000
99	335011.55	6265720.57	334954.95	6265751.41	102418	120099-0	120098-0	Circular	1	R375	0.375	31.400	162.630	158.490	0.000		0.000	0.000	0.000	0.000	0.000		0.000
102	334944.55	6265746.40	334943.37	6265762.12	102421	120102-0	120101-0	Circular	1	R375	0.375	12.700	157.780	157.340	0.000		0.000	0.000	0.000	0.000	0.000		0.000
98	334954.95	6265751.41	334943.37	6265762.12	102417	120098-0	120101-0	Circular	1	R375	0.375	11.400	158.490	157.340	0.000		0.000	0.000	0.000	0.000	0.000		0.000
100	334943.60	6265772.63	334943.37	6265762.12	102419	120100-0	120101-0	Circular	1	R300	0.300	14.900	157.580	157.340	0.000		0.000	0.000	0.000	0.000	0.000		0.000
88	334948.51	6265812.55	334946.67	6265795.01	113943	120088-0	120089-0	Circular	1	R525	0.525	27.200	158.670	157.890	0.000		0.000	0.000	0.000	0.000	0.000		0.000
89	334946.67	6265795.01	334935.04	6265785.16	102408	120089-0	120090-0	Circular	1	R525	0.525	13.300	157.810	157.690	0.000		0.000	0.000	0.000	0.000	0.000		0.000
90	334935.04	6265785.16	334924.23	6265778.39	102409	120090-0	120091-0	Circular	1	R525	0.525	14.100	157.350	156.130	0.000		0.000	0.000	0.000	0.000	0.000		0.000
101	334943.37	6265762.12	334924.23	6265778.39	102420	120101-0	120091-0	Circular	1	R450	0.450	19.200	157.340	156.060	0.000		0.000	0.000	0.000	0.000	0.000		0.000
91	334924.23	6265778.39	334893.57	6265802.73	102410	120091-0	120092-0	Circular	1	R675	0.675	23.600	155.780	154.730	0.000		0.000	0.000	0.000	0.000	0.000		0.000
93	334892.06	6265790.89	334893.57	6265802.73	102412	120093-0	120092-0	Circular	1	R375	0.375	7.300	155.300	154.910	0.000		0.000	0.000	0.000	0.000	0.000		0.000
92	334893.57	6265802.73	334881.56	6265813.00	102411	120092-0	120094-0	Circular	1	R750	0.750	32.100	154.570	152.830	0.000		0.000	0.000	0.000	0.000	0.000		0.000
94	334881.56	6265813.00	334871.61	6265829.86	102413	120094-0	120096-0	Circular	1	R750	0.750	25.400	152.830	152.140	0.000		0.000	0.000	0.000	0.000	0.000		0.000
96	334871.61	6265829.86	334856.69	6265834.22	102416	120096-0	120095-0	Circular	1	R375	0.375	6.500	152.840	152.470	0.000		0.000	0.000	0.000	0.000	0.000		0.000
95	334856.69	6265834.22	334823.36	6265835.93	102415	120095-0	120095-1	Circular	1	R750	0.750	36.800	152.130	150.110	0.000		0.000	0.000	0.000	0.000	0.000		0.000
97	334870.69	6265854.79	334856.69	6265834.22	102414	120097-0	120095-0	Circular	1	R375	0.375	21.300	154.130	152.410	0.000		0.000	0.000	0.000	0.000	0.000		0.000
87	334955.84	6265818.37	334948.51	6265812.55	102407	120087-0	120088-0	Circular	1	R375	0.375	13.300	158.900	158.790	0.000		0.000	0.000	0.000	0.000	0.000		0.000
86	334956.07	6265828.88	334955.84	6265818.37	102406	120086-0	120087-0	Circular	1	R375	0.375	6.300	158.960	158.900	0.000		0.000	0.000	0.000	0.000	0.000		0.000
85	334950.26	6265835.77	334948.51	6265812.55	102405	120085-0	120088-0	Circular	1	R525	0.525	25.000	159.360	158.690	0.000		0.000	0.000	0.000	0.000	0.000		0.000
84	334953.94	6265871.28	334950.26	6265835.77	102404	120084-0	120085-0	Circular	1	R450	0.450	34.200	160.450	159.370	0.000		0.000	0.000	0.000	0.000	0.000		0.000
62-4	335120.60	6266053.91	335117.89	6266057.80	113504	120062-4	120062-3	Circular	1	R375	0.375	5.000	167.830	167.640	0.000		0.000	0.000	0.000	0.000	0.000		0.000
62-5	335109.80	6266001.63	335120.60	6266053.91	113503	120062-5	120062-4	Circular	1	R900	0.900	53.500	168.050	167.830	0.000		0.000	0.000	0.000	0.000	0.000		0.000
62-8	335101.01	6265958.15	335109.80	6266001.63	113527	120062-8	120062-5	Circular	1	R900	0.900	19.000	169.360	168.050	0.000		0.000	0.000	0.000	0.000	0.000		0.000
62-6	335142.24	6265998.32	335109.80	6266001.63	113502	120062-6	120062-5	Circular	1	R300	0.300	31.500	168.970	168.650	0.000		0.000	0.000	0.000	0.000	0.000		0.000
62-7	335150.57	6265997.17	335142.24	6265998.32	113501	120062-7	120062-6	Circular	1	R300	0.300	4.000	169.020	168.970	0.000		0.000	0.000	0.000	0.000	0.000		0.000
62-3	335117.89	6266057.80	335042.92	6266065.53	113505	120062-3	120062-2	Circular	1	R375	0.375	74.200	167.640	166.390	0.000		0.000	0.000	0.000	0.000	0.000		0.000
62-2	335042.92	6266065.53	334985.93	6266071.42	113506	120062-2	120062-0	Circular	1	R375	0.375	59.500	166.390	162.950	0.000		0.000	0.000	0.000	0.000	0.000		0.000
62	334985.93	6266071.42	334958.34	6266073.08	102382	120062-0	120059-0	Circular	1	R525	0.525	25.800	162.590	160.880	0.000		0.000	0.000	0.000	0.000	0.000		0.000
61	334973.85	6266062.88	334962.50	6266061.34	102381	120061-0	120060-0	Circular	1	R375	0.375	6.200	161.410	161.380	0.000		0.000	0.000	0.000	0.000	0.000		0.000
60	334962.50	6266061.34	334958.34	6266073.08	113941	120060-0	120059-0	Circular	1	R375	0.375	15.500	161.340	160.750	0.000		0.000	0.000	0.000	0.000	0.000		0.000
59	334958.34	6266073.08	334949.55	6266074.66	102380	120059-0	120058-0	Circular	1	R525	0.525	4.300	160.720	160.520	0.000		0.000	0.000	0.000	0.000	0.000		0.000
63	334966.79	6266088.12	334949.55	6266074.66	102383	120063-0	120058-0	Circular	1	R375	0.375	16.400	163.200	160.830	0.000		0.000	0.000	0.000	0.000	0.000		0.000
58	334949.55	6266074.66	334897.40	6266078.90	102379	120058-0	120057-0	Circular	1	R525	0.525	49.800	160.520	158.670	0.000		0.000	0.000	0.000	0.000	0.000		0.000
57	334897.40	6266078.90	334865.82	6266082.66	102378	120057-0	120055-0	Circular	1	R600	0.600	28.500	158.650	156.830	0.000		0.000	0.000	0.000	0.000	0.000		0.000
56	334889.33	6266066.49	334865.82	6266082.66	102377	120056-0	120055-0	Circular	1	R375	0.375	20.200	157.650	157.110	0.000		0.000	0.000	0.000	0.000	0.000		0.000
55	334865.82	6266082.66	334792.63	6266089.12	102376	120055-0	120054-0	Circular	1	R600	0.600	74.500	156.730	151.660	0.000		0.000	0.000	0.000	0.000	0.000		0.000
54	334792.63	6266089.12	334731.26	6266094.92	102375	120054-0	120040-0	Circular	1	R600	0.600	66.200	151.650	148.840	0.000		0.000	0.000	0.000	0.000	0.000		0.000
67	334898.69	6266170.37	334906.82	6266179.71	102387	120067-0	120067-1	Circular	1	R375	0.375	6.100	160.800	160.710	0.000		0.000	0.000	0.000	0.000	0.000		0.000
67-1	334906.82	6266179.71	334902.32	6266208.50	102556	120067-1	120067-2	Circular	1	R375	0.375	41.200	160.560	158.880	0.000		0.000	0.000	0.000	0.000	0.000		0.000
67-2	334902.32	6266208.50	334899.25	6266231.63	102557	120067-2	120066-0	Circular	1	R375	0.375	15.200	158.120	157.140	0.000		0.000	0.000	0.000	0.000	0.000		0.000
66	334899.25	6266231.63	334909.96	6266243.65	102386	120066-0	120066-1	Circular	1	R375	0.375	13.400	157.050	156.210	0.000		0.000	0.000	0.000	0.000	0.000		0.000
66-1	334909.96	6266243.65	334899.40	6266291.58	102555	120066-1	120064-1	Circular	1	R375	0.375	76.800	155.910	153.090	0.000		0.000	0.000	0.000	0.000	0.000		0.000
64-1	334899.40	6266291.58	334868.33	6266292.29	102554	120064-1	120053-0	Circular	1	R600	0.600	20.900	152.460	150.420	0.000		0.000	0.000	0.000	0.000	0.000		0.000
53	334868.33	6266292.29	334826.41	6266264.79	102374	120053-0	120052-0	Circular	1	R675	0.675	54.600	149.790	146.130	0.000		0.000	0.000	0.000	0.000	0.000		0.000
52	334826.41	6266264.79	334769.08	6266265.87	102373	120052-0	120051-0	Circular	1	R675	0.675	38.300	146.090	145.550	0.000		0.000	0.000	0.000	0.000	0.000		0.000
64	334938.37	6266290.15	334899.40	6266291.58	102384	120064-0	120064-1	Circular	1	R600	0.600	41.300	155.000	152.460	0.000		0.000	0.000	0.000	0.000	0.000		0.000
65	334951.51	6266289.97	334938.37	6266290.15	102385	120065-0	120064-0	Circular	1	R600	0.600	6.400	155.500	154.930	0.000		0.000	0.000	0.000	0.000	0.000		0.000
68-3	335000.54	6266288.29	334951.51	6266289.97	103934	120068-3	120065-0	Circular	1	R600	0.600	40.000	158.580	155.590	0.000		0.000	0.000	0.000	0.000	0.000		0.000
68-2	335020.90	6266253.69	335000.54	6266288.29	102389	120068-2	120068-3	Circular	1	R600	0.600	40.500	160.580	158.810	0.000		0.000	0.000	0.000	0.000	0.000		0.000
68-1	335030.09	6266253.86	335020.90	6266253.69	102514	120068-1	120068-2	Circular	1	R450	0.450	8.000	161.230	160.930	0.000		0.000	0.000	0.000	0.000	0.000		0.000
68	335035.38	6266251.34	335030.09	6266253.86	102388	120068-0	120068-1	Circular	1	R450	0.450	5.500	161.400	161.230	0.000		0.000	0.000	0.000	0.000	0.000		0.000
69-1	335021.46	6266247.14	335020.90	6266253.69	102515	120069-1	120068-2	Circular	1	R525	0.525	5.000	161.010	160.780	0.000		0.000	0.000	0.000	0.000	0.000		0.000
69	335025.66	6266211.34	335021.46	6266247.14	102390	120069-0	120069-1	Circular	1	R525	0.525	30.100	162.400	161.010	0.000		0.000	0.000	0.000	0.000	0.000		0.000
70	335020.78	6266169.67	335025.66	6266211.34	102391	120070-0	120069-0	Circular	1	R450	0.450	37.000	164.400	162.410	0.000		0.000	0.000	0.000	0.000	0.000		0.000
71	335031.63	6266151.94	335020.78	6266169.67	102392	120071-0	120070-0	Circular	1	R375	0.375	21.000	165.500	164.420	0.000		0.000	0.000	0.000	0.000	0.000		0.000
72	335040.83	6266150.81	335031.63	6266151.94	102393	120072-0	120071-0	Circular	1	R375	0.375	13.600	166.000	165.540	0.000		0.000	0.000	0.000	0.000	0.000		0.000
73	335075.45	6266147.98	335040.83	6266150.81	102394	120073-0	120072-0	Circular	1	R375	0.375	30.100	167.000	166.010	0.000		0.000	0.000	0.000	0.000	0.000		0.000
74	335080.86	6266140.21	335075.45	6266147.98	102395	120074-0	120073-0	Circular	1	R375	0.375	13.100	167.200	166.940	0.000		0.000	0.000	0.000	0.000	0.000		0.000
75	335092.23	6266140.43	335080.86	6266140.21	113942	120075-0	120074-0	Circular	1	R375	0.375	6.300	167.500	167.100	0.000		0.000	0.000	0.000	0.000	0.000		0.000
76	335105.69	6266145.95	335075.45	6266147.98	102396	120076-0	120073-0	Circular	1	R375	0.375	30.000	167.800	166.940	0.000		0.000	0.000	0.000	0.000	0.000		0.000
77	335116.42	6266156.65	335105.69	6266145.95	102397	120077-0	120076-0	Circular	1	R375	0.375	7.300	168.000	167.750	0.000		0.000	0.000	0.000	0.000	0.000		0.000
83	335103.46	6266215.91	335113.81	6266223.11	102403	120083-0	120082-0	Circular	1	R375	0.375	14.800	164.900	164.580	0.000		0.000	0.000	0.000	0.000	0.000		0.000
82	335113.81	6266223.11	335113.91	6266240.62	102402	120082-0	120079-0	Circular	1	R375	0.375	19.700	164.400	164.170	0.000		0.000	0.000	0.000	0.000	0.000		0.000
78	335119.30	6266233.72	335113.91	6266240.62	102398	120078-0	120079-0	Circular	1	R375	0.375	14.400	164.500	164.140	0.000		0.000	0.000	0.000	0.000	0.000		0.000
79	335113.91	6266240.62	335108.26	6266261.50	102399	120079-0	120080-0	Circular	1	R375	0.375	13.500	164.100	163.850	0.000		0.000	0.000	0.000	0.000	0.000		0.000
81	335122.69	6266261.78	335108.26	6266261.50	102401	120081-0	120080-0	Circular	1	R375	0.375	6.400	164.100	163.880	0.000		0.000	0.000	0.000	0.000	0.000		0.000
80-1	335078.46	6266263.99	335035.38	6266251.34	102521	120080-1	120068-0	Circular	1	R450	0.450	51.800	162.780	161.750	0.000		0.000	0.000	0.000	0.000	0.000		0.000
222	334373.41	6265298.98	334339.88	6265303.91	103028	120222-0	120223-0	Circular	1	R1050	1.050	52.000	-1.640	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
221	334434.69	6265290.85	334373.41	6265298.98	102589	120221-0	120222-0	Circular	1	R900	0.900	62.000	-1.460	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
218	334513.53	6265280.09	334434.69	6265290.85	102586	120218-0	120221-0	Circular	1	R900	0.900	63.000	-1.910	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
206	334395.04	6265375.05	334391.05	6265388.76	102535	120206-0	120205-0	Circular	1	R375	0.375	8.000	-1.010	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
207	334448.73	6265373.85	334391.05	6265388.76	102536	120207-0	120205-0	Circular	1	R375	0.375	85.000	-1.010	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
208	334470.14	6265364.95	334448.73	6265373.85	102537	120208-0	120207-0	Circular	1	R375	0.375	10.000	-0.800	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
219	334532.28	6265292.74	334434.75	6265306.88	102587	120219-0	120220-0	Circular	1	R375	0.375	78.000	-1.010	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
215	334565.83	6265272.90	334513.53	6265280.09	102583	120215-0	120218-0	Circular	1	R900	0.900	47.000	-1.710	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000

ID	U_EASTING	U_NORTHING	D_EASTING	D_NORTHING	LINE_NUMBE	FROM_PIT	TO_PIT	PIPE_SHAPE	TYPE_NO	PIPE_DIAMETER	DIAMETER	LENGTH	US_INVERT	DS_INVERT	BOX_WIDTH	BOX_TYPE	BOX_HEIGHT	CHANNEL_BA	CHANNEL	STREAM_BAS	STREAM_HEI	KG_LENGTH	SIDE_SLOPE
200	334628.32	6265279.33	334532.28	6265292.74	102512	120200-0	120219-0	Circular	1	R375	0.375	85.000	-1.110	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
216	334577.24	6265241.82	334565.83	6265272.90	102584	120216-0	120215-0	Circular	1	R375	0.375	54.000	-0.800	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
217	334576.43	6265226.53	334577.24	6265241.82	102585	120217-0	120216-0	Circular	1	R375	0.375	14.000	-0.770	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
214	334585.65	6265269.56	334565.83	6265272.90	113957	120214-0	120215-0	Circular	1	R900	0.900	18.000	-1.700	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
198	334634.61	6265262.68	334585.65	6265269.56	102509	120198-0	120214-0	Circular	1	R900	0.900	43.000	-1.700	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
199	334650.74	6265276.04	334628.32	6265279.33	102511	120199-0	120200-0	Circular	1	R375	0.375	23.000	-1.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
201	334645.76	6265283.02	334628.32	6265279.33	102513	120201-0	120200-0	Circular	1	R375	0.375	17.000	-1.060	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
197	334634.61	6265262.68	334676.46	6265256.42	102510	120197-0	120198-0	Circular	1	R900	0.900	36.000	-1.620	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
195	334722.46	6265209.61	334676.46	6265256.42	102507	120195-0	120197-0	Natural Channel	7	R0	0.000	67.000	-1.350	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
196	334759.83	6265242.75	334722.46	6265209.61	102508	120196-0	120195-0	Circular	1	R525	0.525	26.000	-0.850	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
194	334755.35	6265204.65	334722.46	6265209.61	102506	120194-0	120195-0	Circular	1	R600	0.600	36.000	-1.170	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
193	334771.40	6265203.10	334755.35	6265204.65	102505	120193-0	120194-0	Circular	1	R600	0.600	6.000	-1.030	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
173	334779.18	6265263.62	334759.83	6265242.75	102487	120173-0	120196-0	Natural Channel	7	R0	0.000	25.000	155.240	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
172	334823.63	6265277.16	334779.18	6265263.62	102486	120172-0	120173-0	Circular	1	R450	0.450	51.000	153.170	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
171	334830.54	6265285.86	334823.63	6265277.16	102485	120171-0	120172-0	Circular	1	R375	0.375	11.000	155.080	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
170	334840.81	6265294.63	334830.54	6265285.86	102484	120170-0	120171-0	Circular	1	R375	0.375	7.000	156.340	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
169	334849.88	6265288.10	334840.81	6265294.63	102483	120169-0	120170-0	Circular	1	R375	0.375	11.000	-0.720	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
168-1	334805.43	6265197.06	334771.40	6265203.10	102532	120168-1	120193-0	Circular	1	R375	0.375	36.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
168	334834.19	6265212.89	334805.43	6265197.06	113948	120168-0	120168-1	Circular	1	R375	0.375	73.000	-0.900	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
167	334850.79	6265221.79	334834.19	6265212.89	102482	120167-0	120168-0	Circular	1	R375	0.375	8.000	-0.770	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
166	335043.98	6265444.64	335032.42	6265521.56	102481	120166-0	120165-0	Circular	1	R375	0.375	92.100	171.220	169.400	0.000		0.000	0.000	0.000	0.000	0.000		0.000
165	335032.42	6265521.56	335020.86	6265541.45	102480	120165-0	120164-0	Circular	1	R375	0.375	14.500	169.340	168.220	0.000		0.000	0.000	0.000	0.000	0.000		0.000
164	335020.86	6265541.45	335012.02	6265561.31	102479	120164-0	120163-0	Circular	1	R375	0.375	24.600	168.140	166.360	0.000		0.000	0.000	0.000	0.000	0.000		0.000
179	334855.58	6265493.54	334826.51	6265513.10	102492	120179-0	120180-0	Circular	1	R300	0.300	35.500	167.310	166.620	0.000		0.000	0.000	0.000	0.000	0.000		0.000
180	334826.51	6265513.10	334824.49	6265521.25	102493	120180-0	120181-0	Circular	1	R300	0.300	6.300	166.620	162.690	0.000		0.000	0.000	0.000	0.000	0.000		0.000
181	334824.49	6265521.25	334808.42	6265523.18	102494	120181-0	120182-0	Circular	1	R300	0.300	8.700	162.440	161.080	0.000		0.000	0.000	0.000	0.000	0.000		0.000
182	334808.42	6265523.18	334792.10	6265519.88	102495	120182-0	120183-0	Circular	1	R300	0.300	24.800	161.080	159.440	0.000		0.000	0.000	0.000	0.000	0.000		0.000
183	334792.10	6265519.88	334791.66	6265523.22	102496	120183-0	120184-0	Circular	1	R300	0.300	3.100	159.440	159.160	0.000		0.000	0.000	0.000	0.000	0.000		0.000
184	334791.66	6265523.22	334716.27	6265509.47	102497	120184-0	120185-0	Circular	1	R375	0.375	74.600	158.920	157.060	0.000		0.000	0.000	0.000	0.000	0.000		0.000
185	334716.27	6265509.47	334705.59	6265521.93	102498	120185-0	120186-0	Circular	1	R450	0.450	2.800	157.020	156.970	0.000		0.000	0.000	0.000	0.000	0.000		0.000
187	334701.57	6265518.13	334705.59	6265521.93	113950	120187-0	120186-0	Circular	1	R450	0.450	4.000	156.660	156.550	0.000		0.000	0.000	0.000	0.000	0.000		0.000
188	334686.56	6265504.04	334701.57	6265518.13	102500	120188-0	120187-0	Circular	1	R450	0.450	12.400	157.050	156.700	0.000		0.000	0.000	0.000	0.000	0.000		0.000
189-1	334689.29	6265478.76	334686.56	6265504.04	114046	120189-1	120188-0	Circular	1	R375	0.375	32.500	158.920	157.050	0.000		0.000	0.000	0.000	0.000	0.000		0.000
189	334675.78	6265464.34	334689.29	6265478.76	102501	120189-0	120189-1	Circular	1	R375	0.375	19.000	160.010	158.920	0.000		0.000	0.000	0.000	0.000	0.000		0.000
190	334695.59	6265422.98	334675.78	6265464.34	102502	120190-0	120189-0	Circular	1	R375	0.375	30.700	160.850	160.010	0.000		0.000	0.000	0.000	0.000	0.000		0.000
191	334703.85	6265419.79	334695.59	6265422.98	102503	120191-0	120190-0	Circular	1	R375	0.375	12.600	161.150	160.910	0.000		0.000	0.000	0.000	0.000	0.000		0.000
192	334710.01	6265409.48	334703.85	6265419.79	102504	120192-0	120191-0	Circular	1	R375	0.375	6.500	161.280	161.210	0.000		0.000	0.000	0.000	0.000	0.000		0.000
209	334599.90	6265399.52	334546.77	6265506.55	101977	120209-0	120210-0	Circular	1	R375	0.375	110.000	157.620	155.380	0.000		0.000	0.000	0.000	0.000	0.000		0.000
210	334546.77	6265506.55	334533.01	6265505.17	101978	120210-0	120211-0	Circular	1	R375	0.375	7.900	155.380	155.220	0.000		0.000	0.000	0.000	0.000	0.000		0.000
211	334533.01	6265505.17	334470.62	6265493.89	101979	120211-0	120211-1	Circular	1	R375	0.375	67.000	155.150	153.490	0.000		0.000	0.000	0.000	0.000	0.000		0.000
211-1	334470.62	6265493.89	334454.59	6265513.34	101980	120211-1	120212-0	Circular	1	R375	0.375	20.000	153.340	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
212	334454.59	6265513.34	334450.92	6265529.66	103027	120212-0	120213-1	Circular	1	R375	0.375	0.000	-0.930	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
213	334473.24	6265531.58	334450.92	6265529.66	102581	120213-0	120213-1	Circular	1	R375	0.375	20.000	-0.770	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
290	334396.81	6265475.70	334391.89	6265499.09	102639	120290-0	120291-0	Circular	1	R375	0.375	27.000	-0.780	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
291	334391.89	6265499.09	334378.66	6265508.88	102640	120291-0	120292-0	Circular	1	R375	0.375	13.000	-0.860	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
292	334378.66	6265508.88	334370.36	6265513.93	102641	120292-0	120293-0	Circular	1	R375	0.375	14.000	-1.010	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
293	334370.36	6265513.93	334362.71	6265524.22	102642	120293-0	120294-0	Circular	1	R375	0.375	9.000	-0.870	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
186	334705.59	6265521.93	334697.79	6265587.16	102499	120186-0	120174-0	Circular	1	R525	0.525	39.600	156.500	155.420	0.000		0.000	0.000	0.000	0.000	0.000		0.000
773	334327.87	6266296.69	334326.36	6266261.66	103513	120773-0	120774-0	Circular	1	R375	0.375	23.800	152.040	150.080	0.000		0.000	0.000	0.000	0.000	0.000		0.000
774	334326.36	6266261.66	334311.81	6266219.60	103514	120774-0	120774-1	Circular	1	R450	0.450	41.600	150.080	148.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
952	335037.59	6266732.27	335029.99	6266722.50	103696	120952-0	120953-0	Circular	1	R375	0.375	9.300	162.770	162.080	0.000		0.000	0.000	0.000	0.000	0.000		0.000
922	334667.90	6266886.00	334687.16	6266885.46	103667	120922-0	120921-0	Circular	1	R375	0.375	19.300	178.300	178.040	0.000		0.000	0.000	0.000	0.000	0.000		0.000
825	335143.58	6266537.67	334941.90	6266536.97	101867	121017-0	120825-0	Circular	1	R525	0.525	195.000	163.470	153.710	0.000		0.000	0.000	0.000	0.000	0.000		0.000
856	334693.17	6266362.56	334702.02	6266355.40	103597	120856-0	120857-0	Circular	1	R375	0.375	11.400	151.800	148.220	0.000		0.000	0.000	0.000	0.000	0.000		0.000
855	334692.03	6266374.00	334693.17	6266362.56	103596	120855-0	120856-0	Circular	1	R375	0.375	10.000	154.300	151.710	0.000		0.000	0.000	0.000	0.000	0.000		0.000
807	334649.76	6266567.99	334658.62	6266560.83	103550	120807-0	120809-0	Circular	1	R525	0.525	10.700	168.350	167.790	0.000		0.000	0.000	0.000	0.000	0.000		0.000
804-1	334472.53	6266513.25	334465.40	6266502.08	103547	120804-1	120804-2	Circular	1	R600	0.600	14.000	165.880	164.740	0.000		0.000	0.000	0.000	0.000	0.000		0.000
409	333948.48	6265572.50	333944.26	6265583.31	103156	120409-0	120410-0	Circular	1	R375	0.375	6.000	-0.900	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
204	334343.92	6265391.08	334339.08	6265404.16	102533	120204-0	120203-0	Circular	1	R375	0.375	11.000	-1.140	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
225	334306.94	6265318.16	334310.10	6265332.55	113984	120225-0	120980-0	Circular	1	R1200	1.200	18.000	-2.650	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
80	335108.26	6266261.50	335078.46	6266263.99	102400	120080-0	120080-1	Circular	1	R375	0.375	32.000	163.900	162.850	0.000		0.000	0.000	0.000	0.000	0.000		0.000
897	334750.40	6266815.64	334811.92	6266799.47	103635	120897-0	120897-1	Circular	1	R450	0.450	65.000	173.330	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
897-1	334811.92	6266799.47	334823.11	6266777.17	103650	120897-1	120893-0	Circular	1	R450	0.450	9.500	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
402	333856.77	6265476.86	333931.97	6265478.21	103125	120402-0	120401-0	Circular	1	R375	0.375	76.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
304	334089.08	6265300.01	334084.23	6265309.26	103002	120304-0	120305-0	Circular	1	R375	0.375	26.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
268-1	334218.91	6265903.88	334137.57	6265939.00	102652	120268-1	120268-2	CRS	2	ELC	0.000	300.000	116.000	0.000	0.000	ELC	0.000	1.200	0.400	0.000	0.000		1.000
236	335138.08	6265551.32	335118.10	6265573.87	102600	120236-0	120230-0	Circular	1	R375	0.375	25.000	171.190	170.420	0.000		0.000	0.000	0.000	0.000	0.000		0.000
163-1	335027.26	6265587.85	335026.55	6265601.84	102527	120163-1	120163-2	Natural Channel	7	R0	0.000	24.900	165.290	164.740	0.000		0.000	0.000	0.000	0.000	0.000		0.000
95-1	334823.36	6265835.93	334727.35	6265784.62	102522	120095-1	120095-2	Natural Channel	7	R0	0.000	140.000	150.110	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
825-1	334937.92	6266529.56	334904.58	6266513.60	103640	120825-1	120825-A	Circular	1	R1650	1.650	44.000	153.330	150.300	0.000	ELC	0.000	2.000	1.000	0.000	0.000		1.000
825-A	334904.58	6266513.60	334893.11	6266491.44	115569	120825-A	120825-B	Circular	1	R1650	1.650	16.200	150.300	149.500	0.000		0.000	0.000	0.000	0.000	0.000		0.000
825-B	334893.11	6266491.44	334891.10	6266461.74	115568	120825-B	120825-2	Circular	1	R1650	1.650	33.600	149.500	147.860	0.000		0.000	0.000	0.000	0.000	0.000		0.000
12-1	334336.52	6266091.71	334351.03	6266072.68	115582	120012-1	120014-0	Circular	1	R675	0.675	22.000	130.890	128.740	0.000		0.000	0.000	0.000	0.000	0.000		0.000
12	334332.62	6266096.83	334336.52	6266091.71	102305	120012-0	120012-1	Circular	1	R675	0.675	15.000	132.560	130.880	0.000		0.000	0.000	0.000	0.000	0.000		0.000
15	334371.26	6266090.13	334366.65	6266086.16	102308	120015-0	120015-1	Rectangular	3	BC6075	0.000	5.500	130.690	130.660	0.750		0.600	0.000	0.000	0.000	0.000		0.000
38001	334366.65	6266086.16	334351.03	6266072.68	115583	120015-1	120014-0	Circular	1	R675	0.675	13.500	130.550	128.740	0.000		0.000	0.000	0.000	0.000	0.000		0.000
213-1	334450.92	6265529.66	0.00	0.00		120213-1	KIAH01-0	Circular	1	R450	0.450	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
213.2	0.00	0.00	334390.85	6265621.03		KIAH01-0	120279-0	Circular	1	R450	0.450	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	334253.23	6265428.86	334236.15	6265452.59		120202-1	120299-0	Circular	1	R1050	1.050	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	334236.15	6265452.59	334207.29	6265463.50		120299-0	120298-0	Circular	1	R1200	1.200	21.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	334236.25	6265092.75	334159.40	6265126.21		120718-0	120716-0	Circular	1	R375	0.375	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	334173.47	6265109.87	334159.40	6265126.21		120717-0	120716-0	Circular	1	R375	0.375	0.000	-0.880	-1.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	334159.40	6265126.21	334141.53	6265131.60		120716-0	120715-0	Circular	1	R450	0.450	25.000	-1.000	-0.760	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	334141.53	6265131.60	334131.32	6265156.04		120715-0	120710-0	Circular	1	R450	0.450	10.000	-0.760	-0.840	0.000		0.000	0.000	0.000	0.000	0.000		0.000

ID	U_EASTING	U_NORTHING	D_EASTING	D_NORTHING	LINE_NUMBE	FROM_PIT	TO_PIT	PIPE_SHAPE	TYPE_NO	PIPE_DIAMETER	DIAMETER	LENGTH	US_INVERT	DS_INVERT	BOX_WIDTH	BOX_TYPE	BOX_HEIGHT	CHANNEL_BA	CHANNEL	STREAM_BAS	STREAM_HEI	KG_LENGTH	SIDE_SLOPE
	334131.32	6265156.04	334121.32	6265169.03		120710-0	120711-0	Circular	1	R375	0.375	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	334121.32	6265169.03	334133.11	6265179.18		120711-0	120712-0	Circular	1	R375	0.375	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	334133.11	6265179.18	334107.17	6265189.95		120712-0	120332-0	Circular	1	R375	0.375	0.000	-0.840	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	334102.61	6265129.69	334120.64	6265144.95		120714-0	120713-0	Circular	1	R375	0.375	0.000	-0.720	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	334120.64	6265144.95	334131.32	6265156.04		120713-0	120710-0	Circular	1	R375	0.375	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
GCS-5	0.00	0.00	334255.81	6265354.99		GSC005-0	120313-0		0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
GSC-4	0.00	0.00	334255.81	6265354.99		GSC004-0	120313-0		0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
GCS-3	0.00	0.00	0.00	0.00		GSC003-0	GSC002-0		0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
GCS-1	0.00	0.00	0.00	0.00		GSC001-0	GSC002-0		0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
GCS-2	0.00	0.00	334210.15	6265404.53		GSC002-0	120985-0		0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
BBC-1	0.00	0.00	0.00	0.00		BBC001-0	BBC002-0		0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
BBC-2	0.00	0.00	334953.94	6265871.28		BBC002-0	120084-0		0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	334994.09	6266057.14	334985.93	6266071.42		120062-1	120062-0	Circular	0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	335143.58	6266537.67	335074.92	6266532.68		121017-0	120828-0	Circular	0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	334966.83	6266693.78	334968.82	6266685.56		120934-1	120958-0	Circular	1	R600	0.600	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	334884.87	6266807.24	334894.79	6266791.85		120926-1	120928-0	Circular	0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	334827.59	6266758.92	334835.53	6266751.28		120893-3	120894-0	Circular	0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
	334095.53	6265287.71	334089.08	6265300.01		120300-1	120304-0	Circular	1	R375	0.375	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
ADV-1	0.00	0.00	334935.04	6265785.16		ADV001-0	120090-0		0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
WDR-1	334347.53	6266457.63	334360.93	6266452.38		WDR001-0	120874-0	Circular	1	R375	0.375	0.000	0.000	164.800	0.000		0.000	0.000	0.000	0.000	0.000		0.000
L01-0	0.00	0.00	0.00	0.00		LYN001-0	LYN002-0		0		0.300	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
L03-0	0.00	0.00	0.00	0.00		LYN003-0	LYN004-0		0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
L02-0	0.00	0.00	0.00	0.00		LYN002-0	LYN005-0		0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
L04-0	0.00	0.00	0.00	0.00		LYN004-0	LYN005-0		0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
L07-0	0.00	0.00	0.00	0.00		LYN007-0	LYN008-0		0		0.000	0.000	0.000	0.000	4.500		1.000	0.000	0.000	0.000	0.000		0.000
L08-0	0.00	0.00	0.00	0.00		LYN008-0	LYN010-0		0		0.000	0.000	0.000	0.000	4.500		1.000	0.000	0.000	0.000	0.000		0.000
L10-0	0.00	0.00	0.00	0.00		LYN010-0	LYN011-0		0		0.000	0.000	0.000	0.000	4.500		1.000	0.000	0.000	0.000	0.000		0.000
L06-0	0.00	0.00	0.00	0.00		LYN006-0	LYN008-0		0		0.225	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
L09-0	0.00	0.00	0.00	0.00		LYN009-0	LYN010-0		0		0.300	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000
L05-0	0.00	0.00	0.00	0.00		LYN005-0	LYN010-0		0		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000		0.000

A P P E N D I X D

Summary of Design Model Results

The tables on the following 15 pages contain the model results for peak water level at the stormwater pits for the base case (existing conditions, no blockage of stormwater inlets and culverts) scenario. The results have been presented for all the flood events tested for the critical duration storm (2 hour duration).

Pit ID	Peak Water Level (mAHD)				
	PMF	1% AEP	2% AEP	5% AEP	20% AEP
120001-0	141.09	140.98	140.98	140.95	140.85
120002-0	150.45	150.40	150.37	150.34	150.24
120003-0	147.11	146.99	146.93	146.88	146.77
120004-0	148.50	148.29	148.28	148.24	148.14
120005-0	141.95	141.64	141.50	141.44	140.97
120006-0	140.35	140.20	140.15	140.11	139.90
120007-0	142.04	141.38	141.19	141.11	141.02
120008-0	142.02	141.36	141.17	141.10	141.01
120008-1	141.23	140.66	140.63	140.58	140.57
120008-2	139.35	139.21	139.20	139.19	139.18
120009-0	134.64	134.63	134.61	134.60	134.55
120010-0	133.72	133.64	133.64	133.61	133.54
120011-0	134.31	134.21	134.21	134.18	134.12
120012-0	133.10	133.02	133.02	132.99	132.93
120012-1	131.95	131.85	131.85	131.81	131.74
120013-0	131.20	130.97	130.90	130.83	130.78
120014-0	131.20	130.97	130.90	130.83	130.78
120014-1	129.15	128.30	128.13	128.04	128.01
120014-2	128.19	127.44	127.35	127.23	127.13
120015-0	131.74	131.25	131.23	131.13	131.04
120015-1	131.55	131.14	131.12	131.02	130.93
120016-0	143.23	143.23	143.23	143.22	143.20
120017-0	140.29	140.28	140.28	140.27	140.21
120018-0	135.07	134.98	134.98	134.95	134.88
120019-0	135.07	134.98	134.98	134.95	134.88
120020-0	133.86	133.76	133.75	133.72	133.66
120021-0	132.02	131.42	131.42	131.37	131.29
120022-0	154.96	154.95	154.94	154.92	154.86
120023-0	154.35	154.34	154.33	154.32	154.27
120024-0	150.36	150.29	150.25	150.23	150.23
120025-0	140.81	140.38	140.32	140.29	140.27
120026-0	139.91	139.11	139.03	138.98	138.95
120027-0	138.29	137.99	137.92	137.88	137.85
120028-0	137.21	137.04	136.98	136.95	136.92
120028-1	134.74	132.97	132.61	132.49	132.41
120028-2	132.93	132.47	132.45	132.27	131.88
120029-0	138.99	138.78	138.74	138.65	138.36
120030-0	137.70	137.38	137.37	137.23	136.75
120031-0	137.17	136.44	136.39	136.29	135.74
120031-1	135.54	135.32	135.03	134.79	134.41
120032-0	137.68	137.46	137.43	137.31	136.79
120033-0	137.67	137.45	137.43	137.30	136.78
120034-0	138.26	138.05	137.97	137.91	137.90
120035-0	136.82	136.50	136.49	136.47	136.39
120036-0	136.92	136.69	136.68	136.67	136.25
120037-0	137.94	137.71	137.69	137.67	137.62
120038-0	141.03	140.95	140.93	140.53	140.21
120039-0	144.73	144.45	144.45	144.39	144.26
120040-0	149.71	149.53	149.52	149.49	149.37
120041-0	150.23	150.19	150.15	150.14	150.14
120042-0	147.62	147.57	147.51	147.46	147.31
120043-0	147.62	147.57	147.51	147.46	147.31
120044-0	147.22	147.15	147.15	147.05	147.04
120045-0	148.28	148.25	147.93	147.80	147.78
120046-0	146.67	146.62	146.57	146.54	146.53
120047-0	145.50	145.26	145.23	145.13	144.97

Pit ID	Peak Water Level (mAHD)				
	PMF	1% AEP	2% AEP	5% AEP	20% AEP
120048-0	145.05	144.76	144.76	144.59	144.32
120049-0	144.60	144.23	144.21	144.13	144.02
120050-0	145.42	145.20	145.20	144.97	144.56
120051-0	145.83	145.52	145.47	145.25	144.82
120052-0	147.39	147.25	147.23	147.19	147.05
120053-0	149.75	149.68	149.67	149.66	149.55
120054-0	152.22	151.96	151.96	151.95	151.77
120055-0	157.26	157.13	157.13	157.13	156.99
120056-0	158.03	157.91	157.89	157.85	157.81
120057-0	158.90	158.82	158.82	158.82	158.73
120058-0	160.66	160.64	160.64	160.60	160.51
120059-0	161.01	160.92	160.91	160.89	160.81
120060-0	161.35	161.34	161.34	161.30	161.21
120061-0	161.53	161.48	161.48	161.48	161.45
120062-0	162.67	162.63	162.63	162.61	162.59
120062-1	165.00	165.00	165.00	165.00	165.00
120062-2	166.41	166.37	166.35	166.33	166.32
120062-3	167.75	167.70	167.68	167.65	167.63
120062-4	167.76	167.71	167.69	167.67	167.66
120062-5	167.77	167.76	167.76	167.75	167.74
120062-6	169.68	169.68	169.68	169.67	169.66
120062-7	169.85	169.85	169.85	169.84	169.82
120062-8	167.77	167.76	167.76	167.75	167.74
120063-0	161.62	161.62	161.62	161.62	161.59
120064-0	155.16	155.11	155.11	155.08	155.00
120064-1	152.13	152.08	152.07	152.04	151.96
120065-0	155.64	155.58	155.58	155.53	155.37
120066-0	155.33	155.32	155.31	155.31	155.27
120066-1	154.65	154.64	154.63	154.62	154.58
120067-0	159.40	159.39	159.38	159.38	159.37
120067-1	158.59	158.58	158.58	158.57	158.56
120067-2	156.60	156.59	156.58	156.58	156.57
120068-0	161.39	161.30	161.23	161.16	161.00
120068-1	161.12	160.89	160.82	160.75	160.67
120068-2	160.45	160.37	160.37	160.34	160.27
120068-3	158.42	158.35	158.35	158.32	158.25
120069-0	161.87	161.77	161.76	161.74	161.65
120069-1	160.77	160.57	160.56	160.52	160.34
120070-0	163.76	163.71	163.70	163.67	163.61
120071-0	164.78	164.77	164.76	164.72	164.65
120072-0	165.52	165.44	165.44	165.27	165.00
120073-0	166.41	166.37	166.36	166.07	165.75
120074-0	166.59	166.49	166.48	166.19	166.12
120075-0	166.60	166.49	166.48	166.20	166.13
120076-0	166.82	166.59	166.53	166.31	166.16
120077-0	166.88	166.62	166.61	166.38	166.25
120078-0	164.45	164.37	164.30	164.26	164.18
120079-0	163.98	163.96	163.92	163.89	163.57
120080-0	163.87	163.83	163.79	163.75	163.46
120080-1	162.37	162.34	162.33	162.32	162.27
120081-0	163.87	163.83	163.79	163.75	163.46
120082-0	164.01	163.99	163.94	163.90	163.57
120083-0	164.00	163.98	163.94	163.91	163.84
120084-0	161.50	161.46	161.29	161.00	160.90
120085-0	160.52	160.46	160.42	160.31	160.12
120086-0	160.50	160.46	160.45	160.43	160.38

Pit ID	Peak Water Level (mAHD)				
	PMF	1% AEP	2% AEP	5% AEP	20% AEP
120087-0	160.46	160.43	160.42	160.40	160.37
120088-0	160.16	160.15	160.14	160.12	159.86
120089-0	159.28	159.23	159.23	159.12	158.91
120090-0	158.57	158.48	158.47	158.40	158.31
120091-0	157.69	157.43	157.37	157.18	156.99
120092-0	155.72	155.66	155.62	155.59	155.55
120093-0	155.84	155.80	155.74	155.73	155.72
120094-0	154.89	154.85	154.82	154.80	154.80
120095-0	153.43	153.36	153.28	153.27	153.27
120095-1	152.13	151.87	151.71	151.70	151.70
120096-0	154.47	154.46	154.40	154.39	154.36
120097-0	155.01	154.94	154.93	154.91	154.85
120098-0	159.88	159.68	159.66	159.63	159.57
120099-0	164.41	164.31	164.27	164.25	164.20
120100-0	158.84	158.04	158.04	158.03	157.91
120101-0	158.82	158.03	158.03	158.02	157.74
120102-0	159.23	159.18	159.18	159.14	158.92
120103-0	132.50	132.49	132.49	132.49	132.47
120104-0	135.36	135.34	135.31	135.20	134.99
120105-0	135.62	135.58	135.54	135.52	135.51
120106-0	135.62	135.58	135.54	135.52	135.51
120107-0	136.44	136.39	136.35	136.29	136.21
120108-0	138.45	138.37	138.34	138.32	138.28
120109-0	139.11	138.98	138.94	138.92	138.89
120110-0	139.64	139.52	139.47	139.45	139.43
120111-0	140.29	140.27	140.25	140.19	140.09
120112-0	140.49	140.47	140.44	140.42	140.28
120113-0	140.50	140.49	140.49	140.44	140.29
120114-0	140.50	140.49	140.49	140.44	140.30
120115-0	145.12	145.08	145.07	145.06	145.04
120116-0	144.07	143.96	143.95	143.93	143.87
120117-0	141.56	141.51	141.48	141.47	140.77
120118-0	141.69	141.63	141.63	141.58	141.00
120119-0	140.83	140.81	140.78	140.76	140.23
120120-0	139.63	139.61	139.61	139.59	139.41
120121-0	138.06	138.04	138.03	138.02	138.00
120122-0	137.37	137.36	137.36	137.35	137.34
120123-0	137.09	136.95	136.94	136.92	136.88
120124-0	137.04	136.75	136.69	136.66	136.63
120125-0	132.96	132.79	132.71	132.64	132.54
120125-1	131.96	131.36	131.32	131.27	131.27
120126-0	135.84	135.75	135.73	135.72	135.69
120127-0	135.33	135.26	135.25	135.24	135.18
120127-1	134.61	134.49	134.49	134.49	134.40
120128-0	136.52	136.49	136.46	136.45	136.44
120129-0	138.35	138.32	138.28	138.18	138.17
120130-0	136.69	136.61	136.55	136.54	136.53
120131-0	140.05	139.81	139.75	139.72	139.72
120132-0	141.06	140.78	140.65	140.64	140.63
120133-0	141.66	141.62	141.58	141.58	141.57
120134-0	151.52	151.50	150.96	150.91	150.91
120135-0	151.49	151.43	150.82	150.69	150.69
120136-0	152.16	152.13	151.36	151.30	151.30
120137-0	150.27	150.23	150.12	149.76	149.76
120138-0	148.41	148.37	148.31	148.29	148.28
120139-0	145.85	145.78	145.77	145.74	145.73

Pit ID	Peak Water Level (mAHD)				
	PMF	1% AEP	2% AEP	5% AEP	20% AEP
120140-0	145.50	145.46	145.38	145.34	145.33
120141-0	146.15	146.10	146.10	145.98	145.74
120142-0	146.16	146.11	146.11	145.99	145.87
120143-0	147.08	146.11	146.11	145.99	145.87
120144-0	138.16	138.06	138.00	137.96	137.85
120145-0	138.65	138.57	138.52	138.48	138.35
120146-0	138.65	138.57	138.52	138.48	138.35
120147-0	139.29	139.24	139.21	139.18	139.01
120148-0	140.99	140.91	140.89	140.81	140.12
120149-0	141.40	141.40	141.40	141.36	140.20
120149-1	143.94	143.94	143.94	143.88	143.69
120150-0	141.88	141.70	141.65	141.56	141.16
120151-0	144.96	144.74	144.73	144.69	143.20
120152-0	146.25	145.89	145.46	145.36	145.04
120153-0	146.93	146.66	146.32	146.27	146.17
120154-0	146.28	145.92	145.51	145.51	145.50
120155-0	148.82	148.56	148.54	148.46	148.31
120156-0	149.62	149.36	149.30	149.26	149.22
120156-1	151.06	150.89	150.84	150.81	150.78
120157-0	153.92	153.91	153.91	153.87	153.75
120158-0	157.58	157.02	157.02	156.92	156.75
120159-0	157.59	157.04	157.04	156.93	156.75
120160-0	159.97	159.92	159.92	159.92	159.78
120161-0	162.32	162.25	162.24	162.23	162.20
120162-0	163.20	163.19	163.19	163.15	163.08
120162-1	167.65	167.64	167.63	167.63	167.62
120163-0	168.08	168.06	168.04	168.02	167.26
120163-1	167.34	166.49	166.48	166.48	166.48
120163-2	166.35	166.32	166.32	166.32	166.29
120163-3	166.96	166.72	166.61	166.61	166.61
120164-0	169.17	169.13	169.13	169.13	168.70
120165-0	170.35	169.89	169.83	169.78	169.66
120166-0	171.40	171.39	171.39	171.38	171.34
120167-0	163.82	163.81	163.81	163.80	163.75
120168-0	163.47	163.39	163.39	163.38	163.32
120168-1	162.48	162.35	162.35	162.33	162.25
120169-0	165.57	165.54	165.54	165.53	165.51
120170-0	164.63	164.56	164.55	164.51	164.50
120171-0	164.57	164.50	164.50	164.45	164.33
120172-0	163.71	163.62	163.62	163.57	163.42
120173-0	162.63	162.53	162.53	162.49	162.30
120174-0	150.39	150.36	150.36	150.34	150.24
120175-0	148.70	148.59	148.56	148.50	148.42
120176-0	145.89	145.27	145.08	144.92	144.68
120177-0	144.90	144.45	144.38	144.29	144.12
120178-0	146.02	145.87	145.75	145.67	145.57
120179-0	167.33	167.33	167.33	167.33	167.30
120180-0	166.45	166.44	166.44	166.44	166.43
120181-0	162.21	162.21	162.21	162.20	162.18
120182-0	160.30	160.30	160.30	160.29	160.27
120183-0	159.35	159.34	159.34	159.33	159.30
120184-0	159.16	159.15	159.15	159.13	159.05
120185-0	157.28	157.27	157.27	157.24	157.15
120186-0	156.87	156.87	156.87	156.83	156.74
120187-0	157.46	157.45	157.45	157.40	157.29
120188-0	157.84	157.82	157.79	157.67	157.50

Pit ID	Peak Water Level (mAHD)				
	PMF	1% AEP	2% AEP	5% AEP	20% AEP
120189-0	160.30	160.29	160.17	159.85	159.47
120189-1	159.23	159.22	159.20	159.15	159.04
120190-0	161.82	161.72	161.67	161.58	161.45
120191-0	162.23	162.14	162.08	161.87	161.58
120192-0	162.24	162.14	162.08	161.87	161.58
120193-0	162.03	161.74	161.70	161.64	161.58
120194-0	162.02	161.73	161.68	161.59	161.48
120195-0	161.13	160.98	160.96	160.86	160.77
120196-0	162.24	162.17	162.13	162.05	162.03
120197-0	159.86	159.69	159.62	159.55	159.31
120198-0	159.11	158.79	158.73	158.61	158.10
120199-0	159.54	159.50	159.45	159.44	159.43
120200-0	159.06	159.01	158.99	158.97	158.96
120201-0	159.22	159.18	159.15	159.06	159.00
120202-0	148.19	147.95	147.85	147.80	147.77
120202-1	143.99	143.97	143.97	143.97	143.96
120203-0	149.00	148.86	148.78	148.75	148.75
120204-0	149.20	149.12	149.12	149.10	148.77
120205-0	151.49	151.43	151.42	151.40	151.38
120206-0	151.65	151.61	151.59	151.58	151.58
120207-0	153.60	153.18	153.15	153.10	153.02
120208-0	154.17	153.97	153.97	153.93	153.82
120209-0	157.92	157.89	157.89	157.87	157.85
120210-0	155.68	155.67	155.67	155.64	155.55
120211-0	155.46	155.41	155.40	155.40	155.35
120211-1	152.79	152.73	152.73	152.72	152.67
120212-0	151.74	151.61	151.61	151.59	151.52
120213-0	151.97	151.93	151.89	151.88	151.88
120213-1	151.36	151.28	151.27	151.25	151.20
120214-0	158.40	158.29	158.28	158.22	157.68
120215-0	158.14	158.02	157.98	157.86	157.51
120216-0	158.64	158.63	158.63	158.63	158.63
120217-0	159.74	159.73	159.73	159.73	159.73
120218-0	156.83	156.65	156.62	156.54	156.24
120219-0	157.51	157.46	157.45	157.44	157.40
120220-0	154.66	154.60	154.59	154.58	154.57
120221-0	154.91	154.90	154.87	154.86	154.68
120222-0	153.65	153.48	153.44	153.44	153.32
120223-0	153.19	152.49	152.45	152.45	152.39
120223-1	152.66	152.08	152.03	151.94	151.78
120224-0	152.66	152.08	152.03	151.94	151.78
120225-0	152.19	151.76	151.73	151.64	151.46
120226-0	153.05	152.43	152.39	152.37	152.23
120227-0	152.81	152.60	152.53	152.49	152.48
120228-0	153.01	152.78	152.62	152.58	152.56
120230-0	170.60	170.58	170.58	170.58	170.56
120231-0	169.40	169.18	169.14	169.06	169.00
120232-0	169.68	169.55	169.55	169.54	169.50
120233-0	169.99	169.98	169.96	169.96	169.95
120234-0	169.99	169.98	169.96	169.96	169.95
120235-0	170.76	170.75	170.70	170.66	170.64
120236-0	171.60	171.60	171.60	171.59	171.58
120237-0	169.68	169.19	169.19	169.19	169.01
120238-0	170.04	170.04	170.04	170.00	169.92
120239-0	168.56	168.12	168.12	168.07	167.99
120240-0	135.89	135.70	135.70	135.70	135.63

Pit ID	Peak Water Level (mAHD)				
	PMF	1% AEP	2% AEP	5% AEP	20% AEP
120240-1	134.36	134.29	134.29	134.29	134.21
120241-0	127.60	127.55	127.52	127.14	127.00
120241-1	125.57	125.57	125.38	125.36	125.06
120242-0	128.29	128.26	128.22	128.16	127.95
120243-0	128.86	128.76	128.76	128.65	128.41
120244-0	130.43	130.39	130.39	130.36	130.29
120245-0	133.97	133.97	133.97	133.95	133.88
120246-0	130.00	129.97	129.85	129.78	129.53
120247-0	129.96	129.93	129.89	129.87	129.53
120248-0	128.31	128.27	128.27	128.26	127.97
120249-0	123.10	123.10	123.10	123.10	123.09
120250-0	124.56	124.52	124.46	124.44	124.43
120251-0	122.37	122.33	122.25	122.25	122.25
120252-0	121.83	121.77	121.59	121.58	121.49
120252-1	121.76	121.62	121.48	121.47	121.43
120253-0	121.97	121.90	121.65	121.62	121.61
120253-1	122.11	121.91	121.75	121.75	121.73
120254-0	123.01	122.74	122.74	122.72	122.65
120254-1	122.93	122.66	122.66	122.65	122.57
120255-0	124.88	124.41	124.30	124.27	124.18
120256-0	125.71	125.33	125.26	125.22	125.17
120257-0	128.31	128.25	128.18	128.15	128.11
120258-0	130.01	129.92	129.64	129.49	129.32
120259-0	132.13	132.09	132.05	132.03	131.95
120260-0	134.01	133.64	133.61	133.56	133.14
120261-0	134.63	134.58	134.57	134.56	133.82
120262-0	134.52	134.48	134.46	134.36	134.23
120263-0	127.40	127.36	127.36	127.33	127.17
120264-0	127.40	127.36	127.36	127.33	127.17
120265-0	125.36	125.09	125.09	125.05	124.75
120266-0	128.73	128.73	128.73	128.69	128.60
120267-0	133.88	133.54	133.49	133.48	133.48
120268-0	133.75	132.84	132.84	132.80	132.73
120268-1	132.02	131.39	131.39	131.35	131.28
120268-2	130.46	129.07	129.03	128.95	128.83
120269-0	133.77	132.88	132.88	132.88	132.87
120270-0	141.04	141.04	141.04	141.02	140.95
120270-1	140.62	140.59	140.59	140.57	140.51
120270-2	138.87	138.84	138.84	138.82	138.76
120270-3	137.22	137.15	137.15	137.09	136.99
120271-0	142.39	142.36	142.36	142.35	142.33
120272-0	151.51	151.15	151.13	150.99	150.80
120273-0	151.51	151.15	151.12	150.98	150.72
120274-0	150.99	150.95	150.85	150.56	150.24
120275-0	151.00	150.96	150.86	150.56	150.26
120276-0	149.93	149.90	149.87	149.86	149.78
120277-0	149.11	149.08	149.03	148.93	148.67
120278-0	147.38	147.20	147.20	147.20	147.09
120279-0	147.92	147.71	147.71	147.65	147.44
120280-0	147.94	147.72	147.72	147.66	147.45
120281-0	147.94	147.73	147.73	147.66	147.53
120282-0	146.04	145.73	145.72	145.63	145.50
120283-0	146.45	146.29	145.88	145.86	145.82
120284-0	146.75	146.71	146.14	146.10	146.03
120285-0	143.77	143.72	143.69	143.47	143.15
120286-0	142.08	142.06	142.05	142.04	141.87

Pit ID	Peak Water Level (mAHD)				
	PMF	1% AEP	2% AEP	5% AEP	20% AEP
120286-1	139.81	139.57	139.56	139.54	138.92
120287-0	142.09	142.07	142.07	142.04	141.87
120288-0	142.08	142.08	142.06	142.04	141.92
120289-0	141.57	141.52	141.48	141.44	141.44
120289-1	140.77	140.32	140.27	140.23	140.22
120290-0	150.53	150.50	150.50	150.50	150.48
120291-0	150.22	150.18	150.17	150.16	150.12
120292-0	149.87	149.85	149.84	149.83	149.78
120293-0	149.31	149.29	149.27	149.26	149.25
120294-0	148.83	148.69	148.69	148.65	148.62
120295-0	146.36	146.32	146.30	146.29	146.26
120296-0	144.84	144.77	144.76	144.75	144.53
120297-0	143.96	143.85	143.83	143.80	143.40
120298-0	142.12	141.72	141.70	141.65	141.55
120298-1	141.06	140.64	140.62	140.58	140.50
120298-2	140.29	139.63	139.58	139.53	139.50
120299-0	142.26	142.07	142.07	142.06	142.01
120300-0	151.80	151.60	151.57	151.35	151.19
120300-1	151.71	151.56	151.56	150.92	150.67
120301-0	151.17	150.93	150.91	150.91	150.91
120301-1	151.34	151.30	151.27	151.26	151.25
120301-2	151.22	151.06	151.04	151.03	151.03
120301-3	151.20	151.00	150.98	150.97	150.97
120302-0	151.72	151.57	151.56	151.46	151.46
120303-0	151.71	151.56	151.56	151.02	151.02
120304-0	151.54	151.49	151.46	150.60	150.41
120305-0	151.21	151.08	151.02	150.12	149.96
120306-0	151.61	151.60	151.54	151.35	151.30
120307-0	148.93	148.31	148.31	148.22	148.05
120308-0	147.18	147.07	147.06	146.98	146.87
120309-0	148.24	148.16	148.11	148.02	147.93
120309-1	151.19	150.82	150.77	150.73	150.68
120309-2	151.14	150.82	150.77	150.73	150.68
120309-3	150.20	150.06	150.04	150.03	150.02
120309-4	149.58	149.52	149.50	149.49	149.47
120310-0	145.78	145.67	145.63	145.47	145.31
120311-0	145.81	145.68	145.66	145.49	145.31
120312-0	145.65	145.62	145.62	145.62	145.59
120312-1	144.65	144.63	144.63	144.62	144.59
120312-2	142.87	142.81	142.78	142.75	142.73
120313-0	150.63	150.61	150.60	150.59	150.59
120314-0	150.30	150.29	150.28	150.28	150.27
120315-0	153.60	153.30	153.28	153.21	153.08
120316-0	153.76	153.43	153.42	153.37	153.29
120317-0	152.98	152.73	152.71	152.65	152.54
120318-0	153.92	153.69	153.69	153.69	153.57
120319-0	155.25	155.23	155.23	155.22	155.21
120320-0	154.21	154.20	154.20	154.20	154.20
120321-0	154.66	154.65	154.65	154.65	154.65
120322-0	153.73	153.39	153.37	153.27	153.11
120323-0	153.84	153.45	153.42	153.31	153.13
120324-0	153.84	153.59	153.59	153.58	153.52
120325-0	153.96	153.72	153.69	153.66	153.64
120326-0	154.73	154.57	154.53	154.48	154.42
120327-0	155.35	155.22	155.18	155.12	155.05
120328-0	155.61	155.60	155.59	155.58	155.56

Pit ID	Peak Water Level (mAHD)				
	PMF	1% AEP	2% AEP	5% AEP	20% AEP
120329-0	156.29	156.28	156.28	156.27	156.25
120330-0	156.82	156.81	156.81	156.80	156.79
120331-0	157.22	157.21	157.21	157.20	157.18
120332-0	156.27	156.19	156.16	156.12	156.07
120333-0	156.65	156.59	156.55	156.51	156.47
120334-0	157.52	157.49	157.45	157.41	157.39
120335-0	158.15	158.13	158.13	158.13	158.08
120336-0	158.91	158.91	158.91	158.91	158.90
120337-0	159.78	159.78	159.78	159.77	159.77
120338-0	157.74	157.73	157.67	157.64	157.64
120339-0	158.40	158.38	158.28	158.24	158.24
120340-0	158.54	158.54	158.54	158.54	158.52
120341-0	158.85	158.79	158.47	158.38	158.30
120342-0	159.47	159.39	159.04	159.02	159.02
120345-0	139.05	139.01	138.97	138.91	138.91
120346-0	137.15	137.11	137.11	137.06	136.98
120347-0	136.45	136.43	136.43	136.39	136.32
120348-0	135.92	135.91	135.91	135.89	135.84
120349-0	134.30	134.29	134.26	134.26	134.25
120350-0	133.72	133.70	133.69	133.69	133.67
120351-0	133.48	133.43	133.42	133.39	133.18
120352-0	134.46	134.46	134.46	134.39	134.20
120353-0	135.62	135.62	135.62	135.56	135.40
120354-0	127.26	127.23	127.21	127.20	127.20
120354-1	126.40	126.31	126.30	126.26	126.25
120354-2	126.49	126.49	126.40	126.40	126.24
120355-0	128.80	128.80	128.80	128.80	128.78
120356-0	130.29	130.27	130.24	130.24	130.23
120357-0	131.58	131.54	131.50	131.48	131.48
120358-0	132.89	132.81	132.81	132.80	132.72
120359-0	132.78	132.69	132.63	132.57	132.46
120360-0	131.73	131.66	131.54	131.42	131.18
120361-0	130.53	130.36	130.28	130.19	130.07
120362-0	130.43	130.26	130.19	130.10	129.94
120363-0	130.38	130.19	130.13	130.03	129.90
120364-0	130.80	130.75	130.70	130.68	130.68
120365-0	131.34	131.27	131.20	131.17	131.17
120366-0	131.77	131.67	131.44	131.19	131.17
120367-0	132.14	131.99	131.99	131.97	131.87
120368-0	135.80	135.72	135.72	135.69	135.64
120369-0	137.57	137.50	137.48	137.45	137.42
120370-0	138.55	138.48	138.45	138.43	138.42
120371-0	141.28	141.25	141.22	141.21	141.20
120372-0	142.01	141.97	141.95	141.93	141.92
120386-0	129.53	129.53	129.53	129.51	129.43
120387-0	128.73	128.73	128.73	128.70	128.63
120388-0	127.81	127.75	127.75	127.73	127.66
120388-1	126.04	125.86	125.74	125.67	125.59
120389-0	146.10	146.07	146.07	146.07	145.97
120390-0	141.44	141.14	141.12	141.09	140.94
120391-0	144.29	144.14	144.12	143.97	143.81
120392-0	140.20	140.20	140.20	140.19	140.15
120393-0	140.13	140.13	140.13	140.03	139.76
120394-0	140.12	139.93	139.79	139.73	139.64
120395-0	139.31	139.13	139.00	138.90	138.77
120395-1	138.31	138.03	137.94	137.73	137.40

Pit ID	Peak Water Level (mAHD)				
	PMF	1% AEP	2% AEP	5% AEP	20% AEP
120396-0	142.92	142.86	142.83	142.82	142.81
120397-0	144.28	144.25	144.19	144.18	144.17
120398-0	145.37	145.35	145.32	145.31	145.31
120399-0	146.10	146.08	146.05	146.04	146.04
120400-0	146.07	145.79	145.69	145.58	145.50
120401-0	147.38	146.65	146.53	146.47	146.45
120402-0	150.10	150.04	149.99	149.97	149.96
120403-0	151.22	151.17	151.13	151.11	151.10
120404-0	152.96	152.90	152.85	152.83	152.82
120405-0	153.31	153.22	153.15	153.12	153.11
120406-0	153.98	153.94	153.90	153.89	153.89
120407-0	157.42	157.41	157.40	157.39	157.39
120408-0	153.85	153.81	153.77	153.74	153.73
120409-0	141.88	141.88	141.88	141.83	141.62
120410-0	141.60	141.60	141.60	141.57	141.45
120411-0	135.39	135.12	135.12	135.10	134.83
120412-0	135.61	135.57	135.56	135.54	135.32
120413-0	135.88	135.84	135.79	135.77	135.76
120414-0	134.73	134.65	134.64	134.62	134.30
120710-0	158.16	158.11	158.10	158.09	158.02
120711-0	157.49	157.41	157.41	157.39	157.31
120712-0	157.08	157.04	157.03	157.01	156.95
120713-0	158.35	158.35	158.35	158.34	158.31
120714-0	159.40	159.40	159.40	159.39	159.37
120715-0	158.78	158.75	158.75	158.73	158.68
120716-0	159.19	159.16	159.15	159.13	159.08
120717-0	159.64	159.61	159.60	159.60	159.55
120718-0	160.17	160.15	160.13	160.12	160.11
120751-0	164.26	164.26	164.26	164.25	164.23
120752-0	162.50	162.44	162.43	162.40	162.36
120753-0	167.73	167.67	167.66	167.63	167.59
120754-0	168.16	168.16	168.16	168.15	168.13
120755-0	171.58	171.52	171.50	171.47	171.44
120756-0	171.91	171.86	171.79	171.77	171.76
120757-0	159.80	159.73	159.71	159.66	159.61
120758-0	155.45	155.42	155.35	154.50	154.44
120759-0	151.73	151.70	151.68	151.67	151.64
120760-0	152.18	152.01	151.92	151.89	151.89
120761-0	149.77	149.62	149.61	149.59	149.45
120762-0	148.60	148.60	148.60	148.59	148.55
120763-0	148.67	148.67	148.67	148.67	148.59
120764-0	148.13	148.09	148.07	148.05	148.04
120765-0	148.46	148.45	148.45	148.43	148.36
120767-0	149.58	149.58	149.58	149.27	148.58
120768-0	154.12	154.10	154.10	154.08	154.02
120769-0	160.45	160.44	160.44	160.43	160.39
120770-0	155.68	155.60	155.59	155.57	155.54
120771-0	154.21	153.95	153.91	153.86	153.82
120772-0	154.36	154.05	153.96	153.89	153.88
120773-0	153.26	152.57	152.55	152.48	152.40
120774-0	150.99	150.86	150.84	150.78	150.71
120774-1	147.64	147.51	147.49	147.44	147.36
120775-0	141.79	141.71	141.71	141.67	141.53
120776-0	137.92	137.88	137.87	137.80	137.23
120777-0	137.19	137.18	137.18	137.16	136.91
120778-0	149.29	149.29	149.29	149.27	149.21

Pit ID	Peak Water Level (mAHD)				
	PMF	1% AEP	2% AEP	5% AEP	20% AEP
120779-0	146.87	146.49	146.47	146.39	146.31
120780-0	147.54	147.11	147.03	146.94	146.87
120781-0	144.61	144.51	144.49	144.46	144.41
120782-0	143.74	143.64	143.63	143.60	143.53
120783-0	142.68	142.64	142.63	142.61	142.55
120784-0	139.71	139.69	139.44	139.34	139.33
120785-0	138.59	138.57	138.54	138.52	138.51
120786-0	138.05	138.00	137.99	137.97	137.63
120787-0	136.37	136.33	136.33	136.32	136.13
120788-0	135.86	135.86	135.71	135.70	135.62
120789-0	132.25	132.13	132.05	132.05	131.63
120790-0	131.77	131.77	131.77	131.75	131.52
120791-0	131.92	131.92	131.92	131.82	131.58
120792-0	132.76	132.75	132.75	132.69	132.55
120793-0	144.00	144.00	144.00	144.00	144.00
120794-0	139.92	139.92	139.91	139.90	139.90
120795-0	137.55	137.53	137.53	137.52	137.37
120796-0	168.56	168.55	168.54	168.53	168.50
120797-0	167.49	167.49	167.49	167.47	167.40
120798-0	167.32	167.28	167.27	167.25	167.21
120799-0	165.20	165.16	165.16	165.15	165.12
120800-0	150.35	150.27	150.27	150.23	150.18
120801-0	170.44	170.44	170.44	170.42	170.29
120802-0	170.25	170.20	170.20	170.16	170.11
120803-0	170.40	170.27	170.27	170.21	170.13
120804-0	169.68	169.62	169.62	169.59	169.54
120804-1	166.44	166.38	166.38	166.34	166.30
120804-2	165.13	165.00	165.00	164.95	164.90
120805-0	169.33	169.31	169.31	169.30	169.26
120806-0	169.57	169.56	169.54	169.53	169.27
120807-0	168.86	168.84	168.84	168.83	168.76
120808-0	169.10	169.00	169.00	168.98	168.95
120809-0	167.89	167.87	167.86	167.81	167.71
120810-0	168.86	168.85	168.85	168.83	168.79
120811-0	169.92	169.92	169.92	169.92	169.92
120812-0	167.19	167.17	167.17	167.06	166.95
120813-0	165.91	165.88	165.87	165.30	165.05
120814-0	169.21	169.21	169.21	169.18	169.09
120814-1	168.74	168.74	168.74	168.71	168.61
120814-2	168.43	168.43	168.43	168.40	168.33
120815-0	169.21	169.21	169.21	169.18	169.09
120816-0	172.04	172.03	172.03	172.03	172.02
120817-0	171.19	171.18	171.18	171.18	171.17
120817-1	166.57	166.56	166.56	166.56	166.55
120817-2	161.59	161.57	161.57	161.57	161.56
120817-3	160.08	160.07	160.07	160.06	160.05
120818-0	163.55	163.53	163.51	163.48	163.45
120819-0	162.90	162.86	162.84	162.82	162.81
120819-1	163.04	163.04	163.04	163.04	163.04
120820-0	160.96	160.82	160.77	160.73	160.67
120820-1	162.01	162.00	162.00	162.00	162.00
120821-0	159.45	159.33	159.28	159.23	159.09
120822-0	158.09	158.06	158.03	158.00	157.69
120822-1	158.37	158.37	158.37	158.34	158.26
120823-0	156.59	156.53	156.50	156.44	156.37
120824-0	156.26	156.04	155.89	155.43	154.88

Pit ID	Peak Water Level (mAHD)				
	PMF	1% AEP	2% AEP	5% AEP	20% AEP
120825-0	156.14	155.91	155.79	155.41	154.86
120825-1	155.68	155.34	155.15	154.93	154.79
120825-2	151.75	151.15	150.97	150.84	150.47
120825-A	154.29	153.77	153.33	152.89	152.61
120825-B	152.77	152.22	151.94	151.67	151.43
120826-0	156.48	156.24	156.06	155.48	154.91
120828-0	160.39	160.30	160.29	160.26	160.21
120829-0	158.45	158.38	158.38	158.32	158.20
120830-0	158.56	158.55	158.53	158.52	158.52
120831-0	158.53	158.48	158.35	158.31	158.31
120832-0	158.42	158.19	158.08	158.05	158.01
120833-0	158.30	157.89	157.53	157.47	157.42
120834-0	158.25	157.88	157.53	157.47	157.42
120835-0	157.99	157.80	157.11	156.97	156.90
120836-0	156.50	156.46	156.35	156.29	156.25
120837-0	159.14	158.96	158.86	158.82	158.78
120838-0	162.92	162.85	162.84	162.81	162.75
120839-0	162.42	162.35	162.32	162.29	162.26
120840-0	151.11	151.09	151.06	151.01	150.84
120841-0	149.95	149.95	149.94	149.93	149.93
120842-0	149.88	149.53	149.31	149.25	149.16
120842-1	149.95	149.32	149.14	149.02	148.87
120843-0	149.88	149.55	149.32	149.26	149.17
120844-0	149.88	149.55	149.32	149.26	149.17
120845-0	150.07	149.97	149.95	149.94	149.93
120846-0	154.64	154.57	154.27	154.15	153.98
120847-0	153.55	153.54	153.53	153.50	153.05
120848-0	152.73	152.61	152.53	152.48	152.41
120849-0	148.30	147.60	147.35	147.26	147.16
120850-0	148.36	147.69	147.49	147.40	147.26
120851-0	147.89	147.27	147.11	147.03	146.91
120851-1	146.54	146.04	145.96	145.91	145.85
120851-2	144.79	143.90	143.76	143.68	143.61
120851-3	143.73	143.01	142.94	142.86	142.80
120852-0	148.12	147.52	147.29	147.20	147.10
120853-0	155.73	155.68	155.65	155.63	155.61
120854-0	155.25	155.21	155.20	155.18	155.16
120855-0	152.29	152.24	152.23	152.21	152.18
120856-0	150.97	150.88	150.87	150.84	150.78
120857-0	148.74	148.66	148.66	148.64	148.58
120858-0	148.74	148.67	148.66	148.63	148.52
120859-0	156.85	156.84	156.83	156.81	156.78
120860-0	153.70	153.68	153.67	153.66	153.63
120861-0	153.87	153.86	153.85	153.84	153.83
120862-0	151.80	151.72	151.72	151.69	151.66
120863-0	158.95	158.77	158.74	158.70	158.69
120864-0	158.74	158.27	158.17	158.00	157.85
120865-0	158.24	158.07	157.98	157.90	157.37
120866-0	157.11	156.95	156.64	156.56	156.23
120867-0	157.05	156.93	156.61	156.54	156.23
120867-1	155.74	155.69	155.56	155.51	155.24
120867-2	154.53	154.52	154.48	154.47	154.34
120867-3	153.33	153.32	153.30	153.29	153.20
120868-0	157.71	157.71	157.70	157.69	157.67
120869-0	158.31	158.08	158.00	157.91	157.37
120870-0	159.04	158.99	158.91	158.84	158.43

Pit ID	Peak Water Level (mAHD)				
	PMF	1% AEP	2% AEP	5% AEP	20% AEP
120871-0	160.66	160.57	160.41	159.95	159.63
120872-0	162.30	162.26	162.26	162.20	162.10
120873-0	162.36	162.34	162.31	162.31	162.31
120874-0	163.05	163.05	163.05	163.01	162.84
120875-0	163.38	162.89	162.84	162.67	162.56
120876-0	162.88	162.38	162.24	162.09	162.03
120877-0	175.90	175.87	175.79	175.71	175.65
120878-0	175.73	175.70	175.66	175.63	175.61
120878-1	172.04	172.03	172.03	172.03	172.02
120879-0	176.39	176.37	176.37	176.36	176.17
120880-0	176.78	176.78	176.77	176.65	176.34
120881-0	176.43	176.43	176.42	176.39	176.17
120882-0	175.13	175.08	174.80	174.62	174.61
120883-0	175.11	175.07	174.81	174.29	174.27
120884-0	174.92	174.88	174.71	173.53	173.33
120885-0	176.00	175.98	175.96	175.60	175.50
120886-0	178.19	178.08	178.07	178.06	177.93
120887-0	179.47	179.38	179.38	179.38	179.28
120888-0	179.48	179.39	179.39	179.38	179.29
120889-0	173.23	173.19	173.17	173.15	173.14
120890-0	173.20	172.78	172.76	172.71	172.64
120891-0	172.25	172.10	172.09	172.05	172.01
120892-0	171.22	171.05	171.03	170.98	170.92
120893-0	170.07	169.93	169.84	169.81	169.78
120893-1	169.82	169.74	169.71	169.68	169.65
120893-2	167.87	167.51	167.41	167.23	167.02
120893-3	167.25	167.02	166.96	166.84	166.68
120893-4	166.03	166.00	166.00	165.98	165.92
120893-5	160.71	160.66	160.66	160.63	160.54
120893-6	157.03	156.86	156.80	156.48	155.84
120893-7	156.55	156.40	156.32	156.06	155.56
120894-0	168.80	168.80	168.80	168.80	168.77
120895-0	176.19	176.15	176.12	176.11	176.11
120896-0	174.94	174.53	174.53	174.51	174.47
120897-0	174.88	173.91	173.81	173.77	173.74
120897-1	171.66	170.96	170.83	170.78	170.75
120898-0	181.31	181.28	181.28	181.27	181.19
120899-0	182.24	182.19	182.19	182.18	182.13
120900-0	182.81	182.81	182.81	182.80	182.74
120911-0	174.88	174.88	174.88	174.88	174.80
120912-0	173.58	173.46	173.46	173.46	173.35
120913-0	173.71	173.62	173.62	173.60	173.54
120914-0	173.73	173.66	173.50	173.16	173.06
120915-0	172.49	172.36	172.36	172.33	172.19
120916-0	174.86	174.83	174.77	174.43	174.33
120917-0	175.91	175.76	175.74	175.22	175.11
120918-0	175.82	175.78	175.74	175.35	175.35
120919-0	176.79	176.56	176.49	176.46	176.37
120920-0	177.80	177.63	177.59	177.59	177.52
120921-0	178.49	178.27	178.25	178.19	178.14
120922-0	178.70	178.56	178.53	178.45	178.42
120923-0	178.70	178.68	178.68	178.68	178.66
120924-0	178.93	178.93	178.93	178.90	178.80
120925-0	169.71	169.71	169.71	169.70	169.66
120926-0	169.59	169.40	169.34	169.33	169.15
120926-1	167.89	167.63	167.61	167.47	167.31

Pit ID	Peak Water Level (mAHD)				
	PMF	1% AEP	2% AEP	5% AEP	20% AEP
120926-2	167.89	167.63	167.60	167.46	167.30
120926-3	167.87	167.58	167.52	167.36	167.15
120927-0	169.86	169.58	169.51	169.48	169.47
120928-0	167.01	166.73	166.69	166.48	166.28
120929-0	165.89	165.81	165.81	165.58	165.28
120930-0	167.17	167.09	166.89	166.71	166.57
120931-0	164.80	164.73	164.72	164.67	164.53
120932-0	164.77	164.70	164.68	164.65	164.56
120933-0	164.65	164.61	164.59	164.56	164.13
120934-0	164.51	164.46	164.42	164.35	163.67
120934-1	161.74	161.74	161.54	161.33	161.02
120935-0	164.65	164.61	164.59	164.56	164.34
120936-0	171.36	171.35	171.35	171.35	171.31
120937-0	170.49	170.45	170.45	170.44	170.32
120938-0	171.17	171.17	171.17	171.09	170.78
120939-0	170.64	170.51	170.51	170.43	170.17
120940-0	170.64	170.52	170.51	170.43	170.30
120941-0	168.92	168.87	168.87	168.83	168.23
120942-0	168.95	168.87	168.87	168.83	168.23
120943-0	167.04	167.00	166.96	166.91	166.58
120944-0	167.30	167.26	167.15	166.97	166.75
120945-0	166.32	166.27	166.05	165.98	165.86
120946-0	165.21	165.13	164.73	164.63	164.57
120947-0	165.44	165.34	164.87	164.78	164.78
120948-0	164.44	164.37	163.94	163.66	163.48
120949-0	164.42	164.37	163.94	163.66	163.44
120950-0	164.42	164.29	163.65	163.46	163.36
120951-0	163.95	163.82	163.34	163.26	163.22
120952-0	163.52	163.36	163.03	162.80	162.65
120953-0	163.46	163.36	163.00	162.80	162.63
120954-0	162.89	162.83	162.76	162.69	162.40
120955-0	162.91	162.89	162.88	162.87	162.46
120956-0	162.91	162.91	162.88	162.87	162.45
120957-0	162.66	162.64	162.50	162.40	162.28
120957-1	161.21	161.21	160.93	160.78	160.61
120958-0	160.44	160.44	160.25	160.12	159.98
120959-0	161.73	161.71	161.69	161.67	161.66
120960-0	161.64	161.60	161.58	161.57	161.56
120961-0	159.42	159.41	159.25	159.09	158.91
120962-0	159.08	158.74	158.42	158.25	158.04
120963-0	158.33	158.10	157.85	156.97	156.03
120963-1	157.81	157.59	157.36	156.63	155.89
120964-0	166.53	166.53	166.53	166.52	166.52
120965-0	166.00	165.95	165.92	165.90	165.89
120966-0	166.37	166.34	166.32	166.30	166.30
120968-0	154.36	154.30	153.83	153.81	153.81
120969-0	153.34	153.33	153.29	153.26	153.25
120970-0	153.38	153.35	153.29	153.25	153.13
120971-0	154.46	154.41	154.06	153.97	153.86
120972-0	152.85	152.78	152.78	152.71	152.48
120973-0	151.92	151.90	151.90	151.89	151.84
120974-0	146.78	146.77	146.77	146.77	146.73
120975-0	143.90	143.83	143.83	143.78	143.73
120976-0	141.64	141.55	141.55	141.53	141.42
120977-0	152.22	152.05	152.04	152.01	151.92
120978-0	152.36	152.29	152.29	152.26	152.21

Pit ID	Peak Water Level (mAHD)				
	PMF	1% AEP	2% AEP	5% AEP	20% AEP
120979-0	151.53	151.38	151.37	151.34	151.26
120980-0	151.03	150.69	150.67	150.58	150.44
120981-0	149.60	149.03	149.01	148.79	148.54
120982-0	148.53	148.40	148.40	148.28	148.03
120983-0	147.67	147.43	147.36	147.26	147.07
120984-0	146.63	146.47	146.40	146.32	146.14
120985-0	145.91	145.81	145.76	145.70	145.52
120986-0	144.93	144.88	144.85	144.82	144.72
120987-0	142.38	142.30	142.27	142.22	142.09
120988-0	140.42	140.25	140.20	140.11	139.85
120989-0	139.69	139.20	139.18	139.10	138.84
120990-0	138.90	138.58	138.58	138.57	138.27
120991-0	137.97	137.66	137.58	137.38	137.11
120992-0	135.69	135.34	135.22	134.89	134.37
120993-0	134.08	133.92	133.85	133.72	133.48
120994-0	132.29	132.16	132.09	131.98	131.79
120995-0	130.42	130.25	130.18	130.08	129.92
120996-0	125.36	124.94	124.94	124.84	124.82
120997-0	124.40	124.03	124.03	123.99	123.75
121001-0	168.56	168.56	168.56	168.56	168.56
121002-0	167.33	167.33	167.33	167.32	167.32
121003-0	167.20	167.18	167.17	167.16	167.15
121004-0	166.11	166.10	166.06	166.06	166.06
121005-0	165.87	165.83	165.80	165.77	165.77
121006-0	164.94	164.94	164.94	164.92	164.87
121007-0	164.72	164.65	164.64	164.61	164.57
121008-0	163.93	163.85	163.84	163.82	163.79
121009-0	166.66	166.63	166.56	166.55	166.55
121010-0	164.95	164.91	164.80	164.78	164.78
121011-0	164.95	164.91	164.80	164.78	164.78
121012-0	164.76	164.68	164.65	164.62	164.61
121013-0	163.97	163.88	163.86	163.84	163.83
121014-0	163.85	163.74	163.71	163.67	163.64
121015-0	164.17	164.10	164.08	164.06	164.01
121016-0	163.43	163.43	163.43	163.42	163.35
121017-0	163.34	163.27	163.26	163.24	163.19
ADV001-0	158.57	158.51	158.50	158.50	158.50
BBC001-0	168.01	168.00	168.00	168.00	168.00
BBC002-0	166.01	166.01	166.01	166.00	166.00
GSC001-0	146.02	145.84	145.80	145.72	145.63
GSC002-0	146.00	145.83	145.79	145.72	145.52
GSC003-0	146.17	146.16	146.16	146.15	146.11
KIAH01-0	148.51	148.33	148.31	148.30	148.23
LYN001-0	157.19	157.14	157.13	157.12	157.10
LYN001-1	157.00	156.53	156.51	156.49	156.48
LYN001-2	155.75	155.25	155.00	154.97	154.95
LYN001-3	155.47	154.93	154.57	154.51	154.48
LYN001-4	153.54	153.15	153.03	152.82	152.56
LYN001-5	153.54	153.15	153.03	152.82	152.56
LYN001-5A	153.53	153.13	151.92	151.75	151.72
LYN002-0	153.54	153.15	153.03	152.82	152.56
LYN002-1	153.54	153.15	153.03	152.82	152.56
LYN002-2	151.72	151.72	151.72	151.69	151.57
LYN002-3	152.57	151.80	151.80	151.75	151.66
LYN003-0	152.53	152.46	152.35	152.33	152.33
LYN003-1	151.90	151.84	151.83	151.83	151.57

Pit ID	Peak Water Level (mAHD)				
	PMF	1% AEP	2% AEP	5% AEP	20% AEP
LYN004-0	156.32	156.32	156.32	156.32	156.29
LYN004-1	155.22	155.21	155.18	155.18	155.18
LYN004-2	154.43	154.42	154.39	154.33	154.19
LYN004-3	152.91	152.91	152.91	152.90	152.90
LYN004-4	151.89	151.66	151.49	151.34	151.16
LYN004-5	151.89	151.66	151.49	151.34	151.16
LYN004-6	151.87	151.64	151.36	151.21	150.87
LYN004-7	151.72	151.16	150.99	150.88	150.88
LYN007-0	152.14	151.57	151.43	151.27	151.26
LYN008-0	152.05	151.32	151.22	151.16	151.13
LYN010-0	152.00	151.32	151.14	151.02	150.97
LYN011-0	151.95	151.31	151.14	151.00	150.78
WDR001-0	164.51	164.50	164.50	164.50	164.50

The tables on the following 23 pages contain the model results for peak discharge in each stormwater pipe for the base case (existing conditions, no blockage of stormwater inlets and culverts) scenario. The results have been presented for all the flood events tested for the critical duration storm (2 hour duration).

Qf represents the pipe full capacity of the individual pipe and is dependent on pipe diameter, pipe gradient and pipe material and associated surface roughness.

The percentage full discharge is calculated the discharge in the pipe for a particular event expressed as a percentage of the pipe full capacity. i.e.:

Percentage of full flow = (Discharge/Pipe full capacity) x 100

Where the pipe discharge exceeds the pipe capacity (% discharge is more than 100%), the pipe will surcharge and flooding may occur.

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
1	120001-0	120006-0	1.733	0.784	0.721	0.754	0.750	0.697	45%	42%	44%	43%	40%
2	120002-0	120003-0	6.210	3.079	2.864	2.694	2.580	2.066	50%	46%	43%	42%	33%
3	120003-0	120005-0	7.675	4.599	3.893	3.553	3.279	2.710	60%	51%	46%	43%	35%
4	120004-0	120003-0	0.860	0.546	0.245	0.264	0.187	0.075	63%	28%	31%	22%	9%
5	120005-0	120006-0	4.891	3.552	3.328	3.414	3.426	2.864	73%	68%	70%	70%	59%
6	120006-0	120029-0	7.114	4.290	4.088	4.189	4.183	3.585	60%	57%	59%	59%	50%
7	120007-0	120008-0	0.433	0.107	0.075	0.087	0.083	0.075	25%	17%	20%	19%	17%
8	120008-0	120008-1	0.480	0.368	0.327	0.319	0.319	0.308	77%	68%	66%	66%	64%
9	120009-0	120010-0	1.781	0.023	0.013	0.029	0.020	0.005	1%	1%	2%	1%	0%
10	120010-0	120012-0	2.259	0.393	0.263	0.287	0.217	0.135	17%	12%	13%	10%	6%
11	120011-0	120010-0	0.469	0.222	0.149	0.157	0.121	0.079	47%	32%	33%	26%	17%
12	120012-0	120012-1	2.544	0.393	0.263	0.288	0.217	0.134	15%	10%	11%	9%	5%
13	120013-0	120014-0	0.705	0.010	0.007	0.007	0.006	0.003	1%	1%	1%	1%	0%
14	120014-0	120014-1	3.460	1.709	1.191	0.995	0.788	0.637	49%	34%	29%	23%	18%
15	120015-0	120015-1	1.597	0.736	0.465	0.457	0.347	0.244	46%	29%	29%	22%	15%
16	120016-0	120017-0	0.836	0.020	0.012	0.018	0.015	0.006	2%	1%	2%	2%	1%
17	120017-0	120018-0	0.720	0.045	0.029	0.060	0.050	0.015	6%	4%	8%	7%	2%
18	120018-0	120020-0	0.609	0.315	0.209	0.210	0.176	0.103	52%	34%	34%	29%	17%
19	120019-0	120018-0	0.223	0.002	0.002	0.002	0.002	0.001	1%	1%	1%	1%	0%
20	120020-0	120015-0	2.113	0.514	0.344	0.333	0.265	0.180	24%	16%	16%	13%	9%
21	120021-0	120015-0	0.367	0.192	0.106	0.106	0.074	0.053	52%	29%	29%	20%	14%
22	120022-0	120023-0	0.408	0.082	0.033	0.078	0.066	0.033	20%	8%	19%	16%	8%
23	120023-0	120024-0	0.657	0.085	0.035	0.081	0.068	0.034	13%	5%	12%	10%	5%
24	120024-0	120025-0	0.825	0.336	0.231	0.167	0.140	0.135	41%	28%	20%	17%	16%
25	120025-0	120026-0	0.723	0.441	0.324	0.250	0.210	0.184	61%	45%	35%	29%	25%
26	120026-0	120027-0	0.497	0.471	0.350	0.274	0.231	0.199	95%	70%	55%	46%	40%
27	120027-0	120028-0	0.528	0.473	0.349	0.280	0.235	0.200	90%	66%	53%	45%	38%
28	120028-0	120028-1	0.765	0.518	0.381	0.307	0.259	0.218	68%	50%	40%	34%	28%
29	120029-0	120030-0	8.315	4.368	4.201	4.218	4.203	3.639	53%	51%	51%	51%	44%
30	120030-0	120031-0	11.257	4.600	4.046	4.424	4.349	3.723	41%	36%	39%	39%	33%
31	120031-0	120031-1	11.724	5.438	4.967	5.188	5.026	4.490	46%	42%	44%	43%	38%
32	120032-0	120033-0	0.362	0.062	0.044	0.046	0.042	0.026	17%	12%	13%	12%	7%
33	120033-0	120030-0	0.517	0.179	0.137	0.152	0.132	0.085	35%	26%	29%	26%	16%
34	120034-0	120031-0	0.667	0.554	0.512	0.450	0.443	0.518	83%	77%	67%	66%	78%
37	120037-0	120124-0	1.464	1.014	0.953	0.953	0.967	0.933	69%	65%	65%	66%	64%
38	120038-0	120037-0	1.721	1.456	1.445	1.449	1.394	1.081	85%	84%	84%	81%	63%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
39	120039-0	120038-0	1.900	1.639	1.238	1.307	1.165	0.869	86%	65%	69%	61%	46%
40	120040-0	120039-0	1.758	1.565	1.173	1.245	1.115	0.831	89%	67%	71%	63%	47%
41	120041-0	120040-0	0.344	0.301	0.302	0.283	0.283	0.301	88%	88%	82%	82%	88%
42	120042-0	120043-0	0.189	0.001	0.001	0.001	0.001	0.000	1%	1%	1%	1%	0%
43	120043-0	120044-0	0.399	0.039	0.021	0.079	0.065	0.012	10%	5%	20%	16%	3%
44	120044-0	120046-0	0.639	0.316	0.297	0.325	0.254	0.238	49%	46%	51%	40%	37%
45	120045-0	120044-0	0.284	0.274	0.272	0.226	0.173	0.224	96%	96%	80%	61%	79%
46	120046-0	120047-0	0.606	0.519	0.535	0.521	0.517	0.533	86%	88%	86%	85%	88%
47	120047-0	120049-0	0.729	0.533	0.540	0.538	0.531	0.536	73%	74%	74%	73%	74%
48	120048-0	120049-0	2.183	1.192	1.113	1.132	1.029	0.774	55%	51%	52%	47%	35%
49	120049-0	120851-3	4.036	1.833	1.705	1.717	1.599	1.336	45%	42%	43%	40%	33%
50	120050-0	120048-0	1.763	1.146	1.071	1.108	1.009	0.751	65%	61%	63%	57%	43%
51	120051-0	120050-0	2.067	1.051	0.921	0.948	0.872	0.646	51%	45%	46%	42%	31%
52	120052-0	120051-0	2.051	1.077	0.918	0.931	0.859	0.645	53%	45%	45%	42%	31%
53	120053-0	120052-0	1.944	1.041	0.898	0.925	0.854	0.643	54%	46%	48%	44%	33%
54	120054-0	120040-0	1.349	1.207	0.818	0.935	0.804	0.484	89%	61%	69%	60%	36%
55	120055-0	120054-0	1.763	0.835	0.546	0.671	0.561	0.300	47%	31%	38%	32%	17%
56	120056-0	120055-0	0.411	0.214	0.137	0.116	0.097	0.074	52%	33%	28%	24%	18%
57	120057-0	120055-0	1.692	0.400	0.271	0.333	0.271	0.152	24%	16%	20%	16%	9%
58	120058-0	120057-0	0.913	0.275	0.194	0.252	0.205	0.123	30%	21%	28%	22%	13%
59	120059-0	120058-0	0.830	0.199	0.131	0.151	0.121	0.080	24%	16%	18%	15%	10%
60	120060-0	120059-0	0.318	0.089	0.059	0.097	0.079	0.044	28%	19%	31%	25%	14%
61	120061-0	120060-0	0.372	0.020	0.012	0.012	0.010	0.006	5%	3%	3%	3%	2%
62	120062-0	120059-0	1.281	0.056	0.034	0.030	0.021	0.013	4%	3%	2%	2%	1%
63	120063-0	120058-0	0.495	0.048	0.048	0.060	0.050	0.035	10%	10%	12%	10%	7%
64	120064-0	120064-1	1.815	1.005	0.874	0.880	0.818	0.634	55%	48%	48%	45%	35%
65	120065-0	120064-0	0.678	0.749	0.730	0.724	0.701	0.552	110%	108%	107%	103%	81%
66	120066-0	120066-1	0.506	0.034	0.023	0.029	0.024	0.011	7%	5%	6%	5%	2%
67	120067-0	120067-1	0.505	0.016	0.012	0.011	0.009	0.007	3%	2%	2%	2%	1%
68	120068-0	120068-1	0.498	0.335	0.332	0.335	0.331	0.301	67%	67%	67%	66%	60%
69	120069-0	120069-1	0.941	0.447	0.361	0.383	0.339	0.247	48%	38%	41%	36%	26%
70	120070-0	120069-0	0.718	0.401	0.327	0.335	0.301	0.229	56%	46%	47%	42%	32%
71	120071-0	120070-0	0.410	0.304	0.293	0.294	0.264	0.211	74%	71%	72%	64%	51%
72	120072-0	120071-0	0.193	0.304	0.292	0.292	0.263	0.210	158%	151%	151%	136%	109%
73	120073-0	120072-0	0.327	0.264	0.264	0.268	0.244	0.195	81%	81%	82%	75%	60%
74	120074-0	120073-0	0.392	0.134	0.102	0.093	0.083	0.067	34%	26%	24%	21%	17%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
75	120075-0	120074-0	0.240	0.027	0.019	0.027	0.023	0.013	11%	8%	11%	10%	5%
76	120076-0	120073-0	0.244	0.168	0.122	0.152	0.129	0.091	69%	50%	62%	53%	37%
77	120077-0	120076-0	0.274	0.093	0.069	0.106	0.090	0.054	34%	25%	39%	33%	20%
78	120078-0	120079-0	0.477	0.186	0.140	0.103	0.088	0.085	39%	29%	22%	18%	18%
79	120079-0	120080-0	0.271	0.136	0.138	0.130	0.129	0.119	50%	51%	48%	48%	44%
80	120080-0	120080-1	0.322	0.321	0.321	0.315	0.314	0.297	100%	100%	98%	98%	92%
81	120081-0	120080-0	0.222	0.022	0.017	0.014	0.014	0.011	10%	8%	6%	6%	5%
82	120082-0	120079-0	0.285	0.036	0.041	0.027	0.030	0.018	13%	14%	9%	11%	6%
83	120083-0	120082-0	0.286	0.049	0.043	0.028	0.019	0.007	17%	15%	10%	7%	2%
84	120084-0	120085-0	0.448	0.358	0.359	0.328	0.277	0.263	80%	80%	73%	62%	59%
85	120085-0	120088-0	0.672	0.399	0.384	0.353	0.297	0.275	59%	57%	53%	44%	41%
86	120086-0	120087-0	0.150	0.068	0.064	0.067	0.059	0.036	45%	43%	45%	39%	24%
87	120087-0	120088-0	0.340	0.289	0.262	0.267	0.268	0.261	85%	77%	79%	79%	77%
88	120088-0	120089-0	0.901	0.651	0.652	0.643	0.642	0.589	72%	72%	71%	71%	65%
89	120089-0	120090-0	0.950	0.691	0.689	0.693	0.692	0.619	73%	73%	73%	73%	65%
90	120090-0	120091-0	1.426	0.861	0.844	0.842	0.826	0.717	60%	59%	59%	58%	50%
91	120091-0	120092-0	2.188	1.633	1.580	1.588	1.451	1.082	75%	72%	73%	66%	49%
92	120092-0	120094-0	2.851	1.499	1.474	1.470	1.445	1.382	53%	52%	52%	51%	48%
93	120093-0	120092-0	0.558	0.175	0.171	0.185	0.188	0.172	31%	31%	33%	34%	31%
94	120094-0	120096-0	1.289	0.985	0.958	0.977	0.965	0.918	76%	74%	76%	75%	71%
95	120095-0	120095-1	2.239	1.703	1.545	1.385	1.327	1.336	76%	69%	62%	59%	60%
96	120096-0	120095-0	0.362	0.451	0.503	0.487	0.493	0.456	125%	139%	135%	136%	126%
97	120097-0	120095-0	0.576	0.215	0.129	0.144	0.122	0.075	37%	22%	25%	21%	13%
98	120098-0	120101-0	0.667	0.295	0.143	0.114	0.089	0.047	44%	21%	17%	13%	7%
99	120099-0	120098-0	0.517	0.210	0.113	0.082	0.061	0.031	41%	22%	16%	12%	6%
100	120100-0	120101-0	0.188	0.049	0.021	0.030	0.024	0.008	26%	11%	16%	13%	4%
101	120101-0	120091-0	0.739	0.471	0.238	0.367	0.304	0.076	64%	32%	50%	41%	10%
102	120102-0	120101-0	0.610	0.144	0.077	0.225	0.192	0.023	24%	13%	37%	31%	4%
103	120103-0	120266-0	1.113	0.530	0.522	0.525	0.514	0.498	48%	47%	47%	46%	45%
104	120104-0	120103-0	0.511	0.525	0.543	0.532	0.507	0.497	103%	106%	104%	99%	97%
105	120105-0	120104-0	0.213	0.270	0.280	0.269	0.269	0.271	127%	131%	126%	126%	127%
106	120106-0	120105-0	0.258	0.007	0.005	0.005	0.006	0.005	3%	2%	2%	2%	2%
107	120107-0	120104-0	0.478	0.338	0.332	0.317	0.292	0.251	71%	69%	66%	61%	53%
108	120108-0	120107-0	0.449	0.374	0.307	0.284	0.266	0.237	83%	68%	63%	59%	53%
109	120109-0	120108-0	0.409	0.311	0.264	0.239	0.227	0.210	76%	65%	58%	56%	51%
110	120110-0	120109-0	0.454	0.287	0.260	0.232	0.221	0.208	63%	57%	51%	49%	46%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
111	120111-0	120110-0	0.193	0.193	0.193	0.195	0.191	0.170	100%	100%	101%	99%	88%
112	120112-0	120111-0	0.140	0.171	0.177	0.176	0.175	0.152	122%	126%	126%	125%	109%
113	120113-0	120112-0	0.137	0.055	0.058	0.077	0.055	0.044	40%	42%	56%	40%	32%
114	120114-0	120113-0	0.263	0.046	0.003	0.004	0.004	0.003	17%	1%	2%	2%	1%
115	120115-0	120116-0	0.487	0.078	0.056	0.051	0.043	0.036	16%	11%	10%	9%	7%
116	120116-0	120117-0	0.474	0.189	0.092	0.094	0.079	0.053	40%	19%	20%	17%	11%
117	120117-0	120119-0	0.356	0.278	0.281	0.304	0.301	0.208	78%	79%	85%	85%	58%
118	120118-0	120117-0	0.394	0.123	0.079	0.137	0.115	0.047	31%	20%	35%	29%	12%
119	120119-0	120120-0	0.404	0.367	0.368	0.362	0.363	0.288	91%	91%	90%	90%	71%
120	120120-0	120121-0	0.485	0.368	0.367	0.366	0.366	0.289	76%	76%	75%	75%	60%
121	120121-0	120122-0	0.529	0.368	0.357	0.360	0.357	0.350	70%	67%	68%	67%	66%
122	120122-0	120123-0	0.304	0.296	0.284	0.284	0.278	0.289	97%	93%	93%	91%	95%
123	120123-0	120124-0	0.674	0.279	0.274	0.273	0.279	0.288	41%	41%	41%	41%	43%
124	120124-0	120031-1	1.597	1.334	1.224	1.277	1.265	1.216	84%	77%	80%	79%	76%
125	120125-0	120125-1	0.500	0.370	0.323	0.306	0.245	0.150	74%	65%	61%	49%	30%
126	120126-0	120127-0	7.542	3.090	3.142	3.234	3.237	3.203	41%	42%	43%	43%	42%
128	120128-0	120127-0	1.032	0.663	0.603	0.599	0.614	0.595	64%	58%	58%	59%	58%
129	120129-0	120128-0	0.811	0.703	0.699	0.699	0.660	0.670	87%	86%	86%	81%	83%
130	120130-0	120128-0	0.404	0.051	0.023	0.010	0.008	0.006	13%	6%	2%	2%	1%
131	120131-0	120129-0	0.719	0.626	0.598	0.542	0.533	0.565	87%	83%	75%	74%	79%
132	120132-0	120131-0	0.669	0.535	0.534	0.509	0.506	0.526	80%	80%	76%	76%	79%
133	120133-0	120132-0	0.525	0.485	0.484	0.489	0.488	0.484	92%	92%	93%	93%	92%
134	120134-0	120135-0	0.177	0.097	0.112	0.093	0.080	0.073	55%	63%	53%	45%	41%
135	120135-0	120137-0	0.477	0.368	0.368	0.244	0.200	0.296	77%	77%	51%	42%	62%
136	120136-0	120135-0	0.490	0.296	0.296	0.151	0.121	0.224	60%	60%	31%	25%	46%
137	120137-0	120138-0	0.490	0.454	0.455	0.453	0.381	0.408	93%	93%	92%	78%	83%
138	120138-0	120139-0	0.480	0.416	0.416	0.417	0.413	0.416	87%	87%	87%	86%	87%
139	120139-0	120140-0	0.392	0.429	0.431	0.438	0.436	0.431	109%	110%	112%	111%	110%
140	120140-0	120133-0	0.679	0.619	0.619	0.618	0.617	0.618	91%	91%	91%	91%	91%
141	120141-0	120139-0	0.493	0.274	0.128	0.288	0.244	0.062	56%	26%	58%	49%	13%
142	120142-0	120141-0	0.364	0.013	0.010	0.016	0.014	0.006	4%	3%	4%	4%	2%
143	120143-0	120141-0	0.461	0.252	0.078	0.190	0.153	0.035	55%	17%	41%	33%	8%
144	120144-0	120126-0	3.482	3.581	3.577	3.547	3.519	3.459	103%	103%	102%	101%	99%
145	120145-0	120144-0	4.763	2.519	2.463	2.575	2.583	2.298	53%	52%	54%	54%	48%
146	120146-0	120145-0	0.660	0.404	0.383	0.090	0.090	0.409	61%	58%	14%	14%	62%
147	120147-0	120145-0	1.843	2.718	2.630	2.675	2.677	2.553	147%	143%	145%	145%	139%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
148	120148-0	120147-0	5.089	3.371	3.324	3.331	3.287	2.786	66%	65%	65%	65%	55%
149	120149-0	120148-0	1.461	0.471	0.570	0.749	0.744	0.203	32%	39%	51%	51%	14%
150	120150-0	120148-0	5.230	2.473	2.103	2.064	2.050	2.294	47%	40%	39%	39%	44%
151	120151-0	120150-0	2.119	1.710	1.620	1.639	1.636	1.191	81%	76%	77%	77%	56%
152	120152-0	120151-0	1.025	0.518	0.491	0.391	0.335	0.256	51%	48%	38%	33%	25%
153	120153-0	120152-0	0.578	0.337	0.327	0.258	0.220	0.149	58%	57%	45%	38%	26%
154	120154-0	120152-0	0.414	0.065	0.051	0.002	0.002	0.001	16%	12%	0%	0%	0%
155	120155-0	120151-0	2.535	1.891	1.312	1.264	1.079	0.820	75%	52%	50%	43%	32%
156	120156-0	120155-0	1.598	0.829	0.478	0.365	0.310	0.271	52%	30%	23%	19%	17%
157	120157-0	120155-0	1.921	0.511	0.368	0.558	0.465	0.216	27%	19%	29%	24%	11%
158	120158-0	120157-0	0.490	0.507	0.367	0.483	0.402	0.214	103%	75%	99%	82%	44%
159	120159-0	120158-0	0.212	0.097	0.030	0.044	0.036	0.005	46%	14%	21%	17%	2%
160	120160-0	120158-0	0.523	0.347	0.255	0.396	0.335	0.180	66%	49%	76%	64%	34%
161	120161-0	120160-0	0.713	0.291	0.205	0.209	0.177	0.135	41%	29%	29%	25%	19%
162	120162-0	120161-0	0.379	0.155	0.106	0.155	0.129	0.076	41%	28%	41%	34%	20%
163	120163-0	120163-1	0.250	0.391	0.380	0.371	0.367	0.246	156%	152%	148%	147%	98%
164	120164-0	120163-0	0.578	0.351	0.349	0.356	0.355	0.213	61%	60%	62%	61%	37%
165	120165-0	120164-0	0.428	0.354	0.264	0.219	0.184	0.153	83%	62%	51%	43%	36%
166	120166-0	120165-0	0.280	0.016	0.010	0.013	0.011	0.005	6%	4%	5%	4%	2%
167	120167-0	120168-0	0.343	0.011	0.007	0.016	0.013	0.004	3%	2%	5%	4%	1%
168	120168-0	120168-1	0.354	0.149	0.104	0.115	0.096	0.060	42%	29%	32%	27%	17%
169	120169-0	120170-0	0.643	0.049	0.034	0.034	0.029	0.020	8%	5%	5%	5%	3%
170	120170-0	120171-0	0.255	0.075	0.051	0.049	0.042	0.031	29%	20%	19%	16%	12%
171	120171-0	120172-0	0.494	0.270	0.155	0.213	0.174	0.077	55%	31%	43%	35%	16%
172	120172-0	120173-0	0.488	0.270	0.155	0.213	0.174	0.077	55%	32%	44%	36%	16%
173	120173-0	120196-0	0.482	0.279	0.160	0.217	0.178	0.079	58%	33%	45%	37%	16%
174	120174-0	120175-0	1.672	0.442	0.380	0.414	0.349	0.185	26%	23%	25%	21%	11%
175	120175-0	120176-0	1.574	0.674	0.539	0.481	0.400	0.267	43%	34%	31%	25%	17%
176	120176-0	120177-0	2.076	1.396	1.277	1.143	0.979	0.713	67%	62%	55%	47%	34%
177	120177-0	120150-0	2.668	1.934	1.600	1.451	1.233	0.876	72%	60%	54%	46%	33%
178	120178-0	120176-0	0.453	0.239	0.231	0.220	0.189	0.142	53%	51%	49%	42%	31%
179	120179-0	120180-0	0.166	0.006	0.004	0.007	0.006	0.002	4%	2%	4%	4%	1%
180	120180-0	120181-0	0.655	0.006	0.004	0.007	0.006	0.002	1%	1%	1%	1%	0%
181	120181-0	120182-0	0.368	0.006	0.004	0.007	0.006	0.002	2%	1%	2%	2%	1%
182	120182-0	120183-0	0.265	0.006	0.004	0.007	0.006	0.002	2%	2%	3%	2%	1%
183	120183-0	120184-0	0.194	0.006	0.004	0.007	0.006	0.002	3%	2%	4%	3%	1%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
184	120184-0	120185-0	0.302	0.061	0.040	0.063	0.053	0.020	20%	13%	21%	18%	7%
185	120185-0	120186-0	0.636	0.074	0.048	0.080	0.067	0.025	12%	8%	13%	11%	4%
186	120186-0	120174-0	1.465	0.386	0.349	0.375	0.318	0.169	26%	24%	26%	22%	12%
187	120187-0	120186-0	0.704	0.312	0.301	0.295	0.251	0.145	44%	43%	42%	36%	21%
188	120188-0	120187-0	0.245	0.299	0.293	0.282	0.239	0.141	122%	120%	115%	98%	58%
189	120189-0	120189-1	0.201	0.283	0.281	0.268	0.228	0.132	141%	140%	133%	113%	66%
190	120190-0	120189-0	0.420	0.311	0.281	0.262	0.223	0.130	74%	67%	62%	53%	31%
191	120191-0	120190-0	0.125	0.223	0.212	0.208	0.174	0.099	178%	170%	166%	139%	79%
192	120192-0	120191-0	0.142	0.009	0.006	0.004	0.003	0.003	6%	4%	3%	2%	2%
193	120193-0	120194-0	1.237	0.148	0.097	0.110	0.094	0.060	12%	8%	9%	8%	5%
194	120194-0	120195-0	1.003	0.741	0.507	0.459	0.391	0.297	74%	51%	46%	39%	30%
195	120195-0	120197-0	2.958	1.278	1.031	0.952	0.823	0.716	43%	35%	32%	28%	24%
196	120196-0	120195-0	0.754	0.540	0.535	0.500	0.434	0.421	72%	71%	66%	58%	56%
197	120197-0	120198-0	3.564	1.524	1.175	1.211	1.054	0.807	43%	33%	34%	30%	23%
198	120198-0	120214-0	2.594	1.692	1.418	1.478	1.269	0.910	65%	55%	57%	49%	35%
199	120199-0	120200-0	0.330	0.235	0.241	0.207	0.207	0.235	71%	73%	63%	63%	71%
200	120200-0	120219-0	0.244	0.252	0.245	0.235	0.236	0.246	103%	100%	96%	97%	101%
201	120201-0	120200-0	0.319	0.138	0.136	0.131	0.100	0.081	43%	43%	41%	31%	25%
202	120202-0	120202-1	0.665	0.721	0.710	0.704	0.701	0.700	108%	107%	106%	105%	105%
203	120203-0	120202-0	0.367	0.373	0.374	0.370	0.370	0.373	102%	102%	101%	101%	102%
204	120204-0	120203-0	0.452	0.169	0.127	0.217	0.216	0.071	37%	28%	48%	48%	16%
205	120205-0	120203-0	0.423	0.363	0.362	0.372	0.375	0.362	86%	86%	88%	89%	86%
206	120206-0	120205-0	0.439	0.164	0.165	0.160	0.160	0.162	37%	38%	36%	36%	37%
207	120207-0	120205-0	0.403	0.325	0.303	0.292	0.259	0.203	81%	75%	72%	64%	50%
208	120208-0	120207-0	0.325	0.181	0.075	0.099	0.083	0.031	56%	23%	30%	26%	10%
209	120209-0	120210-0	0.279	0.045	0.032	0.031	0.026	0.020	16%	11%	11%	9%	7%
210	120210-0	120211-0	0.272	0.058	0.039	0.064	0.054	0.022	21%	14%	24%	20%	8%
211	120211-0	120211-1	0.384	0.105	0.072	0.082	0.069	0.041	27%	19%	21%	18%	11%
212	120212-0	120213-1	0.327	0.159	0.094	0.103	0.086	0.051	49%	29%	31%	26%	16%
213	120213-0	120213-1	0.376	0.047	0.031	0.017	0.014	0.015	13%	8%	5%	4%	4%
213.2	KIAH01-0	120279-0	0.573	0.206	0.124	0.119	0.099	0.066	36%	22%	21%	17%	12%
214	120214-0	120215-0	2.388	1.458	1.423	1.513	1.516	1.073	61%	60%	63%	63%	45%
215	120215-0	120218-0	2.914	2.188	2.183	2.178	2.152	1.691	75%	75%	75%	74%	58%
216	120216-0	120215-0	0.517	0.000	0.000	0.000	0.000	0.000	0%	0%	0%	0%	0%
217	120217-0	120216-0	0.377	0.000	0.000	0.000	0.000	0.000	0%	0%	0%	0%	0%
218	120218-0	120221-0	2.786	2.415	2.318	2.313	2.256	1.750	87%	83%	83%	81%	63%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
219	120219-0	120220-0	0.320	0.299	0.298	0.300	0.299	0.297	93%	93%	94%	93%	93%
220	120220-0	120226-0	0.257	0.271	0.272	0.270	0.270	0.272	105%	106%	105%	105%	106%
221	120221-0	120222-0	2.939	2.238	2.106	2.079	2.067	1.768	76%	72%	71%	70%	60%
222	120222-0	120223-0	4.763	2.264	2.126	2.099	2.083	1.780	48%	45%	44%	44%	37%
223	120223-0	120223-1	4.730	2.459	2.262	2.205	2.175	1.850	52%	48%	47%	46%	39%
224	120224-0	120223-1	9.051	0.030	0.009	0.023	0.015	0.002	0%	0%	0%	0%	0%
225	120225-0	120980-0	8.858	4.436	3.705	3.597	3.392	2.789	50%	42%	41%	38%	31%
226	120226-0	120225-0	0.722	0.421	0.367	0.392	0.379	0.334	58%	51%	54%	52%	46%
227	120227-0	120225-0	0.856	0.286	0.152	0.084	0.061	0.076	33%	18%	10%	7%	9%
228	120228-0	120227-0	0.218	0.158	0.082	0.025	0.014	0.033	72%	38%	11%	6%	15%
231	120231-0	120239-0	1.188	0.663	0.587	0.616	0.565	0.496	56%	49%	52%	48%	42%
232	120232-0	120231-0	0.430	0.247	0.249	0.247	0.247	0.249	57%	58%	57%	57%	58%
233	120233-0	120232-0	0.237	0.245	0.246	0.242	0.242	0.246	103%	104%	102%	102%	104%
234	120234-0	120233-0	0.187	0.036	0.002	0.002	0.003	0.003	19%	1%	1%	2%	2%
235	120235-0	120233-0	0.278	0.149	0.154	0.127	0.108	0.095	54%	55%	46%	39%	34%
236	120236-0	120230-0	0.341	0.008	0.006	0.008	0.007	0.004	2%	2%	2%	2%	1%
237	120237-0	120231-0	0.168	0.190	0.116	0.165	0.129	0.047	113%	69%	98%	77%	28%
238	120238-0	120237-0	0.300	0.043	0.030	0.048	0.041	0.016	14%	10%	16%	14%	5%
239	120239-0	120163-3	0.584	0.663	0.586	0.614	0.565	0.496	114%	100%	105%	97%	85%
240	120240-0	120127-1	7.518	4.804	4.569	4.535	4.540	4.255	64%	61%	60%	60%	57%
242	120242-0	120241-0	0.385	0.335	0.332	0.324	0.335	0.308	87%	86%	84%	87%	80%
243	120243-0	120242-0	0.413	0.247	0.184	0.242	0.205	0.115	60%	45%	59%	50%	28%
244	120244-0	120243-0	0.535	0.199	0.137	0.160	0.137	0.086	37%	26%	30%	26%	16%
245	120245-0	120244-0	0.417	0.034	0.024	0.051	0.043	0.013	8%	6%	12%	10%	3%
246	120246-0	120247-0	0.290	0.058	0.058	0.003	0.033	0.003	20%	20%	1%	11%	1%
247	120247-0	120248-0	0.410	0.393	0.395	0.360	0.363	0.357	96%	96%	88%	89%	87%
248	120248-0	120249-0	0.488	0.452	0.452	0.450	0.450	0.403	93%	93%	92%	92%	83%
249	120249-0	120251-0	0.536	0.535	0.468	0.485	0.472	0.471	100%	87%	90%	88%	88%
250	120250-0	120249-0	0.428	0.337	0.332	0.326	0.323	0.327	79%	78%	76%	75%	76%
251	120251-0	120252-0	0.814	0.713	0.754	0.526	0.547	0.516	88%	93%	65%	67%	63%
255	120255-0	120997-0	2.133	2.665	2.519	2.285	2.319	2.167	125%	118%	107%	109%	102%
256	120256-0	120255-0	8.366	2.378	2.275	2.112	2.014	1.939	28%	27%	25%	24%	23%
257	120257-0	120256-0	2.473	2.246	2.211	2.073	1.996	1.923	91%	89%	84%	81%	78%
258	120258-0	120257-0	2.286	2.013	2.007	1.921	1.870	1.710	88%	88%	84%	82%	75%
259	120259-0	120258-0	2.422	1.694	1.649	1.664	1.659	1.482	70%	68%	69%	68%	61%
260	120260-0	120259-0	0.839	0.783	0.734	0.745	0.769	0.586	93%	87%	89%	92%	70%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
261	120261-0	120260-0	0.821	0.596	0.581	0.580	0.607	0.510	73%	71%	71%	74%	62%
262	120262-0	120259-0	1.005	0.926	0.921	0.927	0.919	0.896	92%	92%	92%	91%	89%
263	120263-0	120264-0	0.250	0.014	0.002	0.024	0.017	0.002	6%	1%	10%	7%	1%
264	120264-0	120265-0	1.228	1.033	0.979	0.976	0.987	0.906	84%	80%	79%	80%	74%
265	120265-0	120997-0	1.042	1.297	1.152	1.252	1.250	1.047	124%	111%	120%	120%	100%
266	120266-0	120264-0	1.087	0.620	0.540	0.662	0.617	0.504	57%	50%	61%	57%	46%
267	120267-0	120268-0	0.381	0.114	0.058	0.038	0.032	0.033	30%	15%	10%	8%	9%
268	120268-0	120268-1	0.367	0.419	0.177	0.176	0.148	0.099	114%	48%	48%	40%	27%
269	120269-0	120268-0	0.380	0.051	0.001	0.002	0.001	0.001	13%	0%	1%	0%	0%
270	120270-0	120270-1	0.424	0.046	0.023	0.047	0.037	0.012	11%	5%	11%	9%	3%
271	120271-0	120270-1	0.470	0.047	0.031	0.029	0.024	0.019	10%	7%	6%	5%	4%
272	120272-0	120273-0	0.219	0.043	0.020	0.033	0.029	0.008	20%	9%	15%	13%	4%
273	120273-0	120274-0	0.410	0.226	0.139	0.189	0.159	0.070	55%	34%	46%	39%	17%
274	120274-0	120276-0	0.338	0.285	0.282	0.273	0.230	0.174	84%	83%	81%	68%	51%
275	120275-0	120274-0	0.281	0.027	0.018	0.020	0.019	0.012	10%	6%	7%	7%	4%
276	120276-0	120277-0	0.384	0.335	0.320	0.337	0.336	0.333	87%	83%	88%	88%	87%
277	120277-0	120278-0	0.457	0.434	0.435	0.423	0.418	0.392	95%	95%	93%	91%	86%
278	120278-0	120282-0	1.122	0.762	0.637	0.708	0.661	0.519	68%	57%	63%	59%	46%
279	120279-0	120278-0	0.569	0.346	0.207	0.289	0.244	0.135	61%	36%	51%	43%	24%
280	120280-0	120279-0	0.214	0.052	0.034	0.042	0.035	0.021	24%	16%	20%	16%	10%
281	120281-0	120280-0	0.352	0.013	0.004	0.010	0.006	0.002	4%	1%	3%	2%	1%
282	120282-0	120285-0	1.442	1.177	0.995	0.989	0.902	0.723	82%	69%	69%	63%	50%
283	120283-0	120282-0	0.430	0.238	0.238	0.090	0.071	0.130	55%	55%	21%	17%	30%
284	120284-0	120283-0	0.310	0.236	0.236	0.089	0.070	0.129	76%	76%	29%	23%	42%
285	120285-0	120286-0	1.155	1.052	1.059	1.043	0.983	0.813	91%	92%	90%	85%	70%
286	120286-0	120286-1	1.544	1.088	1.061	1.074	0.998	0.848	70%	69%	70%	65%	55%
287	120287-0	120286-0	0.314	0.041	0.053	0.060	0.003	0.002	13%	17%	19%	1%	1%
288	120288-0	120286-0	0.402	0.005	0.034	0.024	0.009	0.001	1%	8%	6%	2%	0%
289	120289-0	120289-1	0.469	0.331	0.319	0.314	0.311	0.312	71%	68%	67%	66%	67%
290	120290-0	120291-0	0.083	0.186	0.186	0.180	0.179	0.186	224%	224%	217%	216%	224%
291	120291-0	120292-0	0.384	0.194	0.192	0.187	0.187	0.193	51%	50%	49%	49%	50%
292	120292-0	120293-0	0.461	0.255	0.255	0.256	0.257	0.248	55%	55%	56%	56%	54%
293	120293-0	120294-0	0.144	0.295	0.291	0.288	0.288	0.292	205%	202%	200%	200%	203%
294	120294-0	120295-0	0.375	0.317	0.307	0.316	0.307	0.304	85%	82%	84%	82%	81%
295	120295-0	120296-0	0.492	0.466	0.437	0.420	0.436	0.441	95%	89%	85%	89%	90%
296	120296-0	120297-0	0.655	0.466	0.437	0.419	0.436	0.441	71%	67%	64%	67%	67%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
297	120297-0	120298-0	0.670	0.656	0.650	0.658	0.657	0.609	98%	97%	98%	98%	91%
298	120298-0	120298-1	7.885	3.299	2.544	2.510	2.358	2.019	42%	32%	32%	30%	26%
300	120300-0	120300-1	0.462	0.112	0.074	0.122	0.098	0.023	24%	16%	26%	21%	5%
301	120301-0	120309-2	0.229	0.207	0.204	0.217	0.217	0.200	90%	89%	95%	95%	87%
302	120302-0	120303-0	0.361	0.048	0.010	0.007	0.000	0.000	13%	3%	2%	0%	0%
303	120303-0	120300-1	0.382	0.014	0.018	0.026	0.001	0.001	4%	5%	7%	0%	0%
304	120304-0	120305-0	0.366	0.240	0.239	0.245	0.217	0.145	66%	65%	67%	59%	40%
305	120305-0	120307-0	0.435	0.434	0.433	0.430	0.388	0.281	100%	100%	99%	89%	65%
306	120306-0	120305-0	0.620	0.240	0.245	0.202	0.171	0.135	39%	40%	33%	28%	22%
307	120307-0	120308-0	0.886	0.807	0.683	0.686	0.604	0.413	91%	77%	77%	68%	47%
308	120308-0	120310-0	1.566	1.092	0.975	0.972	0.888	0.699	70%	62%	62%	57%	45%
309	120309-0	120308-0	0.309	0.327	0.310	0.297	0.290	0.290	106%	100%	96%	94%	94%
310	120310-0	120391-0	1.589	1.279	1.266	1.263	1.225	0.999	80%	80%	79%	77%	63%
311	120311-0	120310-0	0.281	0.064	0.049	0.073	0.063	0.026	23%	17%	26%	22%	9%
312	120312-0	120312-1	0.457	0.037	0.026	0.026	0.022	0.014	8%	6%	6%	5%	3%
313	120313-0	120314-0	0.334	0.015	0.011	0.009	0.007	0.007	4%	3%	3%	2%	2%
314	120314-0	120982-0	0.923	0.017	0.012	0.010	0.009	0.007	2%	1%	1%	1%	1%
315	120315-0	120317-0	1.167	1.194	0.893	0.866	0.730	0.517	102%	77%	74%	63%	44%
316	120316-0	120315-0	0.378	0.140	0.106	0.121	0.112	0.068	37%	28%	32%	30%	18%
317	120317-0	120225-0	4.981	1.275	0.938	0.908	0.766	0.539	26%	19%	18%	15%	11%
318	120318-0	120316-0	0.296	0.140	0.106	0.121	0.112	0.068	47%	36%	41%	38%	23%
319	120319-0	120318-0	0.704	0.058	0.049	0.046	0.043	0.036	8%	7%	7%	6%	5%
320	120320-0	120316-0	0.629	0.000	0.000	0.000	0.000	0.000	0%	0%	0%	0%	0%
321	120321-0	120320-0	0.356	0.000	0.000	0.000	0.000	0.000	0%	0%	0%	0%	0%
322	120322-0	120315-0	0.663	0.779	0.628	0.609	0.502	0.362	117%	95%	92%	76%	55%
323	120323-0	120322-0	0.709	0.736	0.584	0.538	0.447	0.327	104%	82%	76%	63%	46%
324	120324-0	120323-0	0.438	0.004	0.001	0.007	0.006	0.000	1%	0%	2%	1%	0%
325	120325-0	120323-0	2.203	0.682	0.526	0.469	0.394	0.303	31%	24%	21%	18%	14%
326	120326-0	120325-0	2.288	0.668	0.520	0.464	0.387	0.301	29%	23%	20%	17%	13%
327	120327-0	120326-0	1.965	0.570	0.453	0.412	0.342	0.261	29%	23%	21%	17%	13%
328	120328-0	120327-0	0.568	0.014	0.009	0.010	0.008	0.005	2%	2%	2%	1%	1%
329	120329-0	120328-0	0.512	0.014	0.009	0.010	0.009	0.005	3%	2%	2%	2%	1%
330	120330-0	120329-0	0.450	0.010	0.006	0.008	0.006	0.003	2%	1%	2%	1%	1%
331	120331-0	120330-0	0.349	0.010	0.006	0.008	0.006	0.003	3%	2%	2%	2%	1%
332	120332-0	120327-0	2.385	0.520	0.422	0.377	0.315	0.249	22%	18%	16%	13%	10%
333	120333-0	120332-0	2.331	0.309	0.274	0.228	0.191	0.165	13%	12%	10%	8%	7%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
334	120334-0	120333-0	2.069	0.304	0.271	0.225	0.188	0.164	15%	13%	11%	9%	8%
335	120335-0	120334-0	0.375	0.049	0.040	0.050	0.043	0.025	13%	11%	13%	11%	7%
336	120336-0	120335-0	0.276	0.002	0.002	0.003	0.002	0.001	1%	1%	1%	1%	0%
337	120337-0	120336-0	0.578	0.002	0.001	0.001	0.001	0.001	0%	0%	0%	0%	0%
338	120338-0	120334-0	1.376	0.208	0.196	0.137	0.115	0.118	15%	14%	10%	8%	9%
339	120339-0	120338-0	0.357	0.207	0.195	0.135	0.114	0.119	58%	55%	38%	32%	33%
340	120340-0	120339-0	0.343	0.004	0.003	0.003	0.003	0.002	1%	1%	1%	1%	1%
341	120341-0	120339-0	0.094	0.200	0.191	0.131	0.110	0.117	213%	203%	139%	117%	124%
342	120342-0	120341-0	0.225	0.182	0.179	0.120	0.102	0.110	81%	80%	53%	45%	49%
345	120345-0	120346-0	0.305	0.292	0.292	0.286	0.283	0.288	96%	96%	94%	93%	94%
346	120346-0	120347-0	0.547	0.388	0.349	0.381	0.362	0.319	71%	64%	70%	66%	58%
347	120347-0	120348-0	0.635	0.388	0.349	0.381	0.362	0.319	61%	55%	60%	57%	50%
348	120348-0	120349-0	0.699	0.415	0.375	0.405	0.382	0.334	59%	54%	58%	55%	48%
349	120349-0	120350-0	0.704	0.388	0.389	0.383	0.383	0.388	55%	55%	54%	54%	55%
350	120350-0	120351-0	0.434	0.388	0.393	0.389	0.386	0.388	89%	91%	90%	89%	89%
351	120351-0	120359-0	1.089	0.768	0.755	0.809	0.806	0.744	71%	69%	74%	74%	68%
352	120352-0	120351-0	0.653	0.209	0.113	0.241	0.189	0.058	32%	17%	37%	29%	9%
353	120353-0	120352-0	0.540	0.174	0.103	0.212	0.167	0.054	32%	19%	39%	31%	10%
354	120354-0	120354-1	0.312	0.299	0.317	0.311	0.311	0.293	96%	102%	100%	100%	94%
355	120355-0	120354-0	0.414	0.362	0.368	0.375	0.375	0.358	87%	89%	91%	91%	86%
356	120356-0	120355-0	0.446	0.357	0.380	0.376	0.377	0.357	80%	85%	84%	85%	80%
357	120357-0	120356-0	0.443	0.348	0.350	0.341	0.341	0.345	79%	79%	77%	77%	78%
358	120358-0	120357-0	0.383	0.186	0.132	0.159	0.134	0.074	49%	34%	42%	35%	19%
359	120359-0	120360-0	2.325	1.260	1.182	1.156	1.118	1.019	54%	51%	50%	48%	44%
360	120360-0	120361-0	1.481	1.217	1.189	1.165	1.122	1.019	82%	80%	79%	76%	69%
361	120361-0	120362-0	1.244	0.656	0.603	0.557	0.564	0.578	53%	48%	45%	45%	46%
362	120362-0	120995-0	0.674	0.808	0.891	0.893	1.162	0.653	120%	132%	132%	172%	97%
363	120363-0	120362-0	0.315	0.072	0.054	0.076	0.080	0.058	23%	17%	24%	25%	18%
364	120364-0	120995-0	0.664	0.533	0.420	0.460	0.461	0.416	80%	63%	69%	69%	63%
365	120365-0	120364-0	0.616	0.405	0.374	0.400	0.401	0.352	66%	61%	65%	65%	57%
366	120366-0	120365-0	0.223	0.211	0.202	0.154	0.039	0.013	95%	91%	69%	17%	6%
367	120367-0	120365-0	0.451	0.260	0.173	0.200	0.169	0.098	58%	38%	44%	37%	22%
368	120368-0	120367-0	0.431	0.246	0.169	0.169	0.142	0.096	57%	39%	39%	33%	22%
369	120369-0	120368-0	0.437	0.206	0.142	0.126	0.106	0.081	47%	32%	29%	24%	19%
370	120370-0	120369-0	0.433	0.157	0.107	0.081	0.069	0.063	36%	25%	19%	16%	15%
371	120371-0	120370-0	0.429	0.102	0.077	0.061	0.052	0.046	24%	18%	14%	12%	11%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
372	120372-0	120371-0	0.511	0.102	0.077	0.061	0.052	0.046	20%	15%	12%	10%	9%
379	120977-0	120979-0	0.490	0.268	0.148	0.149	0.125	0.075	55%	30%	30%	26%	15%
386	120386-0	120387-0	0.387	0.041	0.029	0.047	0.037	0.009	11%	7%	12%	10%	2%
387	120387-0	120388-0	0.411	0.060	0.042	0.058	0.046	0.016	15%	10%	14%	11%	4%
388	120388-0	120388-1	0.494	0.180	0.141	0.158	0.130	0.070	36%	29%	32%	26%	14%
389	120389-0	120311-0	0.390	0.064	0.049	0.075	0.064	0.027	16%	13%	19%	16%	7%
390	120390-0	120989-0	1.719	1.230	1.194	1.196	1.153	1.000	72%	69%	70%	67%	58%
391	120391-0	120390-0	1.361	1.273	1.266	1.263	1.225	0.999	94%	93%	93%	90%	73%
392	120392-0	120393-0	0.353	0.002	0.001	0.005	0.004	0.001	1%	0%	1%	1%	0%
393	120393-0	120394-0	0.458	0.021	0.013	0.123	0.091	0.006	5%	3%	27%	20%	1%
394	120394-0	120395-0	1.312	0.814	0.816	0.777	0.738	0.694	62%	62%	59%	56%	53%
395	120395-0	120395-1	1.460	0.815	0.823	0.788	0.745	0.695	56%	56%	54%	51%	48%
396	120396-0	120394-0	0.711	0.654	0.654	0.644	0.644	0.649	92%	92%	91%	91%	91%
397	120397-0	120396-0	0.631	0.654	0.654	0.644	0.644	0.649	104%	104%	102%	102%	103%
398	120398-0	120397-0	0.646	0.433	0.431	0.437	0.436	0.431	67%	67%	68%	67%	67%
399	120399-0	120398-0	0.531	0.284	0.283	0.282	0.281	0.281	53%	53%	53%	53%	53%
400	120400-0	120398-0	0.700	0.380	0.302	0.274	0.230	0.190	54%	43%	39%	33%	27%
401	120401-0	120400-0	0.392	0.332	0.256	0.187	0.159	0.149	85%	65%	48%	41%	38%
402	120402-0	120401-0	0.423	0.182	0.132	0.095	0.080	0.071	43%	31%	22%	19%	17%
403	120403-0	120402-0	0.543	0.182	0.132	0.096	0.080	0.072	34%	24%	18%	15%	13%
404	120404-0	120403-0	0.403	0.181	0.132	0.096	0.080	0.072	45%	33%	24%	20%	18%
405	120405-0	120404-0	0.436	0.154	0.116	0.079	0.066	0.065	35%	27%	18%	15%	15%
406	120406-0	120405-0	0.526	0.085	0.064	0.040	0.034	0.039	16%	12%	8%	6%	7%
407	120407-0	120406-0	0.616	0.017	0.013	0.010	0.009	0.007	3%	2%	2%	1%	1%
408	120408-0	120405-0	0.243	0.064	0.049	0.036	0.030	0.026	26%	20%	15%	12%	11%
409	120409-0	120410-0	0.274	0.026	0.017	0.086	0.070	0.007	9%	6%	31%	26%	3%
410	120410-0	120411-0	0.470	0.090	0.059	0.130	0.103	0.024	19%	13%	28%	22%	5%
411	120411-0	120414-0	0.781	0.516	0.445	0.485	0.455	0.356	66%	57%	62%	58%	46%
412	120412-0	120411-0	0.342	0.259	0.250	0.244	0.242	0.245	76%	73%	71%	71%	72%
413	120413-0	120412-0	0.456	0.236	0.226	0.196	0.196	0.229	52%	50%	43%	43%	50%
414	120414-0	120993-0	1.104	0.616	0.652	0.597	0.589	0.387	56%	59%	54%	53%	35%
751	120751-0	120752-0	0.630	0.024	0.018	0.020	0.017	0.011	4%	3%	3%	3%	2%
752	120752-0	120757-0	0.778	0.426	0.330	0.311	0.266	0.206	55%	42%	40%	34%	26%
753	120753-0	120752-0	0.519	0.306	0.239	0.223	0.191	0.150	59%	46%	43%	37%	29%
754	120754-0	120753-0	0.482	0.009	0.007	0.011	0.009	0.005	2%	1%	2%	2%	1%
755	120755-0	120753-0	0.460	0.259	0.202	0.179	0.154	0.128	56%	44%	39%	33%	28%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
756	120756-0	120755-0	0.364	0.100	0.079	0.048	0.042	0.051	27%	22%	13%	12%	14%
757	120757-0	120758-0	0.695	0.440	0.340	0.319	0.273	0.210	63%	49%	46%	39%	30%
758	120758-0	120759-0	0.488	0.475	0.475	0.472	0.413	0.366	97%	97%	97%	85%	75%
759	120759-0	120761-0	0.489	0.451	0.450	0.457	0.460	0.439	92%	92%	93%	94%	90%
760	120760-0	120759-0	0.377	0.197	0.120	0.079	0.065	0.058	52%	32%	21%	17%	15%
761	120761-0	120762-0	0.772	0.585	0.554	0.560	0.547	0.519	76%	72%	73%	71%	67%
762	120762-0	120764-0	0.647	0.545	0.469	0.473	0.475	0.480	84%	72%	73%	73%	74%
763	120763-0	120762-0	0.525	0.075	0.102	0.111	0.117	0.095	14%	19%	21%	22%	18%
764	120764-0	120793-0	0.904	0.864	0.860	0.869	0.859	0.858	96%	95%	96%	95%	95%
765	120765-0	120764-0	0.259	0.182	0.184	0.263	0.253	0.176	70%	71%	102%	98%	68%
767	120767-0	120765-0	0.440	0.317	0.225	0.328	0.281	0.123	72%	51%	75%	64%	28%
768	120768-0	120767-0	0.878	0.181	0.122	0.156	0.131	0.070	21%	14%	18%	15%	8%
769	120769-0	120768-0	0.697	0.045	0.030	0.049	0.041	0.019	6%	4%	7%	6%	3%
770	120770-0	120771-0	0.388	0.164	0.119	0.113	0.095	0.077	42%	31%	29%	24%	20%
771	120771-0	120773-0	0.483	0.329	0.276	0.240	0.191	0.165	68%	57%	50%	40%	34%
772	120772-0	120771-0	0.156	0.139	0.114	0.092	0.067	0.068	89%	73%	59%	43%	44%
773	120773-0	120774-0	0.495	0.491	0.382	0.365	0.297	0.217	99%	77%	74%	60%	44%
774	120774-0	120774-1	0.813	0.672	0.493	0.464	0.380	0.275	83%	61%	57%	47%	34%
775	120775-0	120776-0	0.427	0.248	0.134	0.178	0.140	0.039	58%	31%	42%	33%	9%
776	120776-0	120777-0	0.323	0.280	0.279	0.273	0.263	0.105	87%	86%	85%	81%	33%
777	120777-0	120787-0	0.487	0.284	0.284	0.288	0.276	0.114	58%	58%	59%	57%	23%
778	120778-0	120779-0	0.402	0.011	0.005	0.021	0.016	0.002	3%	1%	5%	4%	0%
779	120779-0	120781-0	0.379	0.327	0.306	0.295	0.244	0.186	86%	81%	78%	64%	49%
780	120780-0	120779-0	0.379	0.290	0.274	0.243	0.204	0.170	77%	72%	64%	54%	45%
781	120781-0	120782-0	0.434	0.407	0.431	0.425	0.402	0.405	94%	99%	98%	93%	93%
782	120782-0	120783-0	0.758	0.683	0.580	0.569	0.527	0.456	90%	77%	75%	70%	60%
783	120783-0	120261-0	1.204	0.736	0.625	0.647	0.590	0.494	61%	52%	54%	49%	41%
784	120784-0	120785-0	0.416	0.293	0.293	0.267	0.226	0.291	70%	70%	64%	54%	70%
785	120785-0	120786-0	0.330	0.347	0.353	0.302	0.303	0.349	105%	107%	92%	92%	106%
786	120786-0	120787-0	0.569	0.454	0.456	0.454	0.453	0.397	80%	80%	80%	80%	70%
787	120787-0	120788-0	0.480	0.655	0.686	0.673	0.680	0.538	136%	143%	140%	142%	112%
790	120790-0	120789-0	0.123	0.087	0.214	0.166	0.306	0.114	71%	174%	135%	249%	93%
791	120791-0	120790-0	0.137	0.101	0.199	0.123	0.097	0.031	74%	145%	90%	71%	23%
792	120792-0	120791-0	0.372	0.125	0.067	0.116	0.082	0.021	34%	18%	31%	22%	6%
793	120793-0	120794-0	0.775	0.753	0.767	0.775	0.763	0.752	97%	99%	100%	98%	97%
794	120794-0	120795-0	0.872	0.796	0.802	0.798	0.792	0.797	91%	92%	92%	91%	91%

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				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
795	120795-0	120262-0	0.886	0.848	0.848	0.849	0.851	0.844	96%	96%	96%	96%	95%
796	120796-0	120797-0	0.252	0.023	0.017	0.018	0.016	0.010	9%	7%	7%	6%	4%
797	120797-0	120798-0	0.304	0.024	0.017	0.029	0.024	0.010	8%	6%	10%	8%	3%
798	120798-0	120799-0	0.511	0.134	0.090	0.090	0.074	0.049	26%	18%	18%	14%	10%
799	120799-0	120800-0	0.879	0.134	0.090	0.089	0.074	0.049	15%	10%	10%	8%	6%
800	120800-0	120761-0	0.583	0.134	0.088	0.089	0.073	0.048	23%	15%	15%	13%	8%
801	120801-0	120802-0	0.266	0.052	0.027	0.051	0.041	0.008	20%	10%	19%	15%	3%
802	120802-0	120804-0	1.054	0.541	0.504	0.525	0.501	0.459	51%	48%	50%	48%	44%
803	120803-0	120804-0	0.553	0.312	0.173	0.186	0.132	0.067	56%	31%	34%	24%	12%
804	120804-0	120804-1	1.952	0.852	0.676	0.709	0.631	0.526	44%	35%	36%	32%	27%
805	120805-0	120809-0	0.462	0.081	0.059	0.069	0.060	0.039	18%	13%	15%	13%	8%
806	120806-0	120807-0	0.465	0.466	0.478	0.466	0.463	0.362	100%	103%	100%	100%	78%
807	120807-0	120809-0	1.372	0.530	0.506	0.504	0.494	0.385	39%	37%	37%	36%	28%
808	120808-0	120807-0	0.378	0.077	0.041	0.041	0.035	0.022	20%	11%	11%	9%	6%
809	120809-0	120812-0	1.265	0.611	0.565	0.573	0.554	0.422	48%	45%	45%	44%	33%
810	120810-0	120807-0	0.061	0.001	0.001	0.002	0.001	0.000	2%	2%	3%	2%	0%
811	120811-0	120810-0	0.078	0.000	0.000	0.000	0.000	0.000	0%	0%	0%	0%	0%
812	120812-0	120813-0	1.365	0.689	0.618	0.669	0.624	0.451	50%	45%	49%	46%	33%
813	120813-0	120818-0	0.819	0.781	0.778	0.781	0.715	0.547	95%	95%	95%	87%	67%
814	120814-0	120814-1	0.333	0.052	0.036	0.064	0.054	0.020	16%	11%	19%	16%	6%
815	120815-0	120814-0	0.116	0.006	0.004	0.007	0.006	0.002	5%	3%	6%	5%	2%
816	120816-0	120817-0	0.568	0.004	0.003	0.003	0.003	0.002	1%	1%	1%	1%	0%
817	120817-0	120817-1	1.039	0.014	0.004	0.009	0.008	0.006	1%	0%	1%	1%	1%
818	120818-0	120819-0	0.964	0.650	0.646	0.651	0.655	0.648	67%	67%	68%	68%	67%
819	120819-0	120820-0	1.147	0.855	0.839	0.810	0.798	0.781	75%	73%	71%	70%	68%
820	120820-0	120821-0	1.883	1.433	1.257	1.175	1.120	1.046	76%	67%	62%	59%	56%
821	120821-0	120822-0	2.076	1.401	1.304	1.228	1.164	1.076	67%	63%	59%	56%	52%
822	120822-0	120823-0	1.748	1.241	1.228	1.229	1.222	1.119	71%	70%	70%	70%	64%
823	120823-0	120893-7	2.140	1.277	1.178	1.153	1.168	1.197	60%	55%	54%	55%	56%
825	121017-0	120825-0	1.017	0.231	0.149	0.139	0.113	0.073	23%	15%	14%	11%	7%
828	120828-0	120829-0	0.328	0.168	0.110	0.104	0.086	0.056	51%	34%	32%	26%	17%
829	120829-0	120825-0	0.504	0.307	0.218	0.275	0.231	0.129	61%	43%	55%	46%	26%
830	120830-0	120831-0	0.309	0.013	0.010	0.006	0.005	0.007	4%	3%	2%	2%	2%
831	120831-0	120832-0	0.222	0.081	0.056	0.020	0.012	0.026	36%	25%	9%	5%	12%
832	120832-0	120834-0	0.187	0.084	0.057	0.020	0.013	0.027	45%	30%	11%	7%	14%
833	120833-0	120834-0	0.039	0.085	0.038	0.024	0.019	0.006	218%	97%	62%	49%	15%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
834	120834-0	120835-0	0.775	0.248	0.147	0.114	0.088	0.061	32%	19%	15%	11%	8%
835	120835-0	120836-0	0.752	0.811	0.775	0.602	0.509	0.441	108%	103%	80%	68%	59%
836	120836-0	120848-0	1.125	0.891	0.835	0.652	0.552	0.480	79%	74%	58%	49%	43%
837	120837-0	120835-0	0.474	0.294	0.218	0.189	0.159	0.122	62%	46%	40%	34%	26%
838	120838-0	120839-0	0.406	0.183	0.136	0.144	0.123	0.080	45%	33%	35%	30%	20%
839	120839-0	120837-0	0.498	0.284	0.213	0.187	0.158	0.123	57%	43%	38%	32%	25%
840	120840-0	120841-0	0.376	0.318	0.316	0.311	0.304	0.280	85%	84%	83%	81%	74%
841	120841-0	120842-0	0.389	0.254	0.244	0.249	0.249	0.247	65%	63%	64%	64%	63%
842	120842-0	120842-1	0.450	0.306	0.221	0.236	0.252	0.222	68%	49%	52%	56%	49%
843	120843-0	120842-0	0.271	0.123	0.134	0.108	0.110	0.111	45%	49%	40%	41%	41%
844	120844-0	120843-0	0.214	0.058	0.066	0.067	0.021	0.068	27%	31%	31%	10%	32%
845	120845-0	120841-0	0.359	0.113	0.057	0.036	0.032	0.026	31%	16%	10%	9%	7%
846	120846-0	120847-0	0.591	0.384	0.378	0.324	0.283	0.237	65%	64%	55%	48%	40%
847	120847-0	120848-0	0.327	0.310	0.334	0.325	0.337	0.252	95%	102%	99%	103%	77%
848	120848-0	120849-0	1.347	1.158	1.105	0.959	0.865	0.721	86%	82%	71%	64%	54%
849	120849-0	120851-0	1.178	0.565	0.454	0.449	0.466	0.462	48%	39%	38%	40%	39%
850	120850-0	120851-0	4.278	7.000	6.708	6.545	6.445	6.201	164%	157%	153%	151%	145%
851	120851-0	120851-1	6.895	7.571	7.141	6.936	6.834	6.627	110%	104%	101%	99%	96%
852	120852-0	120851-0	0.231	0.160	0.154	0.144	0.146	0.141	69%	67%	62%	63%	61%
853	120853-0	120854-0	0.394	0.129	0.095	0.078	0.066	0.056	33%	24%	20%	17%	14%
854	120854-0	120855-0	0.764	0.179	0.130	0.111	0.094	0.075	23%	17%	15%	12%	10%
855	120855-0	120856-0	0.675	0.194	0.141	0.122	0.103	0.081	29%	21%	18%	15%	12%
856	120856-0	120857-0	0.849	0.460	0.315	0.319	0.271	0.189	54%	37%	38%	32%	22%
857	120857-0	120858-0	0.309	0.205	0.171	0.170	0.199	0.180	66%	55%	55%	64%	58%
858	120858-0	120974-0	0.473	0.603	0.584	0.582	0.575	0.566	127%	123%	123%	122%	120%
859	120859-0	120860-0	0.708	0.128	0.097	0.102	0.087	0.059	18%	14%	14%	12%	8%
860	120860-0	120862-0	0.830	0.144	0.109	0.115	0.098	0.065	17%	13%	14%	12%	8%
861	120861-0	120860-0	0.340	0.005	0.004	0.003	0.003	0.002	1%	1%	1%	1%	1%
862	120862-0	120856-0	0.541	0.231	0.161	0.156	0.133	0.105	43%	30%	29%	25%	19%
863	120863-0	120864-0	0.403	0.105	0.067	0.059	0.051	0.051	26%	17%	15%	13%	13%
864	120864-0	120865-0	0.501	0.225	0.167	0.148	0.127	0.126	45%	33%	30%	25%	25%
865	120865-0	120867-0	3.013	2.100	2.074	2.100	2.111	1.740	70%	69%	70%	70%	58%
866	120866-0	120867-0	0.485	0.091	0.050	0.057	0.049	0.031	19%	10%	12%	10%	6%
868	120868-0	120867-0	0.461	0.008	0.006	0.008	0.007	0.004	2%	1%	2%	2%	1%
869	120869-0	120865-0	0.393	0.086	0.041	0.038	0.029	0.020	22%	10%	10%	7%	5%
870	120870-0	120865-0	3.751	1.887	1.893	1.832	1.835	1.560	50%	50%	49%	49%	42%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
871	120871-0	120870-0	2.163	1.660	1.658	1.646	1.427	1.168	77%	77%	76%	66%	54%
872	120872-0	120871-0	0.457	0.173	0.110	0.167	0.129	0.060	38%	24%	37%	28%	13%
873	120873-0	120872-0	0.249	0.021	0.015	0.010	0.008	0.009	8%	6%	4%	3%	4%
874	120874-0	120872-0	0.316	0.077	0.052	0.143	0.120	0.033	24%	16%	45%	38%	10%
875	120875-0	120876-0	1.683	0.783	0.722	0.762	0.674	0.553	47%	43%	45%	40%	33%
876	120876-0	120871-0	2.209	1.652	1.495	1.297	1.142	1.065	75%	68%	59%	52%	48%
877	120877-0	120878-0	0.312	0.145	0.144	0.125	0.098	0.068	46%	46%	40%	31%	22%
878	120878-0	120878-1	0.433	0.442	0.442	0.440	0.439	0.439	102%	102%	102%	101%	101%
879	120879-0	120878-0	0.356	0.219	0.224	0.240	0.239	0.196	62%	63%	67%	67%	55%
880	120880-0	120879-0	0.316	0.204	0.182	0.209	0.180	0.137	65%	58%	66%	57%	43%
881	120881-0	120879-0	0.338	0.017	0.040	0.049	0.065	0.012	5%	12%	14%	19%	4%
882	120882-0	120883-0	0.420	0.059	0.057	0.044	0.007	0.008	14%	14%	10%	2%	2%
883	120883-0	120884-0	0.655	0.168	0.173	0.131	0.097	0.098	26%	26%	20%	15%	15%
884	120884-0	120806-0	0.456	0.458	0.459	0.461	0.422	0.311	100%	101%	101%	93%	68%
885	120885-0	120884-0	0.556	0.338	0.331	0.362	0.330	0.222	61%	60%	65%	59%	40%
886	120886-0	120885-0	0.412	0.345	0.254	0.310	0.264	0.151	84%	62%	75%	64%	37%
887	120887-0	120886-0	0.368	0.238	0.180	0.207	0.177	0.108	65%	49%	56%	48%	29%
888	120888-0	120887-0	0.221	0.038	0.027	0.026	0.021	0.015	17%	12%	12%	10%	7%
889	120889-0	120890-0	0.195	0.052	0.049	0.041	0.035	0.046	27%	25%	21%	18%	24%
890	120890-0	120891-0	0.245	0.258	0.161	0.152	0.126	0.095	105%	66%	62%	51%	39%
891	120891-0	120892-0	0.401	0.263	0.163	0.155	0.128	0.097	66%	41%	39%	32%	24%
892	120892-0	120893-1	0.500	0.421	0.270	0.252	0.208	0.153	84%	54%	50%	42%	31%
894	120894-0	120935-0	0.880	0.004	0.003	0.008	0.007	0.002	0%	0%	1%	1%	0%
895	120895-0	120896-0	0.359	0.037	0.025	0.017	0.014	0.015	10%	7%	5%	4%	4%
896	120896-0	120897-0	0.441	0.089	0.040	0.042	0.035	0.022	20%	9%	10%	8%	5%
897	120897-0	120897-1	0.672	0.605	0.472	0.354	0.303	0.268	90%	70%	53%	45%	40%
898	120898-0	120887-0	0.362	0.155	0.118	0.150	0.130	0.075	43%	33%	41%	36%	21%
899	120899-0	120898-0	0.387	0.119	0.090	0.100	0.085	0.057	31%	23%	26%	22%	15%
900	120900-0	120899-0	0.389	0.041	0.035	0.054	0.046	0.023	11%	9%	14%	12%	6%
911	120911-0	120912-0	0.326	0.056	0.041	0.066	0.054	0.025	17%	13%	20%	17%	8%
912	120912-0	120915-0	0.462	0.218	0.129	0.168	0.133	0.062	47%	28%	36%	29%	13%
913	120913-0	120912-0	0.316	0.069	0.034	0.038	0.027	0.011	22%	11%	12%	9%	3%
914	120914-0	120915-0	0.778	0.754	0.753	0.666	0.601	0.566	97%	97%	86%	77%	73%
915	120915-0	120926-0	1.444	1.123	0.921	1.005	0.873	0.630	78%	64%	70%	60%	44%
916	120916-0	120914-0	0.719	0.517	0.509	0.535	0.516	0.429	72%	71%	74%	72%	60%
917	120917-0	120916-0	0.641	0.502	0.491	0.506	0.491	0.421	78%	77%	79%	77%	66%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
918	120918-0	120917-0	0.347	0.233	0.228	0.133	0.129	0.198	67%	66%	38%	37%	57%
919	120919-0	120917-0	0.856	0.465	0.272	0.306	0.246	0.151	54%	32%	36%	29%	18%
920	120920-0	120919-0	0.663	0.315	0.169	0.182	0.137	0.083	48%	25%	27%	21%	13%
921	120921-0	120920-0	0.355	0.283	0.161	0.146	0.111	0.080	80%	45%	41%	31%	23%
922	120922-0	120921-0	0.301	0.076	0.030	0.021	0.005	0.003	25%	10%	7%	2%	1%
923	120923-0	120922-0	0.222	0.005	0.003	0.004	0.004	0.002	2%	1%	2%	2%	1%
924	120924-0	120920-0	0.321	0.029	0.006	0.032	0.023	0.001	9%	2%	10%	7%	0%
925	120925-0	120926-0	0.385	0.006	0.003	0.006	0.005	0.002	2%	1%	2%	1%	1%
926	120926-0	120926-1	1.414	1.272	1.133	1.215	1.048	0.720	90%	80%	86%	74%	51%
927	120927-0	120926-0	0.498	0.187	0.112	0.070	0.056	0.070	38%	22%	14%	11%	14%
928	120928-0	120929-0	1.805	1.225	1.039	0.956	0.721	0.414	68%	58%	53%	40%	23%
929	120929-0	120931-0	1.721	0.912	0.886	0.906	0.770	0.421	53%	51%	53%	45%	24%
930	120930-0	120928-0	0.397	0.232	0.233	0.163	0.138	0.085	58%	59%	41%	35%	21%
931	120931-0	120933-0	1.111	0.744	0.754	0.762	0.758	0.748	67%	68%	69%	68%	67%
932	120932-0	120931-0	0.379	0.340	0.328	0.260	0.235	0.328	90%	87%	69%	62%	87%
933	120933-0	120934-0	0.869	0.803	0.818	0.860	0.853	0.808	92%	94%	99%	98%	93%
934	120934-0	120934-1	1.346	1.216	1.231	1.219	1.192	1.147	90%	91%	91%	89%	85%
935	120935-0	120933-0	1.804	0.026	0.018	0.015	0.017	0.001	1%	1%	1%	1%	0%
936	120936-0	120937-0	0.323	0.017	0.012	0.016	0.013	0.006	5%	4%	5%	4%	2%
937	120937-0	120939-0	0.235	0.031	0.020	0.026	0.023	0.012	13%	9%	11%	10%	5%
938	120938-0	120939-0	0.324	0.103	0.055	0.191	0.162	0.016	32%	17%	59%	50%	5%
939	120939-0	120941-0	0.581	0.334	0.200	0.376	0.305	0.107	57%	34%	65%	52%	18%
940	120940-0	120939-0	0.277	0.146	0.082	0.013	0.010	0.034	53%	30%	5%	4%	12%
941	120941-0	120943-0	0.576	0.475	0.452	0.491	0.490	0.257	82%	78%	85%	85%	45%
942	120942-0	120941-0	0.267	0.056	0.028	0.011	0.009	0.007	21%	10%	4%	3%	3%
943	120943-0	120945-0	0.847	0.721	0.715	0.698	0.695	0.573	85%	84%	82%	82%	68%
944	120944-0	120943-0	0.381	0.189	0.189	0.151	0.086	0.142	50%	50%	40%	23%	37%
945	120945-0	120946-0	1.025	0.784	0.783	0.811	0.753	0.582	76%	76%	79%	73%	57%
946	120946-0	120950-0	4.525	1.650	1.417	1.117	0.952	0.804	36%	31%	25%	21%	18%
947	120947-0	120946-0	2.299	0.737	0.671	0.265	0.177	0.226	32%	29%	12%	8%	10%
948	120948-0	120949-0	0.367	0.074	0.051	0.008	0.007	0.005	20%	14%	2%	2%	1%
949	120949-0	120950-0	0.366	0.234	0.229	0.162	0.135	0.087	64%	63%	44%	37%	24%
950	120950-0	120951-0	1.202	1.603	1.556	1.313	1.113	0.906	133%	129%	109%	93%	75%
951	120951-0	120953-0	3.200	1.640	1.570	1.351	1.121	0.913	51%	49%	42%	35%	29%
952	120952-0	120953-0	0.410	0.101	0.019	0.074	0.015	0.013	25%	5%	18%	4%	3%
953	120953-0	120957-0	1.180	1.694	1.605	1.350	1.157	0.936	144%	136%	114%	98%	79%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
954	120954-0	120957-0	0.147	0.175	0.170	0.171	0.168	0.111	119%	116%	116%	114%	76%
955	120955-0	120954-0	0.175	0.105	0.102	0.116	0.119	0.071	60%	58%	66%	68%	41%
956	120956-0	120955-0	0.137	0.016	0.061	0.007	0.006	0.041	12%	45%	5%	4%	30%
957	120957-0	120957-1	3.710	1.825	1.746	1.524	1.313	1.031	49%	47%	41%	35%	28%
958	120958-0	120961-0	7.706	2.981	2.874	2.707	2.457	2.160	39%	37%	35%	32%	28%
959	120959-0	120960-0	0.172	0.041	0.034	0.026	0.022	0.026	24%	20%	15%	13%	15%
960	120960-0	120961-0	0.437	0.056	0.034	0.027	0.023	0.026	13%	8%	6%	5%	6%
961	120961-0	120962-0	8.055	3.006	2.908	2.785	2.472	2.180	37%	36%	35%	31%	27%
964	120964-0	120966-0	1.115	0.001	0.001	0.001	0.001	0.000	0%	0%	0%	0%	0%
965	120965-0	120947-0	2.293	0.038	0.023	0.018	0.010	0.009	2%	1%	1%	0%	0%
966	120966-0	120965-0	2.490	0.038	0.022	0.018	0.011	0.009	2%	1%	1%	0%	0%
968	120968-0	120969-0	0.239	0.204	0.199	0.129	0.100	0.111	85%	83%	54%	42%	46%
969	120969-0	120970-0	0.366	0.146	0.162	0.115	0.110	0.141	40%	44%	31%	30%	39%
970	120970-0	120972-0	0.313	0.361	0.360	0.322	0.323	0.348	115%	115%	103%	103%	111%
971	120971-0	120970-0	0.527	0.317	0.315	0.278	0.233	0.176	60%	60%	53%	44%	33%
972	120972-0	120973-0	0.417	0.476	0.445	0.463	0.447	0.395	114%	107%	111%	107%	95%
973	120973-0	120858-0	0.856	0.490	0.455	0.473	0.456	0.400	57%	53%	55%	53%	47%
974	120974-0	120975-0	1.730	0.706	0.635	0.722	0.684	0.614	41%	37%	42%	40%	35%
975	120975-0	120976-0	0.990	0.814	0.705	0.770	0.722	0.660	82%	71%	78%	73%	67%
976	120976-0	120001-0	0.856	0.772	0.721	0.736	0.739	0.697	90%	84%	86%	86%	81%
978	120978-0	120979-0	0.421	0.154	0.103	0.108	0.092	0.059	37%	24%	26%	22%	14%
979	120979-0	120307-0	0.792	0.422	0.251	0.257	0.217	0.133	53%	32%	32%	27%	17%
980	120980-0	120981-0	10.836	4.436	3.705	3.598	3.391	2.789	41%	34%	33%	31%	26%
981	120981-0	120982-0	6.412	4.560	3.761	3.651	3.429	2.807	71%	59%	57%	53%	44%
982	120982-0	120983-0	9.507	4.836	3.881	3.730	3.491	2.873	51%	41%	39%	37%	30%
983	120983-0	120984-0	16.162	4.624	3.897	3.742	3.499	2.881	29%	24%	23%	22%	18%
984	120984-0	120985-0	6.205	4.286	3.900	3.745	3.501	2.880	69%	63%	60%	56%	46%
985	120985-0	120986-0	11.549	4.349	3.938	3.784	3.533	2.898	38%	34%	33%	31%	25%
986	120986-0	120987-0	18.736	4.349	3.938	3.784	3.532	2.899	23%	21%	20%	19%	15%
987	120987-0	120988-0	18.491	4.457	4.018	3.871	3.596	2.957	24%	22%	21%	19%	16%
988	120988-0	120989-0	18.978	4.456	4.013	3.940	3.607	2.958	23%	21%	21%	19%	16%
989	120989-0	120990-0	19.210	9.023	7.960	7.500	7.366	6.207	47%	41%	39%	38%	32%
990	120990-0	120991-0	22.534	9.941	9.156	8.805	9.239	6.994	44%	41%	39%	41%	31%
991	120991-0	120992-0	21.353	10.795	9.874	9.694	8.970	7.779	51%	46%	45%	42%	36%
992	120992-0	120993-0	9.554	10.795	9.873	9.200	8.995	7.778	113%	103%	96%	94%	81%
993	120993-0	120994-0	19.627	11.302	10.376	10.469	9.519	8.151	58%	53%	53%	48%	42%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
996	120996-0	120997-0	14.408	17.300	14.000	13.000	12.000	11.000	120%	97%	90%	83%	76%
1001	121001-0	121003-0	0.257	0.000	0.000	0.000	0.000	0.000	0%	0%	0%	0%	0%
1002	121002-0	121003-0	0.190	0.001	0.001	0.001	0.001	0.000	1%	1%	1%	1%	0%
1004	121004-0	121005-0	0.266	0.006	0.004	0.002	0.001	0.002	2%	2%	1%	0%	1%
1005	121005-0	121007-0	0.419	0.056	0.038	0.025	0.018	0.018	13%	9%	6%	4%	4%
1006	121006-0	121007-0	0.258	0.041	0.031	0.037	0.032	0.020	16%	12%	14%	12%	8%
1007	121007-0	121008-0	0.336	0.098	0.066	0.060	0.048	0.034	29%	20%	18%	14%	10%
1008	121008-0	121014-0	0.468	0.102	0.067	0.061	0.049	0.035	22%	14%	13%	10%	7%
1009	121009-0	121011-0	0.413	0.068	0.048	0.020	0.014	0.033	16%	12%	5%	3%	8%
1010	121010-0	121011-0	0.194	0.001	0.002	0.001	0.000	0.001	1%	1%	1%	0%	0%
1011	121011-0	121012-0	0.195	0.067	0.047	0.019	0.014	0.030	34%	24%	10%	7%	15%
1012	121012-0	121013-0	0.211	0.074	0.048	0.035	0.027	0.030	35%	23%	17%	13%	14%
1013	121013-0	121014-0	0.304	0.089	0.053	0.042	0.032	0.031	29%	17%	14%	11%	10%
1014	121014-0	121017-0	0.535	0.194	0.122	0.104	0.082	0.067	36%	23%	19%	15%	13%
1015	121015-0	121017-0	0.474	0.197	0.140	0.126	0.107	0.070	42%	30%	27%	23%	15%
1016	121016-0	121017-0	0.262	0.006	0.006	0.019	0.016	0.003	2%	2%	7%	6%	1%
37994	120008-1	120008-2	8.304	9.130	8.099	8.045	7.953	7.684	110%	98%	97%	96%	93%
38000	120014-1	120014-2	4.168	1.710	1.188	0.993	0.789	0.638	41%	29%	24%	19%	15%
38001	120015-1	120014-0	0.821	0.737	0.464	0.458	0.348	0.244	90%	57%	56%	42%	30%
38014	120028-1	120028-2	0.360	0.518	0.379	0.303	0.264	0.214	144%	105%	84%	73%	59%
38025	120008-2	120036-0	13.064	9.130	8.099	8.045	7.953	7.683	70%	62%	62%	61%	59%
12-1	120012-1	120014-0	2.282	0.393	0.262	0.288	0.216	0.134	17%	11%	13%	9%	6%
120062-1l1	120062-1	120062-0	0.388	0.000	0.000	0.000	0.000	0.000	0%	0%	0%	0%	0%
120202-1l1	120202-1	120299-0	7.551	0.721	0.710	0.704	0.701	0.700	10%	9%	9%	9%	9%
120299-0l1	120299-0	120298-0	7.547	1.428	1.035	1.137	1.067	0.842	19%	14%	15%	14%	11%
120300-1l1	120300-1	120304-0	0.340	0.113	0.078	0.123	0.098	0.023	33%	23%	36%	29%	7%
120710-0l1	120710-0	120711-0	0.375	0.136	0.101	0.111	0.094	0.058	36%	27%	30%	25%	15%
120711-0l1	120711-0	120712-0	0.294	0.151	0.110	0.121	0.101	0.063	51%	37%	41%	34%	21%
120712-0l1	120712-0	120332-0	0.563	0.164	0.120	0.134	0.113	0.068	29%	21%	24%	20%	12%
120713-0l1	120713-0	120710-0	0.363	0.008	0.006	0.009	0.007	0.003	2%	2%	2%	2%	1%
120714-0l1	120714-0	120713-0	0.412	0.008	0.006	0.009	0.007	0.004	2%	1%	2%	2%	1%
120715-0l1	120715-0	120710-0	0.551	0.096	0.071	0.077	0.066	0.042	17%	13%	14%	12%	8%
120716-0l1	120716-0	120715-0	0.432	0.088	0.065	0.072	0.061	0.039	20%	15%	17%	14%	9%
120717-0l1	120717-0	120716-0	0.322	0.058	0.044	0.054	0.046	0.027	18%	14%	17%	14%	8%
120718-0l1	120718-0	120716-0	0.226	0.026	0.019	0.015	0.013	0.011	12%	8%	7%	6%	5%
120893-3l1	120893-3	120894-0	0.000	0.000	0.000	0.000	0.000	0.000	0%	0%	0%	0%	0%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)					% Full Flow				
				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
120926-1l1	120926-1	120928-0	1.855	1.057	0.777	0.755	0.550	0.291	57%	42%	41%	30%	16%
120934-1l1	120934-1	120958-0	1.576	1.217	1.232	1.220	1.193	1.148	77%	78%	77%	76%	73%
121017-0l1	121017-0	120828-0	0.405	0.165	0.110	0.103	0.085	0.056	41%	27%	25%	21%	14%
127-0	120127-0	120240-1	2.133	3.687	3.535	3.513	3.504	3.513	173%	166%	165%	164%	165%
127-1	120127-1	120240-1	4.372	4.804	4.517	4.472	4.474	4.260	110%	103%	102%	102%	97%
149-1	120149-1	120149-0	0.966	0.151	0.150	0.309	0.227	0.063	16%	16%	32%	23%	7%
156-1	120156-1	120156-0	1.669	0.783	0.444	0.339	0.288	0.244	47%	27%	20%	17%	15%
162-1	120162-1	120162-0	0.506	0.044	0.038	0.033	0.031	0.028	9%	8%	7%	6%	6%
163-1	120163-1	120163-2	0.127	0.505	0.347	0.207	0.206	0.320	398%	273%	163%	162%	252%
163-2	120163-2	120163-3	0.127	0.243	0.293	0.295	0.250	0.190	191%	231%	232%	197%	150%
168-1	120168-1	120193-0	0.264	0.149	0.102	0.114	0.096	0.060	56%	39%	43%	36%	23%
189-1	120189-1	120188-0	0.468	0.283	0.281	0.268	0.228	0.132	60%	60%	57%	49%	28%
211-1	120211-1	120212-0	0.383	0.104	0.072	0.082	0.068	0.041	27%	19%	21%	18%	11%
213-1	120213-1	KIAH01-0	0.601	0.206	0.125	0.119	0.099	0.066	34%	21%	20%	16%	11%
223-1	120223-1	120225-0	5.025	2.482	2.271	2.227	2.190	1.848	49%	45%	44%	44%	37%
23*	120230-0	120231-0	0.332	0.009	0.006	0.008	0.007	0.004	3%	2%	2%	2%	1%
241-1	120241-0	120241-1	0.418	0.465	0.472	0.470	0.449	0.394	111%	113%	112%	107%	94%
252-1A	120252-0	120252-1	35.000	18.731	16.000	15.000	14.220	12.100	54%	46%	43%	41%	35%
252-1B	120252-0	120252-1	35.000	18.731	16.000	15.000	14.220	12.100	54%	46%	43%	41%	35%
252-1C	120252-0	120252-1	35.000	18.731	16.000	15.000	14.220	12.100	54%	46%	43%	41%	35%
252-A	120253-0	120252-0	11.418	14.309	16.861	18.717	10.725	9.722	125%	148%	164%	94%	85%
252-B	120253-0	120252-0	11.418	14.309	16.861	18.717	10.725	9.722	125%	148%	164%	94%	85%
252-C	120253-0	120252-0	24.899	31.696	36.976	35.000	34.910	32.206	127%	149%	141%	140%	129%
253-A	120253-1	120253-0	73.311	78.697	75.616	66.700	61.776	51.459	107%	103%	91%	84%	70%
253-B	120253-1	120253-0	33.619	44.965	36.905	39.058	38.656	31.602	134%	110%	116%	115%	94%
253-C	120253-1	120253-0	33.619	44.965	36.905	39.058	38.656	31.602	134%	110%	116%	115%	94%
254-1	120254-0	120254-1	0.219	0.102	0.096	0.095	0.094	0.189	47%	44%	43%	43%	86%
268-1	120268-1	120268-2	0.356	0.385	0.207	0.202	0.169	0.116	108%	58%	57%	47%	33%
270-1	120270-1	120270-2	0.444	0.093	0.054	0.075	0.061	0.030	21%	12%	17%	14%	7%
270-2	120270-2	120270-3	0.479	0.093	0.054	0.074	0.060	0.030	19%	11%	15%	13%	6%
270-3	120270-3	120346-0	0.256	0.092	0.053	0.074	0.060	0.029	36%	21%	29%	23%	11%
286/1	120286-1	120990-0	1.609	1.087	1.040	1.444	0.998	0.847	68%	65%	90%	62%	53%
289-1	120289-1	120298-2	0.306	0.327	0.319	0.314	0.311	0.312	107%	104%	103%	102%	102%
298-1	120298-1	120298-2	8.853	3.299	2.545	2.513	2.361	2.021	37%	29%	28%	27%	23%
298-2	120298-2	120989-0	9.333	3.555	2.854	2.830	2.652	2.320	38%	31%	30%	28%	25%
301-1	120301-1	120301-2	0.061	0.065	0.066	0.064	0.064	0.067	107%	108%	105%	105%	110%

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				PMF	1%	2%	5%	20%	PMF	1%	2%	5%	20%
301-2	120301-2	120301-3	0.107	0.063	0.066	0.063	0.062	0.066	59%	62%	59%	58%	62%
301-3	120301-3	120301-0	0.188	0.061	0.065	0.062	0.061	0.066	32%	35%	33%	32%	35%
309-1	120309-1	120309-2	0.276	0.075	0.010	0.016	0.014	0.005	27%	4%	6%	5%	2%
309-2	120309-2	120309-3	0.288	0.314	0.273	0.269	0.264	0.258	109%	95%	93%	92%	90%
309-3	120309-3	120309-4	0.407	0.302	0.273	0.269	0.264	0.258	74%	67%	66%	65%	63%
309-4	120309-4	120309-0	0.434	0.300	0.273	0.269	0.265	0.258	69%	63%	62%	61%	59%
312-1	120312-1	120312-2	0.454	0.037	0.026	0.026	0.022	0.014	8%	6%	6%	5%	3%
312-2	120312-2	120987-0	0.485	0.117	0.099	0.081	0.074	0.073	24%	20%	17%	15%	15%
354/1	120354-1	120354-2	0.386	0.348	0.938	0.366	0.466	0.296	90%	243%	95%	121%	77%
35-A	120035-0	120031-1	26.500	5.378	4.586	4.410	4.311	4.153	20%	17%	17%	16%	16%
35-B	120035-0	120031-1	26.500	5.378	4.586	4.410	4.311	4.153	20%	17%	17%	16%	16%
36-A	120036-0	120035-0	13.188	4.711	4.141	4.097	4.043	3.908	36%	31%	31%	31%	30%
36-B	120036-0	120035-0	13.188	4.711	4.141	4.097	4.043	3.908	36%	31%	31%	31%	30%
395-1	120395-1	120991-0	1.541	0.803	0.813	1.141	0.773	0.694	52%	53%	74%	50%	45%
62-2	120062-2	120062-0	0.482	0.052	0.032	0.024	0.016	0.012	11%	7%	5%	3%	2%
62-3	120062-3	120062-2	0.253	0.051	0.031	0.024	0.016	0.011	20%	12%	9%	6%	4%
62-4	120062-4	120062-3	0.106	0.028	0.020	0.016	0.013	0.011	26%	19%	15%	12%	10%
62-5	120062-5	120062-4	0.987	0.009	0.006	0.007	0.006	0.004	1%	1%	1%	1%	0%
62-6	120062-6	120062-5	0.259	0.009	0.008	0.009	0.008	0.005	3%	3%	3%	3%	2%
62-7	120062-7	120062-6	0.126	0.009	0.007	0.008	0.007	0.004	7%	6%	6%	6%	3%
62-8	120062-8	120062-5	0.413	0.002	0.001	0.001	0.001	0.000	0%	0%	0%	0%	0%
64-1	120064-1	120053-0	1.908	1.039	0.897	0.908	0.840	0.644	54%	47%	48%	44%	34%
66-1	120066-1	120064-1	0.463	0.034	0.023	0.029	0.024	0.011	7%	5%	6%	5%	2%
67-1	120067-1	120067-2	0.507	0.016	0.012	0.011	0.009	0.007	3%	2%	2%	2%	1%
67-2	120067-2	120066-0	0.445	0.016	0.012	0.011	0.009	0.007	4%	3%	2%	2%	2%
68-1	120068-1	120068-2	0.498	0.436	0.387	0.360	0.347	0.301	88%	78%	72%	70%	60%
68-2	120068-2	120068-3	1.514	0.883	0.733	0.735	0.683	0.546	58%	48%	49%	45%	36%
68-3	120068-3	120065-0	1.653	0.883	0.734	0.736	0.682	0.547	53%	44%	45%	41%	33%
69-1	120069-1	120068-2	0.308	0.447	0.361	0.382	0.339	0.245	145%	117%	124%	110%	80%
774-1	120774-1	120781-0	0.903	0.672	0.492	0.464	0.380	0.275	74%	54%	51%	42%	30%
80-1	120080-1	120068-0	0.576	0.320	0.320	0.316	0.315	0.297	56%	56%	55%	55%	52%
804-1	120804-1	120804-2	2.244	0.852	0.676	0.709	0.631	0.526	38%	30%	32%	28%	23%
804-2	120804-2	120875-0	1.772	0.852	0.676	0.709	0.630	0.526	48%	38%	40%	36%	30%
814-1	120814-1	120814-2	0.277	0.051	0.036	0.064	0.054	0.020	18%	13%	23%	19%	7%
814-2	120814-2	120812-0	0.428	0.051	0.036	0.064	0.054	0.020	12%	8%	15%	13%	5%
817-1	120817-1	120817-2	0.715	0.014	0.004	0.009	0.008	0.006	2%	1%	1%	1%	1%

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817-2	120817-2	120817-3	0.452	0.014	0.004	0.009	0.008	0.006	3%	1%	2%	2%	1%
817-3	120817-3	120863-0	0.617	0.014	0.004	0.009	0.008	0.006	2%	1%	1%	1%	1%
819-1	120819-1	120819-0	0.414	0.000	0.000	0.000	0.000	0.000	0%	0%	0%	0%	0%
820-1	120820-1	120820-0	0.695	0.000	0.000	0.000	0.000	0.000	0%	0%	0%	0%	0%
822-1	120822-1	120822-0	0.312	0.016	0.011	0.024	0.019	0.006	5%	4%	8%	6%	2%
824-1	120824-0	120825-0	4.708	1.597	1.559	1.505	1.342	1.154	34%	33%	32%	29%	25%
824-2	120824-0	120825-0	4.708	1.597	1.559	1.505	1.342	1.154	34%	33%	32%	29%	25%
825-1	120825-1	120825-A	26.270	8.639	7.718	7.642	6.645	5.731	33%	29%	29%	25%	22%
825-2	120825-2	120842-1	12.748	9.156	8.841	8.778	8.603	8.005	72%	69%	69%	67%	63%
825-A	120825-A	120825-B	31.380	12.565	11.415	9.755	7.879	7.006	40%	36%	31%	25%	22%
825-B	120825-B	120825-2	20.707	10.680	10.219	9.176	8.070	7.551	52%	49%	44%	39%	36%
825-X	120825-0	120825-1	3.557	3.028	3.006	3.027	2.851	2.572	85%	85%	85%	80%	72%
825-Y	120825-0	120825-1	3.557	3.028	3.006	3.027	2.851	2.572	85%	85%	85%	80%	72%
826-1	120826-0	120824-0	2.829	1.432	1.406	1.411	1.280	1.129	51%	50%	50%	45%	40%
826-2	120826-0	120824-0	2.829	1.432	1.406	1.411	1.280	1.129	51%	50%	50%	45%	40%
842-1	120842-1	120850-0	15.718	9.103	8.931	8.891	8.749	8.203	58%	57%	57%	56%	52%
851-1	120851-1	120851-2	14.622	7.570	7.140	6.935	6.833	6.625	52%	49%	47%	47%	45%
851-2	120851-2	120851-3	8.350	8.048	7.103	6.949	6.880	6.701	96%	85%	83%	82%	80%
851-3	120851-3	120008-1	11.938	8.836	7.890	7.853	7.768	7.509	74%	66%	66%	65%	63%
867-0	120867-0	120867-1	4.407	2.465	2.424	2.306	2.256	1.828	56%	55%	52%	51%	41%
867-1	120867-1	120867-2	2.983	2.465	2.424	2.306	2.256	1.827	83%	81%	77%	76%	61%
867-2	120867-2	120867-3	4.787	2.465	2.424	2.306	2.257	1.827	51%	51%	48%	47%	38%
867-3	120867-3	120002-0	6.209	2.465	2.424	2.306	2.257	1.826	40%	39%	37%	36%	29%
878-1	120878-1	120802-0	0.616	0.442	0.442	0.440	0.439	0.439	72%	72%	71%	71%	71%
893-1A	120893-1	120893-2	1.817	0.512	0.369	0.301	0.253	0.210	28%	20%	17%	14%	12%
893-1B	120893-1	120893-2	1.817	0.512	0.369	0.301	0.253	0.210	28%	20%	17%	14%	12%
893-2	120893-2	120893-3	2.301	1.193	1.093	1.060	1.000	0.848	52%	48%	46%	43%	37%
893-2A	120926-3	120893-2	1.265	0.478	0.490	0.509	0.506	0.429	38%	39%	40%	40%	34%
893-3	120893-3	120893-4	0.845	1.195	1.094	1.063	1.002	0.848	141%	129%	126%	119%	100%
893-4	120893-4	120893-5	3.265	1.205	1.104	1.090	1.024	0.857	37%	34%	33%	31%	26%
893-5	120893-5	120893-6	3.426	1.211	1.107	1.106	1.039	0.859	35%	32%	32%	30%	25%
893-6	120893-6	120893-7	2.537	1.193	1.116	1.132	1.061	0.869	47%	44%	45%	42%	34%
893-7A	120893-7	120825-0	0.523	0.668	0.661	0.683	0.684	0.660	128%	126%	131%	131%	126%
893-7B	120893-7	120825-0	0.523	0.668	0.661	0.683	0.684	0.660	128%	126%	131%	131%	126%
893-7C	120893-7	120825-0	0.523	0.668	0.661	0.683	0.684	0.660	128%	126%	131%	131%	126%
893-A	120893-0	120893-1	0.100	0.302	0.236	0.177	0.152	0.134	302%	236%	177%	152%	134%

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893-B	120893-0	120893-1	0.100	0.302	0.236	0.177	0.152	0.134	302%	236%	177%	152%	134%
897-1	120897-1	120893-0	0.585	0.605	0.472	0.354	0.303	0.268	103%	81%	61%	52%	46%
926-2	120926-1	120926-2	2.061	0.475	0.484	0.532	0.522	0.429	23%	23%	26%	25%	21%
926-3	120926-2	120926-3	1.153	0.476	0.484	0.518	0.513	0.429	41%	42%	45%	44%	37%
957-1	120957-1	120958-0	5.611	1.822	1.749	1.544	1.309	1.030	32%	31%	28%	23%	18%
962-0A	120962-0	120963-0	3.439	1.494	1.454	1.409	1.234	1.090	43%	42%	41%	36%	32%
962-0B	120962-0	120963-0	3.439	1.494	1.454	1.409	1.234	1.090	43%	42%	41%	36%	32%
963-0A	120963-0	120963-1	2.753	1.488	1.470	1.451	1.273	1.127	54%	53%	53%	46%	41%
963-0B	120963-0	120963-1	2.753	1.488	1.470	1.451	1.273	1.127	54%	53%	53%	46%	41%
963-1	120963-1	120826-0	2.225	2.869	2.814	2.824	2.561	2.259	129%	126%	127%	115%	102%
994-1	120994-0	120995-0	7.426	5.652	5.186	5.095	4.750	4.073	76%	70%	69%	64%	55%
994-2	120994-0	120995-0	7.426	5.652	5.186	5.095	4.750	4.073	76%	70%	69%	64%	55%
ADV-1	ADV001-0	120090-0	0.823	0.001	0.000	0.000	0.000	0.000	0%	0%	0%	0%	0%
BBC-1	BBC001-0	BBC002-0	0.573	0.000	0.000	0.000	0.000	0.000	0%	0%	0%	0%	0%
BBC-2	BBC002-0	120084-0	0.757	0.000	0.000	0.000	0.000	0.000	0%	0%	0%	0%	0%
GCS-1	GSC001-0	GSC002-0	0.146	0.025	0.019	0.018	0.016	0.011	17%	13%	12%	11%	8%
GCS-2	GSC002-0	120985-0	0.245	0.054	0.039	0.043	0.036	0.022	22%	16%	18%	15%	9%
GCS-3	GSC003-0	GSC002-0	0.159	0.023	0.017	0.018	0.016	0.010	14%	11%	11%	10%	6%
L01-0	LYN001-0	LYN001-1	0.028	0.027	0.027	0.027	0.027	0.027	96%	96%	96%	96%	96%
L01-1	LYN001-1	LYN001-2	0.054	0.047	0.046	0.044	0.040	0.037	87%	85%	81%	74%	69%
L01-2	LYN001-2	LYN001-3	0.079	0.049	0.048	0.047	0.042	0.038	62%	61%	59%	53%	48%
L01-3	LYN001-3	LYN001-4	0.196	0.235	0.210	0.164	0.132	0.113	120%	107%	84%	67%	58%
L01-4	LYN001-4	LYN001-5	41.613	0.358	0.249	0.172	0.142	0.112	1%	1%	0%	0%	0%
L01-5	LYN001-5	LYN001-5A	0.020	0.045	0.046	0.046	0.042	0.037	225%	230%	230%	210%	185%
L01-5A	LYN001-5A	LYN010-0	0.151	0.279	0.252	0.152	0.087	0.077	185%	167%	101%	58%	51%
L02-0	LYN002-0	LYN002-1	31.783	0.018	0.017	0.012	0.011	0.009	0%	0%	0%	0%	0%
L02-2	LYN002-2	LYN008-0	0.099	0.115	0.008	0.048	0.036	0.006	116%	8%	48%	36%	6%
L02-3	LYN002-3	LYN010-0	0.268	0.261	0.047	0.110	0.080	0.028	97%	18%	41%	30%	10%
L03-0	LYN003-0	LYN003-1	0.006	0.014	0.013	0.013	0.013	0.013	233%	217%	217%	217%	217%
L03-1	LYN003-1	120825-2	0.035	0.033	0.042	0.040	0.040	0.034	94%	120%	114%	114%	97%
L04-0	LYN004-0	LYN004-1	0.036	0.035	0.035	0.036	0.035	0.035	97%	97%	100%	97%	97%
L04-1	LYN004-1	LYN004-2	0.036	0.036	0.035	0.038	0.038	0.036	100%	97%	106%	106%	100%
L04-2	LYN004-2	LYN004-3	0.038	0.041	0.041	0.041	0.041	0.039	108%	108%	108%	108%	103%
L04-3	LYN004-3	LYN004-4	0.109	0.045	0.044	0.045	0.044	0.041	41%	40%	41%	40%	38%
L04-4	LYN004-4	LYN004-5	9.565	0.098	0.048	0.048	0.051	0.051	1%	1%	1%	1%	1%
L04-5	LYN004-5	LYN004-6	0.010	0.023	0.030	0.030	0.026	0.021	230%	300%	300%	260%	210%

Link ID	From Pit	To Pit	Qf m^3/s	Flow (m^3/s)				
				PMF	1%	2%	5%	20%
L04-6	LYN004-6	LYN004-7	0.262	0.152	0.158	0.133	0.103	0.037
L07-0	LYN007-0	LYN008-0	15.698	3.400	1.069	0.386	0.031	0.010
L08-0	LYN008-0	LYN010-0	21.167	3.400	1.049	0.407	0.054	0.013
L10-0	LYN010-0	LYN011-0	17.710	3.400	1.197	0.532	0.217	0.109
nnnn	121003-0	121005-0	0.251	0.019	0.014	0.011	0.009	0.008
WDR-1	WDR001-0	120874-0	0.504	0.000	0.000	0.000	0.000	0.000

% Full Flow				
PMF	1%	2%	5%	20%
58%	60%	51%	39%	14%
22%	7%	2%	0%	0%
16%	5%	2%	0%	0%
19%	7%	3%	1%	1%
8%	6%	4%	4%	3%
0%	0%	0%	0%	0%

A P P E N D I X E

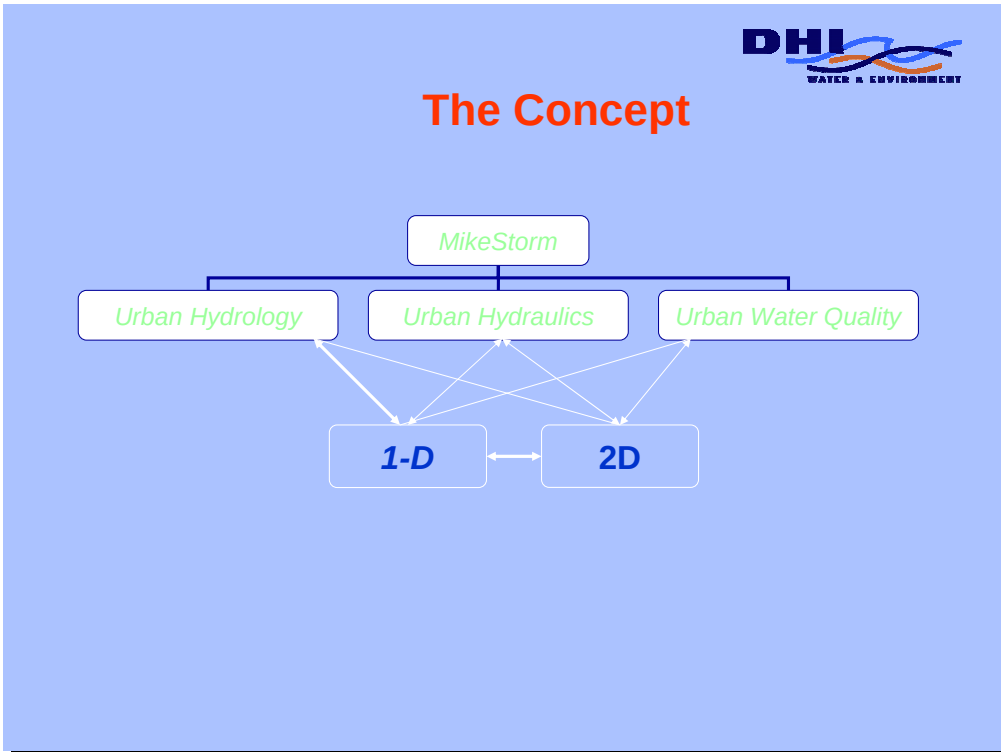
MIKE Storm – Short Description

MIKE STORM SHORT DESCRIPTION

MIKE STORM is a package designed specifically for stormwater applications, but has been based on hydraulic and water quality components that have been developed and tested over more than 20 years in DHI's wide range of numerical tools.

The model has been tailored to provide the facilities required for both lumped and detailed analysis of rainfall-runoff processes in urban catchments and allows the practitioners to describe the complex interactions of stormwater flow with pits, pipes and overland flow paths that you encounter in real-world stormwater applications.

MIKE STORM is not so much a single model, but a range of tools that interlink to allow the user to select a range of options to suite the particular needs.



The model uses a fully dynamic, looped network solution for both pipe hydraulics and optional water quality in an easy-to-use interface.

The concept is that a 1D classical model can be developed for a broad catchment, and can be refined in considerable detail with 2D overland flow paths, rainwater tanks and detailed On-Site Detention structures on a house-by-house basis where required.

MIKE STORM can model the detailed performance of stormwater management devices such as:

- On-Site Detention Systems
- Rain gardens
- Rainwater Tanks
- Grass Swales
- Porous Pavements

MIKE STORM works in both event-based or optional continuous mode for both the design of structures and investigation of the long-term sustainability

MIKE STORM has:

- The power to simulate the WSUD measures practices at a household level by combining rainwater tanks and domestic demand, on-site detentions, infiltration trenches and other water quality control measures and structures into the overall catchment.

- Both design event (UHM, rational method and kinematic wave) and optional continuous hydrology (continuous soil-moisture accounting combined with conceptual storage for surface flows) are accommodated.

- A powerful hydraulic engine for easy analysis of existing stormwater drainage systems, taking into account all the complexities which can be experienced in steep and/or flat areas.

- Optional add-on full 2D surface and groundwater modules for simulating total catchment water balance.

- Optional facilities to assess the long term water quantity and water quality impacts of combined Water Sensitive Urban Design (WSUD) practices and measures.

- A fully dynamic time-varying solution with full backwater in all elements. Overland flow and pipe network are analysed simultaneously, inflow pits under both at-grade and sag pit configurations

- Surcharging pits to the surface system

- Volume balance over the entire network

- Efficient data editing facilities (insert, delete, global edit, QBE and other filtering techniques, SQL, etc)

- Comprehensive time series management facilities

- Automatic data consistency preservation and consistency checking

- Exchange of data and graphics with other Windows-based applications, including ODBC Links

- Data display and import in SI and US customary units

- Controllable local headloss computations

- Add-on modules for GIS-based flood mapping facilities

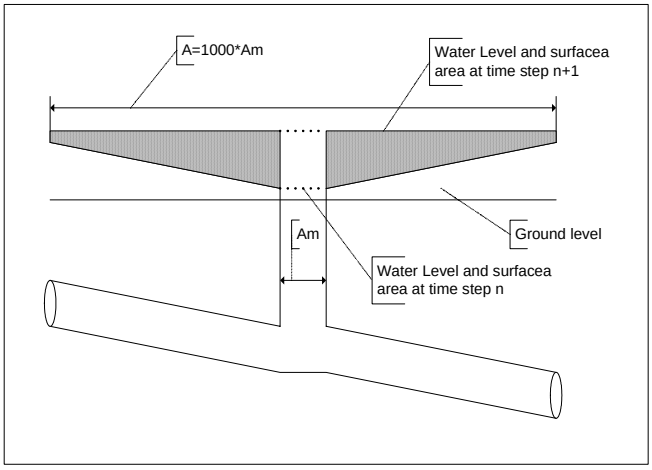
- Context-sensitive online help
- Full graphical interface with network schematisation on the screen with background maps loaded

- Dynamic long sections, comparison of flows and levels in the same plot, model-generated rating curves, copy and paste to MS-Excel, MS-Word or other OLE-enabled tools.

BRIEF TECHNICAL INFORMATION

MIKE STORM is organised in a number of modules with the basic hydrology and hydraulics in the core module. This module also includes extensive input- and output facilities all within a user friendly full 32-bit graphical Windows '95 and NT environment.

The hydrodynamic pipe and channel module solves the complete Saint Venant equations in an implicit finite difference scheme, and uses a dynamic adaptive time step method to speed up the computations. Both supercritical and subcritical flow are accommodated in the unconditionally stable solution method.

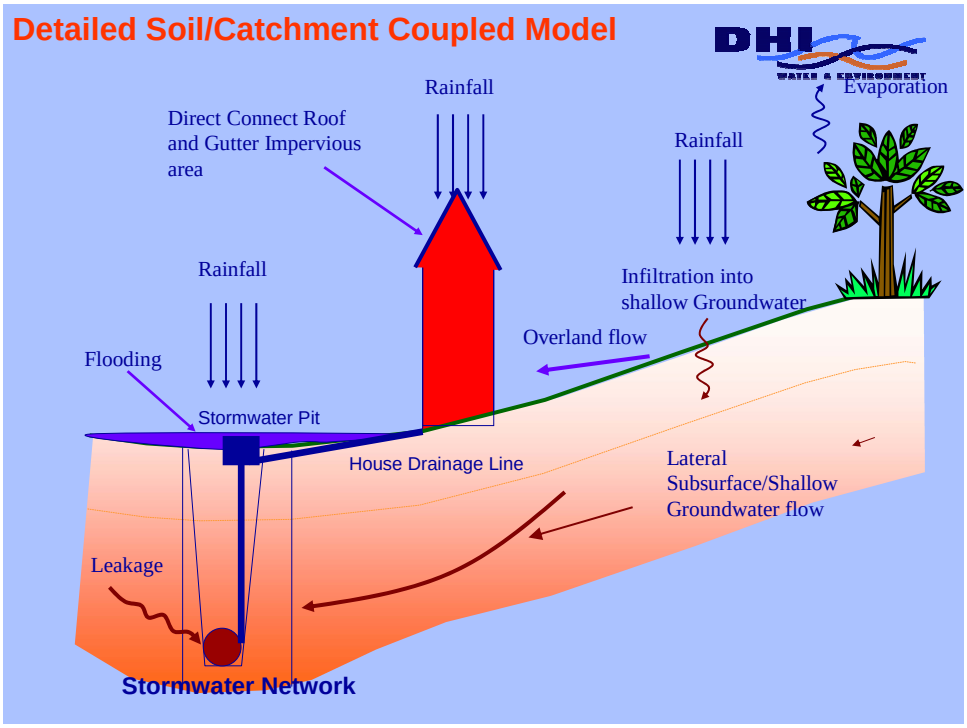


The full Saint Venant equations are used for sub-critical flow conditions (i.e. Fr < 1). When the flow changes to super-critical (i.e. Fr > 1) the local and convective acceleration terms in the momentum equation are neglected thus reducing the flow description to a diffusive wave approximation. The transition from sub-critical to super-critical flow is handled very well by the numerical scheme as the equations transition to upstream centred.

When the flow capacity in a pipe is exceeded, the water level rises in the pit and surcharges the pipe until the transport capacity in the downstream pipe becomes available. Storage of water above the ground level is handled automatically by MIKE STORM by storing the flood volume in an artificial basin inserted above the node. If the flows are allowed to escape the system, then an overflow weir is added to the setup or the node is set as a spilling node.

When the water level changes rapidly, built-in checks ensures that no water volume is generated artificially.

As an alternative to in-line storage, or above ground storage, MIKE STORM also includes facilities to build a two-layer model. The upper layer (i.e. the major system) describes flows and levels on the surface by redirecting flows on the surface to the next downstream pit. The lower layer incorporates the pipes or closed canals/tunnel sections - the minor system. The surface flow system is typically connected with the pipe system through inlets or pits, and these links are normally included in the model set-up by defining lintel descriptions between the surface and sub-surface systems. Various flow control features can be defined for the links, allowing the flow to be unidirectional, control the maximum flow rates, etc.



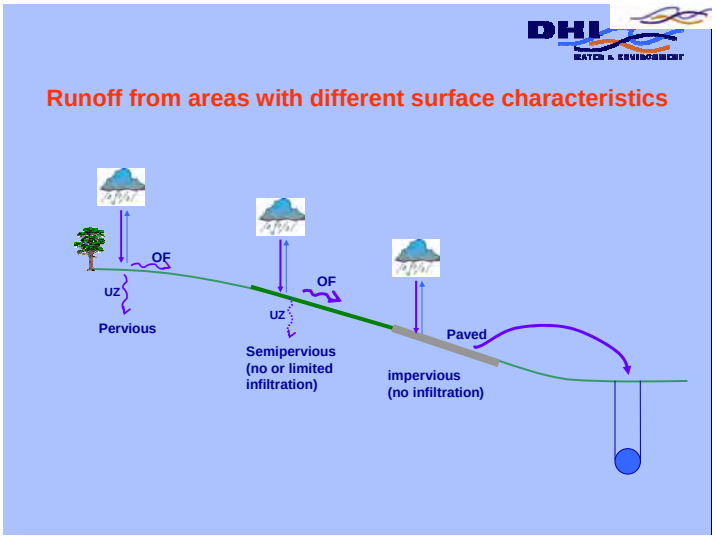
When closed conduits become surcharged, the dynamics of flow is fundamentally altered. Surcharged flow in closed pipes is defined through the Preisman slot technique which is in effect a capillary tube on the top of the pipe cross section. This solution yields stable results without the need for iterations. The slot is added automatically to all closed sections (the built-in standard shapes, and to user defined shapes stored in the cross-section database).

MIKE STORM supports an advanced adaptive variable time step algorithm, which adapts to hydraulic and operational conditions throughout the numerical simulation. The algorithm includes a check of boundary conditions in order to assure that no error is made in the resolution of inflows

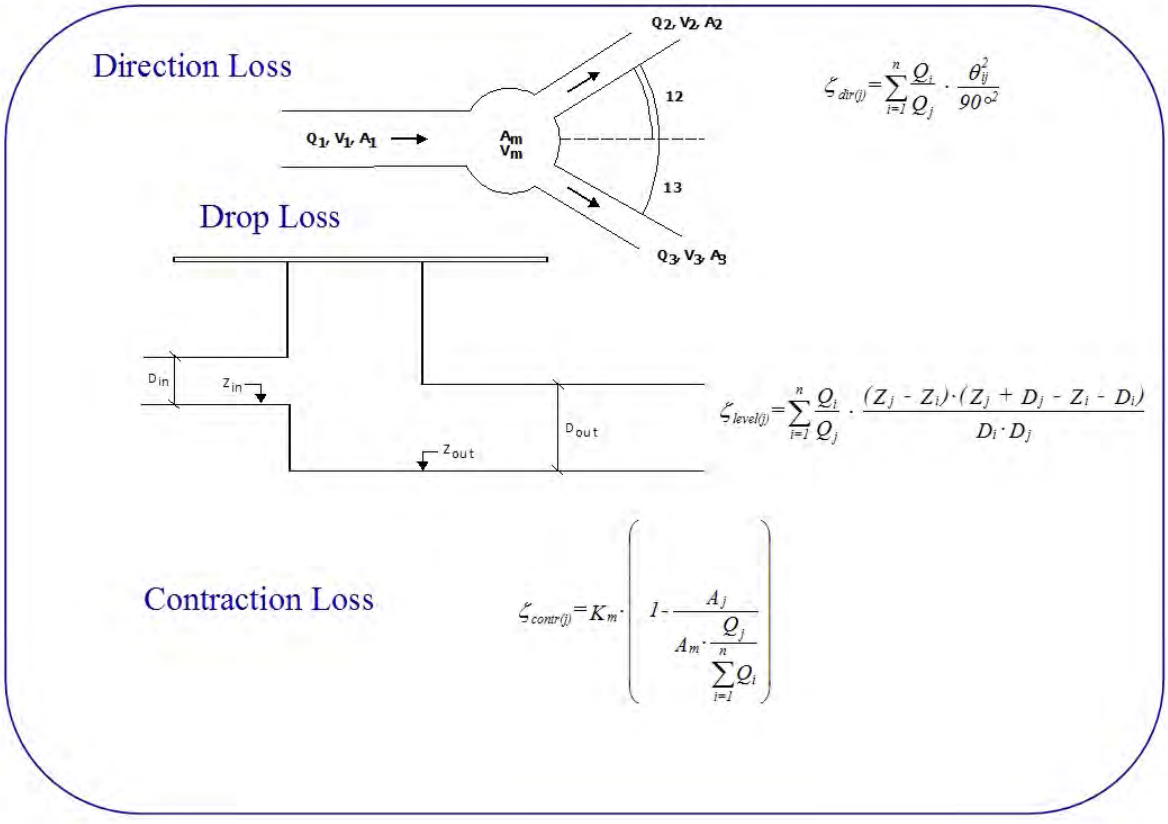
The optional 2D model adds the following processes to the basic pipe and channel model:

- 2D Overland Flow
- 2D Evapotranspiration
- Unsaturated Zone
- Saturated Zone Flow

The 2D overland flow module allows definition of a wide range of land uses, depending on the scale of the application:



PIT LOSSES



$$\zeta_{dir(j)} = \sum_{i=1}^{n} \frac{Q_i}{Q_j} \cdot \frac{\theta_{ij}^2}{90^{o2}}$$

$$\zeta_{level(j)} = \sum_{i=1}^{n} \frac{Q_i}{Q_j} \cdot \frac{(Z_j - Z_i)\cdot(Z_j + D_j - Z_i - D_i)}{D_i \cdot D_j}$$

$$\zeta_{contr(j)} = K_m \cdot \left(1 - \frac{A_j}{A_m \cdot \frac{Q_j}{\sum_{i=1}^{n} Q_i}} \right)$$

Head losses across stormwater pits at the confluence of two or more stormwater pipes are automatically accommodated in MIKE Storm. The MIKE Storm solution algorithm automatically calculates the head losses based on the geometry of the pit including the pit volume, the angle of the incoming and outgoing pipes to the pit, and any offset of pipes through the pit in both the horizontal or vertical planes. The variability of head losses with the rate of flow through the pit is also accommodated.

STANDARD HYDROLOGY

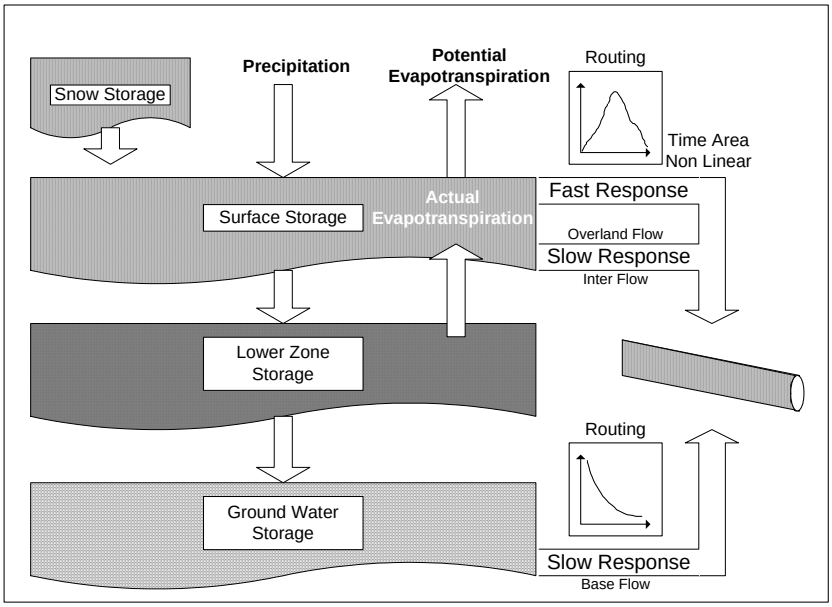
Catchment flows are calculated either by the standard event-based model or by the continuous water balance model.

The standard model contains three hydrological engines:

1. Rational Method with a time-area curve
2. Kinematic Wave
3. Unit Hydrograph

It is also possible to specify a constant infiltration rate in each pipe (m3/s/m).

The optional continuous hydrological module allows for an advanced description of the fast runoff and slow runoff components for long term hydrological simulations. The model consists of four interconnected linear reservoirs modeling snow storage, surface storage, root zone storage and ground water storage.



The input data to the model are:

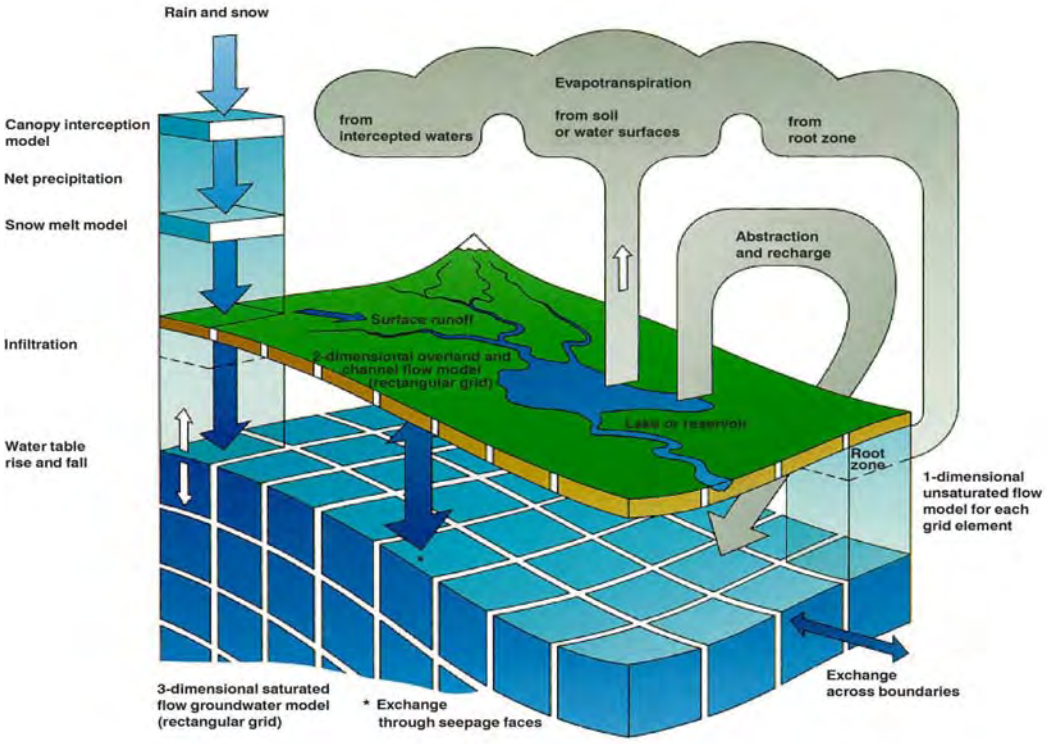
- Precipitation
- Potential evapo-transpiration
- Temperature (only if the snow routine is used).

The output is the flow estimates for the impervious runoff component and the pervious runoff component as separate time series. The time resolution of the rainfall input depends on the objective of the study and on the time scale of the catchment response. Rainfall data with any (variable) time increments can be specified in the rainfall input. The model makes the necessary interpolation according to the simulation time steps.

Being a lumped model, it treats each sub catchment as one unit. The parameters and variables are thus representing average values for the entire sub catchment. A conceptual model like MIKE STORM is based on physical structures and equations used together with semi-empirical ones. Thus, some of the parameters can be evaluated from physical catchment data such as percentage impervious, but the final parameter estimation must be performed by calibration.

ADVANCED HYDROLOGY – COUPLED MODEL

Advanced hydrological cycle modelling in MIKE Storm is available through the application of a spatially distributed system, MIKE SHE. MIKE SHE has it's genesis in more than 25 years ago in the development of the Système Hydrologique Européen, SHE (Refsgaard and Storm, 1995). MIKE SHE – an extension of the original SHE code – is one of the very few commercially available codes that can be described as a physically based and fully distributed hydrological modelling code. Over the past 25 years, MIKE SHE has been successfully applied in hundreds of applications in both research and practical applications and been reviewed through a number of international reviews which recognise the uniqueness of the modelling system.



Structure of the MIKE SHE modelling system

MIKE SHE was developed as an alternative to the more traditional lumped conceptual rainfall-runoff models. International collaboration during the initial development of the SHE code necessitated a modular process-based structure to the code. Each module describes one of the major hydrological processes in the hydrological cycle and, together, they provide a complete integrated description of the land-phase of the hydrological cycle. Additionally, each component can be run separately or coupled to one or more of the other components.

MIKE SHE was originally developed with the view that the level of detail should be sufficient to justify the claim of a physically based system. The equations used are, with few-exceptions, non-empirical and well known to represent the physical processes in the different parts of the hydrological cycle. The parameters in these equations can be obtained from measurements and used in the model, so long as they are compatible with the scale of the model. The flow processes represented in MIKE SHE include: snow melt, rainfall interception and evapotranspiration, overland flow and channel flow, vertical flow in the unsaturated zone, and groundwater flow. In MIKE SHE, each of these processes operates spatially and at time steps consistent with their own spatial and temporal scales. For example, daily rainfall may be distributed, due to topographic relief, into a few zones across a watershed. Infiltration and evapotranspiration will vary with vegetation, surface cover, slope, soil properties, etc. and is calculated directly by the model

based on the distribution of the above mentioned conditions. The drainage network is typically described in a river model (see below) but higher order systems may be included in a more lumped way described in MIKE SHE as a tile network functioning like linear reservoirs.

Overland flow and rainfall-runoff hydrographs may peak within hours after a heavy rainfall necessitating short time steps for overland and channel flow calculations. And, finally groundwater, which is typically the slowest process, may only require monthly time steps. In areas with a shallow groundwater table, direct contact between a river and the aquifer a fully integrated dynamic description with daily time steps (or less) may be required in order to describe the conditions adequately precise. In order to model floodplain hydraulics it essential to have a detailed digital elevation model and dike levels as well as river cross sections and operation characteristics of control measures.

MIKE SHE includes all of the above processes in the land phase of the hydrologic cycle:

- Precipitation (rain and/or snow)
- Evapotranspiration, including canopy interception
- Overland sheet flow
- Channel flow
- Unsaturated sub-surface flow
- Saturated groundwater flow

The modelling system works on various scales from small urban catchments to large river catchment to regional/country wide. It is able to accommodate most information and data directly because it works in a fully distributed manner. Issues concerning sub-surface water balance including groundwater recharge under various conditions, groundwater pumping, reinfiltration from irrigation taken from surface water or groundwater reservoirs can be investigated using MIKE SHE. Detailed investigation - with the aid of the MIKE SHE modelling system - of groundwater and surface interaction under various hydrogeological and hydrological conditions add valuable information to the understanding of the integrated water cycle. In addition groundwater quality issues can be investigated with the aid of MIKE SHE.

MIKE SHE handles all kinds of boundary conditions including flux, gradient, general head boundary condition and others of more special character. It is also possible to construct regional models for larger parts of the region and built a detailed model using boundary conditions from the regional models.

MIKE Storm is an integral part of MIKE SHE and the exchange of water between piped stormwater networks is modelled as surcharging and overland flow on the catchment surface and infiltration and exfiltration through the pipe network i.e. the interaction between piped water and groundwater.

MIKE SHE has a number of additional features that may be relevant in relation to the objectives of the present study. Modules for solute transport and attenuation are integral parts of the modelling system, which enables the user to simulate the transport, dispersion, sorption and degradation of solutes in the sub-surface zone. This enables the user to model the impact of contaminant load from both point sources and diffusive sources on the groundwater quality as well as on the surface water quality.

Within each of the above processes, MIKE SHE offers several different approaches ranging from simple, lumped and conceptual approaches to advanced, distributed and physically-based approaches. Simple and advanced approaches may be combined which leads to an ability for the modeller to tailor the model to the hydrological problem rather than the opposite which is often true in forcing models to fit the data such is often the case with simple lumped conceptual

tools. The MIKE SHE allows the modeler to change from a simple to a more advanced approach if the data sources are available.

Precipitation, Evapotranspiration or Recharge
MIKE SHE will calculate infiltration, actual evapotranspiration and recharge in the unsaturated zone. Input can be specified as constant values or time series and can be distributed in space using stations (for instance, Thiessen polygons) or as cell-by-cell values. If the distribute precipitation by stations, you will be prompted for a time series for each station. The time series for each station can contain different time periods with different, non-equidistant, time steps. When running the simulation, MIKE SHE automatically synchronizes all time steps to the time step adopted in the simulation.

Unsaturated Zone
The unsaturated zone is the link between surface water and groundwater. The unsaturated zone model in MIKE SHE is a vertical soil profile model that interacts with both the overland flow (through ponding) and the groundwater model (the groundwater table is the lower boundary condition for the unsaturated zone). MIKE SHE offers three different approaches including a simple 2-layer root-zone mass balance approach, a gravity flow model and a full Richards equation model. All three approaches require specification of certain soil-properties. The unsaturated zone model interacts with MIKE SHE's evapotranspiration model which calculates actual evapotranspiration as a function of reference ET, soil moisture and crop characteristics. At the simplest level, infiltration to the unsaturated zone can be represented by a proportional loss of the incident rainfall.

Soil Database
MIKE SHE comes with a database of various soils and typical crops for different climatic regions of the world. The soil database includes a number of pedo-transfer functions that link suction, water content and hydraulic conductivity, but also allows the user to specify soil properties in a tabular format. Soil profiles are easily distributed in space using soil maps.

Land-use is described in terms of vegetation types combined with impervious/semi-impervious areas. Vegetation types and impervious/semi-impervious areas may be spatially distributed using land-use maps. Crop rotation is made easy by defining a date-of-establishment and then specifying a link to the crop type in the crop database. MIKE SHE comes with a database of typical crops in different climatic regions. Users may edit the database, add vegetation types to the database or create a new database from scratch.

Groundwater Flow
MIKE SHE includes a traditional 2D or 3D finite-difference groundwater model, which is very similar to MODFLOW.

The geology is described in terms of layers or lenses with attached hydraulic properties. Properties can be specified either on a cell-by-cell basis or by property zones defined by .shp files (polygons) or grid-code files. MIKE SHE allows grid-independent geology specification, which allows you to change the horizontal or vertical mesh in seconds.

Boundary conditions are specified for each computational layer. MIKE SHE supports traditional groundwater boundary conditions and offers large flexibility in terms of spatial and temporal variation of boundary conditions. Boundary conditions may be specified on a cell-by-cell basis, but typically it is more convenient to attach boundary conditions to geometric features such as polygons (lakes), lines (rivers) or points (pumps, injections, drains). A lake could, for instance, be a polygon (.shp file) with an attached water level time series and leakage coefficient. Similar to the meteorological time-series data, boundary time-series data may be specified in separate time-series files that include different and non-equidistant time steps. MIKE SHE 2002 auto-

matically synchronizes all time-series data thus, eliminating tedious time-series preprocessing. Simulation time steps and stress periods may be specified independent of input time series.

Overland Flow
MIKE SHE's overland-flow component includes a 2D finite difference diffusive wave approach using the same 2D mesh as the groundwater component. Overland flow interacts with the stormwater network, the unsaturated zone and saturated groundwater zone.

CALIBRATION PRINCIPLES

MIKE STORM includes a time series database. Observed as well as simulated time series can be stored in the database and retrieved for calibration purposes. Within MIKE STORM it is possible directly to compare simulated results with measured data, but also simulated with simulated - a very useful feature in the calibration process. The calibration is based on a trial basis, where the user changes key parameters and compare with measurements, until satisfactory results are achieved.

The hydrology module contains an automatic calibration tool which eases calibration efforts.

MIKE STORM contains powerful statistical analysis tools to measure and define the accuracy of model calibration. This tool calculates volume and peak comparisons, and calculates the coefficient of determination of the analysis. Scatter plots, time series, magnitude bias and temporal bias analysis are all undertaken.

WATER QUALITY MODELLING

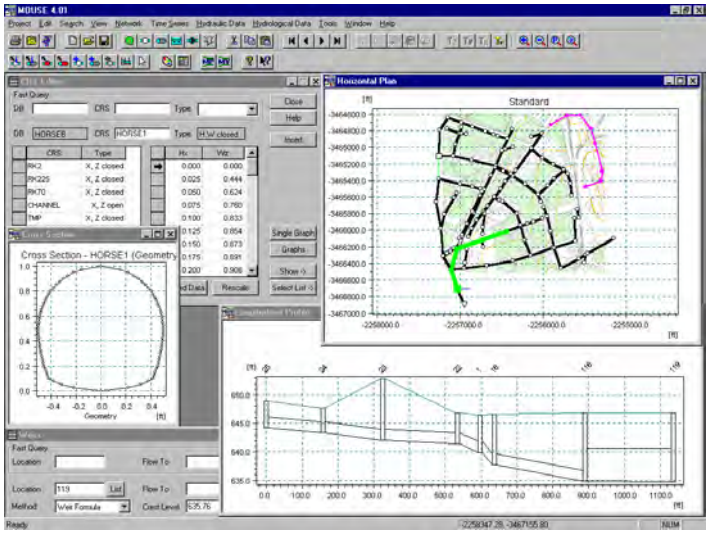
The optional TRAP add-on module consists of three models for simulation of the sediment transport and water quality processes:

1. An Event-Mean Concentration based approach
2. A Sediment transport model
3. An Advection-dispersion model and;
4. A Water Quality Process model.

The EMC model estimates the load from the catchments. Each sub-catchment can have a separate EMC assigned for fast impervious areas and for slow pervious runoff areas. The EMC also has a advection-dispersion model simulates the physical transport of the pollution whilst the water quality model simulates the chemical and biological transformation of the pollutants. Finally, the sediment transport model can simulate the dynamic movement of sediments.

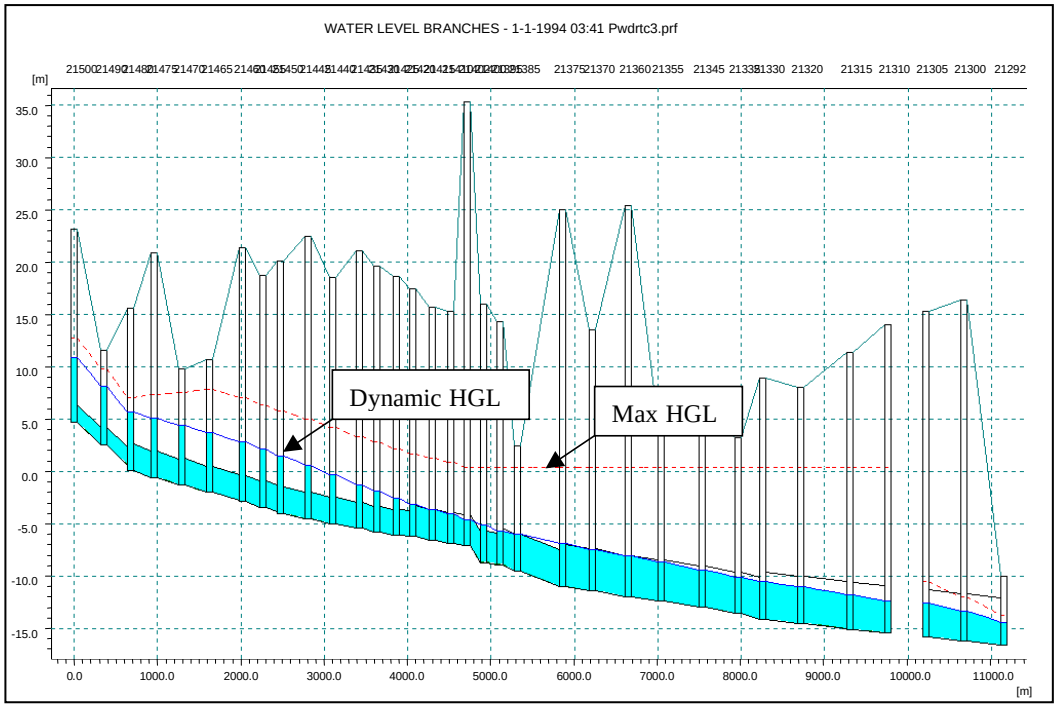
GRAPHICAL USER INTERFACE

MIKE STORM is a fully featured WINDOWS applications with an intuitive, fully graphical user interface. The model-input data are managed by a custom-built, advanced database engine, which allows fast access to the system data with full safeguard against inconsistent data through data checking prior to entry. By combining fast graphics for viewing and editing system data, and handy export/import functions, these features ensure high work productivity even with very large data sets.



Extensive result presentation facilities are available through the result viewer MIKE View, which is a standard part of the MIKE STORM system. The results can be viewed as user-configurable graphics (time series, plan plot, longitudinal profiles, Q-H curves), as well as data tables. Results can be exported to standard applications either as graphics or as numeric data for further processing.

Maximum water levels as well as the dynamics of the HGL during a simulation can be displayed as longitudinal profiles.



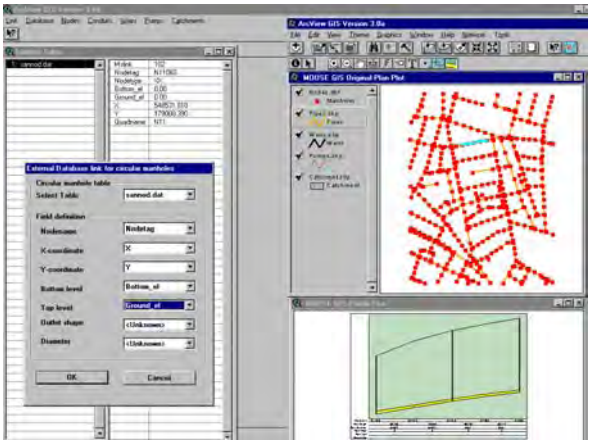
GIS

Data from external sources are easily transferred to MIKE STORM through the add-on GIS module. The GIS works in the ArcView environment and consists of two parts: the Network Editor and the Results Presentation. Both parts support the general features available in ArcView. MIKE

STORM GIS has an extensive On-line help system which guides the user through the network editor and result viewer.

The network editor features the external database function, which is applied to establish links between external data sources and the model. The external data source can be any database supporting ODBC (Open Data Base Connectivity, e.g. Microsoft Access), ORACLE, ASCII delimited files, Dbase IV or INFO files (ARC/Info and ArcView).

Before MIKE STORM GIS is able to use data from an external data source, a link between the



external data source and the internal database must be specified. This is done through a number of dialog boxes, from which the user can select a table from the external data source and define the link for each field to the internal database definition.

In case certain data attributes are not described in the external database, default values are applied. These can subsequently be changed either in the GIS environment or in the graphical user interface. The GIS module extracts field attribute data from data sources such as ARC INFO coverages or from ArcView shapefiles. Links are established between the database and the GIS. They define the relations between the database and the GIS for development of MIKE STORM networks. All information is stored in a link file, which can be saved and reused next time you wish to connect to the external data source.

The GIS network editor also allows simplification of the network automatically while still maintaining consistency in the description of the physical system. Criteria for the simplification process made by the program are based on user-specified criteria, such as maximum pipe diameter, minimum pipe diameter, unaltered hydraulic resistance, etc. All changes are recorded on a separate file, which can later be replayed if the user wants to repeat the process, which may be required after an update to the asset management system database.